E-CARS AND STOCKS

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E-cars and stocks

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Management Summary

The stock price of electric automotive manufacturer Tesla performed astonishing the last years. The good-looking electric models of Tesla have lifted the expectations around the brand. The stock price was already on the rise while the company hadn't report any profits. To see, whether investors react as positively to conventional automotive manufacturers that build an electric vehicle, several release dates and stock prices have been examined. This is the first study examining the financial impacts of e-cars through the market capitalizations of automotive manufacturers. Therefore, this research fills a gap in the literature. The outcomes will provide an indication of the importance of electric cars for automotive manufacturers from a financial point of view. In addition, the results will show whether investors see e-cars, as the vehicle of the future, as is so often proclaimed.

To examine whether investors are enthusiastic about e-cars and in order to draw inferences about investor reactions from the moment an e-car is released an event study have been executed. An event study measures the impact of a specific event on the market capitalization of a firm. An event study attempts to measure the valuation effects of a corporate event, such as a product announcement by examining the response of the stock price around the announcement of the event. The stock return should be taken as a measure of the financial impact of an e-car release as investors update their expectations about long-term future cash flows immediately by buying or selling stock once new information becomes public. For comparison and completeness an event study about the release of new models of conventional cars have been executed as well. To test the robustness of the findings of the event study, the results have been compared to the trends and sentiments in the derivative automotive and part indexes.

The results evince some remarkable outcomes. The release of an electric vehicle or plug-in hybrid car leads to negative abnormal returns for automotive manufacturer's stocks. In the days after the event and especially on the day of the release an automotive manufacturer could expect a decrease in its market capitalization. The trend and sentiment prevailing in automotive manufacturer's stocks at the moment of the e-car releases, show that for more than the half of the investigated e-car releases, the cumulated negative abnormal returns are fully caused by the e-car release. The negative receive of investors towards electric vehicles could work as a disincentive for auto producers to invest in cleaner technologies. On the other side is the release of a conventional car positively received by investors. The positive reaction of investors to new models of conventional cars is in line with the desires of car buyers, who still prefer conventional cars above electric vehicles. The cumulative abnormal returns for conventional cars are positively, while the cumulative abnormal returns are negative in the case of the release of an e-car, suggesting that investors value a brand extension in the core business more positively.

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“I thought things would be much further along than they are“

“We unveiled the roadster in 2007 with a 250-mile battery range, and it has been seven years, and there is no other electric car in production with that range level. That’s not great!“

Elon Musk, CEO Tesla Motors
31 July, 2014

I. Abstract

This is the first study that examines the general reaction of investors on the release of an e-car through the market capitalizations of automotive manufacturers. The event study approach, measures the valuation effects of a corporate event, such as a product announcement by examining the response of the stock price around the announcement of the event. The reaction should be taken as a measure of the financial impact of an e-car release, as investors update their expectations about long-term future cash flows, by buying or selling the stock of relevance immediately. In fact, investors react quite negatively to the release of an e-car, as the automotive manufacturer's market capitalization decreases on the day of the releases and the trading days there after. The negative abnormal returns in case of the release of an e-car show that investors receive a brand extension outside the core business dismissive. This study demonstrates that investors aren't that positive about e-cars, as governments and business society seems to be and in a climate where money rules the world this could function as a disincentive for auto producers to invest heavier in cleaner technologies.

2. Introduction

The automotive industry is undergoing an unprecedented change. The pressure on automotive manufacturers rises to adapt alternative drive technologies that have lower or even zero emissions. The interest for cleaner vehicles and the attention for alternative fuels seem to be growing by the days. An increasing regulation amplifies the emphasis of governments towards cleaner vehicles. Where as the pollution concerns discussed in the media show the apprehension and the call for cleaner vehicles of consumers. For automotive manufacturers meaning that they have to adapt to a fast changing competitive landscape. However, a move to electric propulsion or e-mobility poses more than a technological challenge for the automotive sector. The long development cycles signifies that some of the new advances may take as much as 5 to 10 years to evolve (KPMG, 2014). The current business structure within the automotive sector is built on cost efficiency and long depreciation cycles (Özel et al., 2013). However, to accede the desire of society for cleaner vehicles and the hankering to remain progressive, automotive manufacturers were enforced to come up with solutions that could satisfy the durable demands. The current reaction of automotive manufacturers could be recapitulate in two ways. On one side they try to increase the efficiency of current models while on the other side invest in the development of complete new lines, consisting of cars driven on alternative fuels. A suited example is seen with respect to the strategy of BMW. The German automotive manufacturer tries to provide every new conventional release with a higher fuel-efficient engine while on the other side it developed an e-car line, which is called the BMW i-series (BMW, 2014).

To attain higher fuel efficiencies, automotive manufactures aim for the downsizing and optimization of the conventional internal combustion engines. Auto producers expect that this will stay the dominant technology in the foreseeable future as fuel consumption and emissions continue to fall while the power of the internal combustion engines is expected to increase (KPMG, 2014). However, the implemented regulations show that the interests of governments and to a lesser extent the business community tend to electric vehicles (Het nieuwe rijden, 2014). Government regulations have forced automotive manufacturers to fasten the efficiency innovations. The European Union's legislation has set mandatory emission reduction targets for all newly produced cars. Emission limits are set according to the mass of a vehicle, using a limit value curve. The curve is set in such a way that a fleet average of 130 grams of CO_2 per kilometre should be achieved by 2015 and 95 grams of CO_2 per kilometre by 2021 (European Commission (EC), 2014). Penalty payments will be given to automotive manufacturers violating these requirements, where as super credits will be provided as an incentive for the ones that produce lower emissions vehicles. The introduction of the stringent regulation from the EC (2014) came across a resistance of criticism from automotive manufacturers, as they are forced to make new investments and expect an increase in fabrication costs (European Automobile Manufacturers Association, (ACEA) 2012). According to the ACEA, such regulations are far from realistic, as automotive manufacturers are recovering from the losses that have been made during the European debt crisis. This brings us to the financial position of automotive manufacturers and additionally the aim of this study. The financial position of an automotive manufacturer is translated in the stock price, which represents the expectations of the future cash flows of the company (Sloan, 1996). The regulations have governed to investments in alternative fuels, whereby the changes in fundamentals led to higher costs, expecting to influence the price of the shares (Cutler et al., 1998). What the consequences and causes of these conflicting interests and thoughts are, will be discussed along the study. The economical issues that have doom the last years for automotive manufacturers with regards to electric vehicles have lead to the main question.

> *"What is the impact of the release of a clean vehicle on the performance of the stock price of the relevant automotive manufacturer?"*

In their race to produce cleaner vehicles in order to fulfil EC's requirements, auto producers are betting on the optimization of conventional cars and the production of cars driven by alternative fuels. To see whether investors attach as much value as governments do to the development of e-cars, the stock prices should be scrutinized. The following sub-questions will support to scrutinize stock prices and answer the main question:

1. What is the influence of company specific news on the stock price?
2. What is the general trend in automotive manufacturer's stocks?
3. What is the traded volume around the release of the e-cars?

The answer of the first sub-question should provide an indication of the influence of news on a stock price. The answer of this question could be derived from past experiences and theory. Several papers and theories will be consulted in the literature review to investigate the influence of company specific news on a company's stock price. The answers of the other sub-questions depend on the data. These answers will provide additional information about the impact of the release on the performance of the stock and are necessary to control whether the effects are entirely due to the release or partly caused by sentiment.

As becomes clear from the sub-questions, to answer the main question, research is required in the field of cleaner vehicles produced by listed automotive manufacturers and stock prices. To make the reader familiar with both fields of interest, below a short introduction will follow of the subjects.

After the reader is briefly acquainted with the subjects, the aim of the thesis will be given, where after the methodology will be provided. After the introduction, the social relevance of e-cars will be discussed with the aid of some newspaper examples, after which the transition to the literature review will be made. From the information gained in the literature review, the hypotheses will be set, that should provide an answer on the main question.

Cleaner Vehicles

The social pressure from governments on one hand drives consumers and auto producers into e-cars (Rengers, 2014), where as the financial consciousness of consumers on the other hand encourages automotive manufacturers towards the optimization of internal combustion engines (KPMG, 2014). Both pressures induce people to buy cleaner vehicles, however the contradicting customer requirements and the long development cycles in the automotive sector make the adoption of e-cars a long lasting process. This creates curiosity for the answer of the main question, what is the impact on the market capitalization of a car manufacturer as it releases the concept of an e-car? What is the effect of a vision focused on the future as other auto producers continue to build on their core businesses and former successes, which are achieved with the internal combustion engines?

Financial Impact

The impact of a product release on the stock price could be threefold. Prices will rise, as investors react enthusiastically on the released car as they see the future brighter as cash flows and volume of sales could increase thanks to the new product. On the other side investors could react negatively, leading to a drop in the stock's price after the release. Reasons for a negative response could be as diverse as reasons for an upsurge, however it is straightforward that investors don't see how future cash flows will increase with the new electric car. The last possible reaction is that the price of the stock doesn't react at all on the product release. This reaction is most in line with expectations as e-cars only contain a small share of the total sales of automotive manufacturers, according to KMPG's automotive executive survey 2014. Car manufacturers expect that this will remain as the main focus lays on the optimization of the internal combustion engine.

Anyway, expectations are not always met. But one thing is certain, this thesis will provide new insights about the financial impact of automobile releases translated through the market capitalization of automotive manufacturers.

Aim of the paper

The aim of the paper is to find out whether investors see added value in the production of e-cars[1] for the future cash flows of automotive manufacturers. The aim is to find an answer on the question whether automotive manufacturers will be rewarded in terms of a larger market capitalization if the concepts to produce an e-car are released. The outcomes of the research should give an indication about the importance of electric cars for manufacturers from a financial point of view and additionally the results should indicate whether investors see e-cars, as the vehicle of the future. However the main reason, I want to investigate the financial impact of the release of an e-car, stemmed from the outstanding performance of the Tesla stock the last years. Tesla brought electric cars together with a fine design to the automotive market. From the performance of the stock price could be concluded that investors see the full electric Tesla, as the car of the future, as it combines ostentation with power and ease.

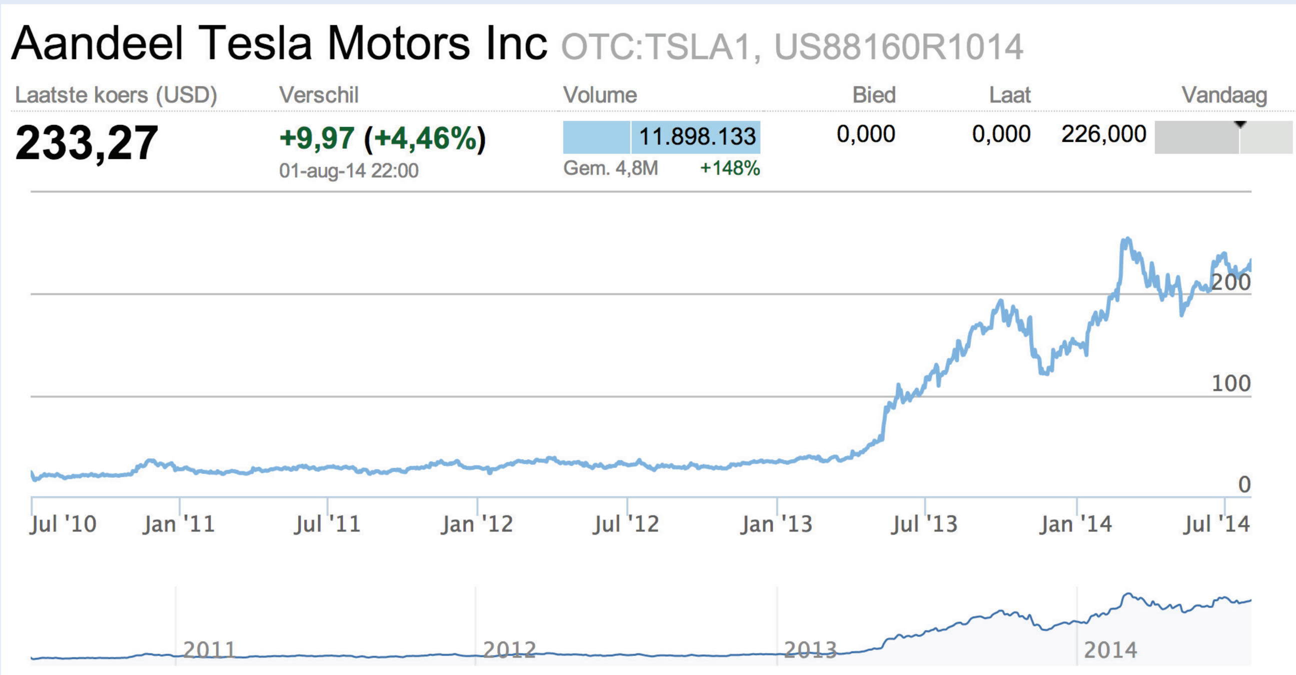


Figure 1. The performance of the stock since the year of existence (2010). Reprinted from IEX. Copyright 2014 by IEX. Retrieved from http://ten.sh/m

Although the Tesla stock became hype as the stock price quoted 100 times the expected profit for 2014, where a price-earning ratio of 20 is viewed as usual (Hendrickx, 2013), the lion's share of the stock's performance should be assigned to the release of their new full electric models. An impact like this after the release of an e-car doesn't seem to be realistic for re-nominated automotive manufacturers as BMW, Volkswagen and Nissan, as their core businesses still exists of the production of internal combustion engines. This research should find out whether a stock performance like Tesla's the last years belongs to the possibilities for established automotive manufacturers.

1 In the remainder of this report, the term full e-cars includes fuel cell electrical vehicles and battery electrified vehicles, according to KPMG's global automotive executive survey, 2014.

Methodology

To provide well-founded answers, the study's findings are partly based on literature research and partly based on data research. This means that quantitative research is combined with a literature review in order to give a clear picture. The literature review will discuss different views, aspects and stimulations for electric vehicles, further the stock market part of the review will give attention to factors and events determining the price of a stock. The information gained in the literature review is used to set realistic hypotheses. Eventually the data will be used to see what the impact will be on the market capitalization of a car manufacturer as it releases concepts to produce a new e-car or new conventional car? What is the effect of a vision focused on the future as other auto producers continue to build on successes, which are achieved with internal combustion engines? To investigate this impact an eye should be cast on the financial markets where the stocks are publicly traded. This means that the stock performance of the automotive manufacturers needs to be researched in the time period around such an event as the release. With the help of financial market data, an event study measures the impact of a specific event on the market capitalization of a firm.

Unfortunately, the impact on the reputation of an automotive manufacturer is hard to measure, as it is seen as an intangible immeasurable asset, which plays a significant role in the pricing of a stock as it influences future cash flows. Therefore the impact of the release of an e-car will be measured through the price of the automotive manufacturer's stock before the release and after the release of the new model.

3. Social Relevance

In the introduction different points of view have been contemplated with respect to cleaner vehicles. In this section, a number of recently published news articles will be cited in order to discuss the social relevance of cleaner vehicles, before the study continues with the literature review. The social relevance of the subject seems quite apparent. The automotive industry has globally a yearly turn over of 2.6 trillion dollars, which makes it one of the largest industries globally (SZW, 2009). Discussions about cleaner energy and alternative fuels belong to the order of the day. As days that no attention is paid to initiatives about alternative fuels in the newspapers, articles or documentaries are rare it signifies the economic and social relevance of the subject. According to Høyer (2008) there are four outstanding societal contexts that show the relevance of alternative fuel technologies and clean vehicles. The three social contexts exist of the following fields of interests, energy policies, environmental problems, sustainability and the more explicit climate change context.

In this section an extensive answer will be provided to the question, why this subject should be considered as social relevant. In order to arrive at a well-founded answer, all the fields given by Høyer (2008) will be examined in combination with recently published news articles. With respect to the societal contexts of energy policy, the EC recently has set some clear targets and achievements with regards to new vehicles and emissions in their energy policy. The targets and achievements must be reached before 2050 (European Commission, 2011). All member countries are enforced to stimulate the use of cleaner vehicles in order to reduce emissions towards 2050. The social relevance of clean vehicles becomes clear from the efforts that have been put in these policies the last years. One example, showing the social relevance of the subject is a report made on commission of the Dutch government, which is called, "waarde creëren uit maatschappelijke uitdagingen (2013)". In this report all the relevant parties that are required to achieve the goals set by the EC in energy policy 2050 are brought together. The report investigates and describes the measurements the parties could take in order to realize the EC-targets, with specific attention paid to the role vehicles could play (Adviesraad Wetenschap en Technologie, 2013). Looking at the second social context sketched by Høyer (2008), the environmental problems, it seems that most people are in some way aware and concerned of the environmental problems caused by emissions. On the forefront of our minds we see cities in Asia were people are wearing surgical mask because of the intensive rate of smog but this seems to be far away.

CHINADAILY 中国日报网 .COM.CN

Govt aims to get larger fleet of alternative-fuel vehicles on road

2014-02-15 08:04

A campaign to drive more new-energy vehicles on to the streets of China's cities has set new goals in the hope of revving up a market showing a distinct lack of interest.

An announcement from the central authorities included 12 more cities in a program to advance the use of environmentally friendly cars, taking the total number of cities and regions involved to 40.

Given lackluster national sales in 2013, the cities - including Beijing - have been set specific sales targets and are expected to act as icebreakers, getting the sector's frozen situation on the move again.
Cities in eastern regions are required to promote not less than 10,000 new-energy vehicles by the end of 2015, while targets for the rest are set at 5,000.

Beijing and Shenzhen have set their own targets of 35,000, pushing up the total for the 40 cities to around 320,000, according to a calculation by Hongyuan Securities.

That means at least 160,000 new-energy cars should be sold this year, over nine times last year's national sales. In 2013, sales of new-energy vehicles stood at just 17,642

The New York Times

High Levels of Pollution Spur Paris to Action

By ALISSA J. RUBIN MARCH 14, 2014

PARIS — Parisians taking public transportation to work on Friday were surprised and delighted to find free subways and buses for the next three days, but the reason was a bit less cheerful: Air pollution had reached an unusually high level and was expected to continue unabated through the weekend.

Bad air quality might be familiar to tourists here from Beijing or Mumbai, but in this elegant capital, where strict limits on building height create the illusion that plenty of fresh air is circulating, pollution is rarely this severe so early in the year and for so long.

“Due to a persistent episode of pollution with fine particles,” the Environment Ministry will impose exceptional measures, said Philippe Martin, the minister, in a somewhat cryptic statement on Thursday...

WALL STREET JOURNAL

Will Natural Gas Fuel America’s Big Trucks? Shell Treads Carefully

By TOM FOWLER - Feb 27, 2014

Shell is tapping the brakes on plans to push natural gas as a fuel for the trucking industry.

The company confirmed it will not build a previously announced plant 20 miles west of Calgary that would turn natural gas into liquid form, known as LNG, for use in heavy duty trucks.

Shell still plans to build out a network of LNG fueling stations along a 900-mile stretch between Alberta and Canada’s Pacific Coast. But those LNG service stations, which will be operated by Pilot Flying J, will sell natural gas fuel created by a company other than Shell.

“We are definitely still interested, but it’s an emerging market so Shell has to take a balanced approach to these developments,” Shell spokeswoman Destin Singleton said....

Figure 2. These images of different newspapers (China Daily, New York Times (A.J Rubin) and Wall Street Journal (T. Fowler)) illustrate the relevance of alternative fuels and pollution caused by conventional cars.

However smog problems aren't that far away for Europe, as becomes clear in figure 3, last spring Paris was hit by high intensity of smog, forcing the French minister of traffic to take unprecedented exceptional measures. The public transport system was free of charge and the government promoted travelling by bike (Rubin, 2014).

The last two fields of relevance mentioned by Høyer (2008) are closely related to the above-discussed contexts and newspaper articles.

The sustainability and climate change social contexts described by Høyer (2008) are highly interrelated with the environmental problems and energy policies in the case of alternative fuels. The widespread attention given to the quarterly results of Tesla, not only in the financial world but also on the general news, provides an example of the growing interest in the field of sustainable products. The climate change is unmannerly said the actuator for the increasing attention paid to sustainable and environmental friendly concepts. According to the European energy policy 2050 (EC, 2011), the only way to avoid intensive climate changes with respect to car usages is by using more sustainable vehicles. However, the ways in which governments should realize the goals that have been set in the energy policy of 2050 are still food for thoughts. This makes it interesting to contribute something to the researches in the field of alternative fuels and vehicles and their implementations.

The importance and issues of cleaner vehicles nowadays are translated in the number of scientific articles published in the last fifteen years. The last fifteen years, almost 1.5 million articles have been published in this field of research according to Google Scholar. While the number of articles published before the millennium amounted a total of 0.5 million articles. Although, there is a large diversity in the aims of these scientific articles, the number of published articles underlines that the research field of alternative fuels is gaining interest from multiple disciplines of science. These examples have hopefully convinced the reader about the social relevance of this subject, before the study continues with the literature review.

4. Literature Review

The literature review which follows, discusses the different views of multiple authors with regards to alternative fuels and stock performances. As have become evident from the introduction this study combines the two subjects. On one hand clean vehicles, alternative fuels and their impact on environment and on the other hand the affect on the market capitalization of the release of a new car by an automotive manufacturer. To keep a clear structure along this study, an individual treat of both subjects is also applied in the literature review.

Clean Vehicles

To get some affiliation with the subject, some characteristics of the automotive market are provided before the different aspects of electric vehicles will be discussed.
The average number of cars per 1000 persons worldwide is showing an increasing trend over the years according to the database of the World Bank (2011). In the year 2011 the number of cars worldwide surpassed for the first time the border of 1 billion cars (Tencer, 2011). According to van den Berg et al. (2009), in 2009, the majority of the motor driven transport in the Netherlands was powered by oil, which makes the automotive industry highly dependent of a finite resource. In the current state this means that vehicle population needs 87 million barrels of oil per day. If the vehicle population increases on the same rate in the upcoming years it needs more than 120 million barrels per day in 2030 according to Sperling and Gordon (2009). Given the slow depletion of conventional oil sources it is not clear if the world could handle such a capacity to produce oil. This increase in vehicles worldwide has different meanings for automotive manufacturers, customers and the environment. Most outstanding are the impacts on the environment, which should ultimately lead to changes in customer desires and producer technology. In their report about global warming and air pollution MacKenzie and Walsh (1990) recommend a shift in policies to stave off deleterious future impacts of increasing car usage. It seems more or less that all parties involved have listened to their recommendations. As they aimed for a better vehicle efficiency, reduction of greenhouse gasses and the creation of non-polluting cars that operate on something other than fossil fuels. Nowadays, a clear trend is visible with regards to new vehicles and their efficiency, as automotive manufacturers and consumers aim for cleaner vehicles in order to minimize the negative externalities of transport (Lewis, 2014).

Therefore, it is essential to understand the correlation between transport and the environment to be able to tackle transportation's negative effects (Timmermans et al., 2006). Automotive manufacturers have become aware of this negative relation the last years, whether or not by legislation, as they responded by making cleaner vehicles. According to KPMG (2014) a strong increase in investments in hybrids, plug in hybrids and the optimization and downsizing of internal combustion engines will take place in powertrain technologies the next 5 years. It is important to make a distinction between the different types of cleaner vehicles as they all contribute to varying degrees to the reduction of greenhouse gas emissions. Where some authors precisely stress the differences between cleaner vehicles and their emissions (Timmermans et al., 2006 and Grünig et al., 2011) others like Lewis (2014) forget to recognise or don't attach value to the distinction. Lewis (2014) makes a more simplistic distinction as there are three types of fuel-efficient vehicles namely, hybrids, those that operate off of bio-diesel and fuel-efficient gas powered cars. In their articles KPMG (2014), van den Berg et al. (2009) and Timmermans et al. (2006) make a comparable but more extensive distinction between the different types of clean vehicles wherein attention is paid to the emissions of these vehicles. However, it becomes clear that the distinction in clean vehicles should be based on the fuels used and the drive trains of these vehicles.

Still, most investments made by automotive manufacturers focus on the optimization of internal combustion engines as they respond to customer's desires. But the changes made in the engine contribute only slightly to the reductions of emissions. As Timmermans et al. (2006) indicates that the positive influence of an improved engine technology is annihilated by an increase of the vehicles weight or an increased energy consumption caused by certain on-board options. As the optimization and downsizing option of internal combustion engines doesn't contribute that much to environmental problems the following clean vehicles are left for discussion according to KPMG (2014), plug in hybrids, hybrid systems, pure-battery electrified, battery-electrified with range extender and fuel cells electrical vehicles. The last three above-listed types usually coincide under the header electric vehicles or e-cars. Van den Berg et al. (2009) add two more alternative fuelled driven cars to this list of so called clean vehicles namely bio fuelled and hydrogen driven vehicles. So that the list of clean vehicles outlined by Lewis (2014) and above mentioned is complete again. But van den Berg et al. (2009) indicates that these alternative fuel driven vehicles comprise some serious shortcomings. Bio fuels vehicles reduce Co2 emissions little, are harmful for the biodiversity of the landscape and additionally have the problem that the generation of bio fuels ensure a competition for land that could be used for food and agriculture. For vehicles powered by hydrogen appear other problems, as the deployment of hydrogen for vehicles contains many uncertainties and the generation costs lots of energy.
These disadvantages make it hard to economically justify the implementation of vehicles driven by bio fuels and hydrogen. Therefore the conclusion can be drawn that only the above-described e-cars by KPMG (2014) fulfil the requirements to become the clean vehicles of the future. That e-cars are economically viable can be seen in the investments made by automotive manufacturers (KPMG, 2014) and is underlined by the findings of van Meerkerk et al. (2011), who indicate that the supply of electric vehicles increased rapidly the last years.

The influence of electric cars on the quality of life

In the nearby future, city governments will lay a greater emphasis on the air quality. The recent air quality problems in the inner city of Paris have shown the relevance of these emphasizes. The introduction and the large enthusiasm from city life for electric vehicles with lower emissions seem therewith not taken out of the air. The municipality of Amsterdam has recently invested heavily in the augmentation of sustainability for taxi traffic around Schiphol Airport through the provision of subsidies for the purchase of Tesla taxis and a tender for more sustainability focused taxi companies. To see why and in which areas people benefit the most from a large-scale implementation of electric vehicles, different articles have been consulted. Most of these articles compare the costs of internal combustion traffic with the costs of alternative fuel driven traffic.

According to Sperling (1995), car users in the United States pay 68 to 80 percent of the total costs of motor vehicle usage. These costs include the car itself, fuel and fuel taxes, registration, insurance and parking costs. However these costs don't include the costs of traffic congestion, accidents, noise and environmental degradation. To capture all these costs in one name, Ogden, Williams and Larson (2004) came up with the concept of societal lifecycle cost of transportation. However, a distinction is necessary between the societal lifecycle costs of transportation for different locations, as dramatic variations exists in environmental costs for cities relative to less densely-populated areas. The external costs of transport are higher in cities relative to less crowded areas. Bickel and Friedrich (2004) have taken into account the different effects of the types of societal lifecycle costs of transportation in urban areas and non-urban areas. Based on the findings of Bickel and Friedrich (2004), Proost and Dender (2001) have done research about the impacts on welfare in urban areas of different policies that should be introduced to reduce the negative effects of societal lifecycle costs of urban transportation. All these articles and researches primarily focus on the societal lifecycle costs for urban areas probably because traffic pollution, congestion, accidents and noise are more relevant for urban areas. This means that car users driving during peak hours in congested city are heavily subsidized, as drivers at those times and places only pay a small share of the factual total costs of travelling by car (Sperling, 1995). Thus, the societal lifecycle costs seem to be higher for cities than for rural areas, suggesting that existence and presence of electric vehicles will be higher valued in these places, as the welfare in urban areas will improve (Proost and Dender, 2001). So, it is the city residents that will benefit the most from the presence of electric vehicles.

Ogden, Williams and Larson (2004), confirm the gain in welfare for city residents, through a comparison between internal combustion engine driven cars and electric driven cars carried out for the different costs levels of the social lifecycle cost concept. They came to the conclusion that fuel cell cars stands out as having the lowest externality costs of any option and, when mass-produced and with high valuations of externalities (environmental and oil supply insecurity and complexity), the least projected lifecycle cost.

To remain satisfied with incremental improvements is to accept a slow deterioration in environmental and urban conditions. It is time for society to contemplate a more radical break from the transportation and energy strategies of the past (Sperling, 1995). With the help of electric vehicles this could be realised without restricting or limiting people in their movement. The number of trips per person could increase or stay constant with respect to current levels without decreasing the quality of life, as social lifecycle costs per trip decrease, as cars will drive on alternative fuels.

Adaption of electric cars

The adaption of electric vehicles will be however to the utmost extent determined by the demand, as consumers should be willing to buy an electric car (van Meerkerk et al., 2011). Despite the different types of cleaner vehicles customers still seem to prefer the internal combustion engines according to KMPG's global automotive executive survey of 2014. As electric vehicles show a lot of advantages in terms of environmental issues but mostly fall short in user friendliness, most authors have aimed for government intervention to provide the e-car market a nudge in the right direction. Governments could intervene with multiple tools to help the e-car market. According to Diamond (2006) several factors such as monetary incentives, gas prices and the costs per mile have a direct impact on total ownership of electrical vehicles. The results of the research show that consumers react to each of these factors to varying degrees, though the largest value is attached to the fuel prices. Since governments are in the position to influence all the factors mentioned by Diamond (2006) they are able to influence the e-car market in different ways. Åhman (2006) looks at these government policies and the development of electric vehicles, in the way they have been applied to Japan. Just like Diamond (2006), Åhman (2006) shows that there are multiple policy instruments. He describes the policies more extensively, as multiple examples and their outcomes of Japan are used during the article.

Policy instruments

The different policy instruments may be divided in three categories according to Åhman (2006). The government could fund research and development and provide strategic guidance. Secondly, the government could invest in the creation of a favourable environment through investments in infrastructure projects. He aims with this category on the establishment of fuel stations for energy vehicles. Additionally, the government could invest in market support by setting up various leasing and purchasing incentives programs for electric vehicles. Grünig et al. (2011) show that most European countries are on the right way with stimulating policies as they have introduced several CO_2-based vehicle taxes favouring the adoption of e-cars. Tax incentives, restrictions and rebates belong to the other measures that could be taken and have been instituted in many European countries. Besides the national governments, local governments and other agencies should be encouraged to supply further funding within their area jurisdiction (Åhman, 2006). All these incentives seem to be useful and should help to enlarge the feasibility of e-cars. But Diamond (2006) warns that despite the interesting insights in the determinants of electric vehicle stimulation there is a need for additional research on the topic that should give a better indication of the impacts of government stimulation. The warning of Diamond (2006) about the usefulness of these articles show that these researches contain much information about policy instruments but don't succeed to provide clear insights about the outcomes of these policies.

Grünig et al. (2011) indicates that the further up take of e-cars, will tend to be heavily supported by government and industry programs. These stimulations remain necessary as the sales of e-cars are still at a low level with respect to the sales of internal combustion engine vehicles (KPMG, 2014). This ensures that governments feel compelled to intervene to reach the targets that have been set by the European Commission for 2050. To reach a world with reduced emissions, which is less dependent of finite resources, governments need to stimulate the use of cleaner vehicles (KPMG, 2014, Timmermans et al., 2006 and Grünig et al., 2011). Diamond (2006) mentions in his paper that the results of policies in financial terms are not always clear but Timmermans et al. (2006) show that a positive evolution of the environmental performance of vehicles can be observed over time. They attribute this success to the ever more stringent European emission regulations. As aforementioned this observation of Timmermans et al. (2006) also underlines that automotive manufacturers succeed in their attempts to reduce the negative relation between the environment and vehicles. As automotive manufacturers succeed, the low shares of e-cars of the total car sales must be the result of a consumer demand that falls short. Customers are dubitable to adapt e-cars because of several shortcomings of the cars (van Meerkerk et al. 2011), which will be discussed in the end of this part. The demand for the cleaner conventional cars comes forth from their efficient fuel use (KPMG, 2014) and as long as e-cars are not as good as conventional cars the percentages of sales doesn't seem to change (Grünig et al. 2011). That governments understand the seriousness of the situation becomes evident from the numbers provided by Grünig et al. (2011). A total of 21.6 billion euros is invested in e-cars globally by governments and industries. The majority of this amount is invested through the governments of the United States and European Union. According to Grünig et al. (2011), the tendency has been to support subsidy programs for electrical vehicles dispersion. An indication of the increasing political pressure and will to promote e-cars becomes clear from the fact that large sums are spent by government institutions or are part of national economic stimulus programs to support electrical vehicles. Additionally, Grünig et al. (2011) indicates that infrastructure for electric vehicles is often developed and installed with the help of private companies. The public- private partnership discloses that there is not only interest for e-cars from a political position, but also from business society because of the economical potential.

Development of electric cars

However, as aforementioned and as Åhman (2006) describes in his article, the development of alternative vehicles has never unfolded according to the plan. Grünig et al. (2011) note that in the near term future the market penetration of e-cars remains low compared to internal combustion engine vehicles. The numbers provided by KPMG in their 2014 survey confirm this expectation as sales of e-cars still contain only a small part of the total car sales. In the remainder of this part will be shown why the plans didn't work out in spite of so many benefits. Electric vehicles are a promising technology for reducing the greenhouse gas emissions and other environmental impacts of road transport (Grünig et al., 2011). Van den Berg et al. (2009) and van Meerkerk et al. (2011) underline that the advantages of e-cars are numerous as they describe them intensively. Both authors allude in their papers that the implementation of electric vehicles will lead to less dependence on oil and the oil-countries and indicate this as an advantage for the respective importing country. Van den Berg et al. (2009) show that electric vehicles have taken, over the whole chain from production to end-use, lower Co2 emissions. With a power generation that makes use of fossil fuels like coals, oil and gas, the Co2 emissions will be 50% lower for electric vehicles compared to oil and diesel driven cars. As renewable energy is used as fuel for the e-cars, Co2 emissions could even be reduced with 90% (Van den Berg et al. 2009). Additionally both authors (van den Berg et al. and van Meerkerk et al.) speak about the importance of electrical driving for the air quality, as traffic has a large share in the poorer quality of air in densely populated areas. Van den Berg et al. (2009) mention the low noise emissions of electric cars as an advantage while on the other hand Cocron et al. (2011) indicate that there are also concerns resulting from the low noise, which mostly focus on the perception of pedestrians, hearing-impaired or blind people. From their results consisting of interviews and questionnaires, Cocron et al. (2011) conclude that the drivers appreciate the low noise emission, but at the same time have to be aware of the related potential dangers. The benefits of e-cars with exception of the noise argument, thus in general relate to environmental improvements. In line with Timmermans et al. (2006) findings, who summarize from their Ecoscore[1] that electric vehicles have a relatively low environmental impact.

(Dis) advantages

The benefits of e-cars are evident but what stands a mass adoption of electric vehicles in the way? According to Grünig et al. (2011) in comparison to a conventional car, e-cars almost always perform weaker. In particular, vehicle price and mass, two essential purchase criteria are significantly higher for the e-car. As a consequence, the market penetration of electric vehicles might remain low, as potential buyers would rather stick to the lower-priced internal combustion engine version with a better overall performance. Although electric cars differ not that

1 A comprehensive and transparent overview/summary of the environmental ratings for road vehicles. This methodology allows the assessment of vehicles with different drive trains and using different fuels. This environmental rating system is designed by Timmermans et al. (2006) and function as a tool for policy measures in Belgium.

much from conventional cars in terms of acceleration and speed, e-cars can only run at the top for a short time because of overheating (Grünig et al. 2011). Additional problems for e-cars occur with respect to the user friendliness of the cars, producers mention that e-cars can travel 150 kilometres but this number is likely to be lower in practice (van Meerkerk et al., 2011). Moreover the charge of the battery takes too long and there are too less charging points. Van den Berg (2009) speaks about the same problems and concludes that this leads to reluctance from customers, as there are a lot of uncertainties.

So although the production of electric vehicles seems to be the best way to respond by automotive manufacturers in terms of the environment and finally the society, there are some drawbacks that make them reticent to make the step. In addition to the development costs and the slow implementation of these cars by the public (sales of e-cars contain less than 5% of total car sales (Lieven et al, 2011), the driving range of the cars has proved to be a barrier of adoption. Van Meerkerk et al. (2011) mentions the limited range of 150 kilometres of e-cars before they need a new re-charge. However there is one exception is Tesla, who claims to have a reach of more than 500 KM, however this comes at a price (Tesla, 2014 and KPMG, 2014). In the subsequent part of the literature review attention is given to the reasoning behind the retained attitude towards e-cars from automotive manufacturers, which is mostly caused by the benefits internal combustion engines enjoy.

According to a survey of KPMG (2014) of auto producers the changes in the automotive industry are not taken place sequentially as the efforts are divided between e-cars and the optimization of internal combustion engines. Although e-cars are expected to gain a large market share far away in the future, at this moment consumers give contrasting signals, as still 94% of the new bought cars contain an old school internal combustion engine (Rijksdienst Ondernemend Nederland, 2013). Besides the relatively long development cycles in the automotive industry means that some of the new advances may take as much as five to ten years to evolve (KPMG, 2014). Additionally, the trend towards e-mobility is happening slow as car producers have strong ties with internal combustion engines and the presence of a large second hand market for cars. The fact that these engines have belonged to the core business for automotive manufacturers for years makes the transition harder.

The last argument in favour of internal combustion engines has to do with the golden business rule, which says, "The client is king". As long as customers around the world stay interested in vehicles with internal combustion engines and as long as their preferences do not change, it pays off to produce these vehicles. According to KPMG's global automotive executive survey 2014, 92% of the automotive buyers worldwide have on top of their priority list, the fuel efficiency of a car and not so much the environmental friendliness or alternative fuels of this car.

The survey of KPMG shows that the top priority for today's car buyers is a longer lasting vehicle with low fuel consumption as consumers behave economically rational. Although driving environmentally friendly is still high on the wish list other things are considered to be more important for consumers, today. This finding underlines again the importance of the economic incentives given by governments for the sales of e-cars.

Financial Impact

With the information about e-cars in our minds it is time for the second part of the literature review, which will discuss subjects related to stock price changes as a result of news or product announcements. To discover which news and events are likely to have an impact on the price of stocks different articles were consulted. In the last part of the review, attention will be paid to the factors that need to be taken into account to measure an impact on the stock price.

News on the stock market

In an efficient market, security prices at any given time fully reflect all available information. A priori, there is a good reason to believe that stock markets are efficient because stock markets are paradigmatic examples of competition (Vega, 2006). According to Lane and Jacobsen (1995) a stock return reflects investor's aggregate expectations of the change in long-term future cash flows. This means that stocks instantly adjust to new levels as a change in fundamentals or future cash flows could be expected. According to Sloan (1996) the price of a stock is majorly determined by the future cash flows of a company, but stock prices are failing to reflect the full information contained in the accrual and cash flow components of current earnings until that information impacts future earnings. But the question remains what the impact of news or an event on the price of a stock could be? Cutler et al. (1998) mention that fluctuations in prices of stocks can't be fully explained by news. They mention that movements in stock prices reflect something other than news about fundamental values consistent with evidence on the correlations of ex post returns. Chan (2003) recognizes the findings of Cutler et al. (1998), as he declares that most of the research on stock returns after specific news items supports the idea of under reaction, which is defined as average post-event abnormal returns of the same sign as event date returns. The above-mentioned conclusions signify that the price movement of stocks after the release of news is negligible.

However McQueen and Rolley (1993) doubt the findings that news has little effect on stock prices. They indicate that after allowing for different stages of the business cycle, a stronger relation between stock prices and news becomes evident. According to the modern financial markets theory of Fama (1991), stock markets rapidly absorb new information as it becomes available. Thus, it is the future, based on current information, not the past that drives current stock return (Lane and Jacobsen, 1995). Ryan and Taffler (2004) confirm the aforementioned

finding, as their results show that firm-specific information events drive economically relevant positive and negative stock price changes. For their research Ryan and Taffler (2004) used 350 companies active in all kinds of sectors, which are listed in the FTSE, and conclude from their results that no less than 65% of significant price changes and trading volume movements can be readily explained by public domain information. This means that share price changes and trading volume activity are driven by information flows.
Chan (2003) comes with new evidence as he examines different views of investor's reaction to news. He indicates that investors appear to underreact to public signals and overreact to perceived private signals. The findings show that there is a possibility that stocks exhibit abnormal returns after news. According to Fama (1991) this take place because of market efficiency, so that the estimate of the abnormal or excess stock return provides an unbiased estimate of the future earnings change in market value generated by news or an event. Rupp (2004) shows that different kinds of recalls cause significant shareholder losses, from the moment of announcement. The stock market's response to automobiles recall announcements does not occur until the information is reported to all market participants (Hoffer, Pruitt and Reilley, 2005). They indicate that the differentials in the trading volumes around the announcement date suggest that the financial community may be trading stocks on the basis of information contained from the first public announcement. These findings show that traders in automotive manufacturer's stocks react and act immediately from the moment new information becomes available. But one has to be careful with these conclusions because according to Jegadeesh and Titman (1993) there are also stocks exhibiting abnormal performances without any news. So distinction must be made between reactions caused by news and other declared reactions. However from these articles could be understood that the release of an e-car could possibly affect the performance of an automotive manufacturer's stock.

Tumarkin and Whitelaw (2001) add to these findings, although one has to keep in mind that their research differs somewhat from the aforementioned ones as they focus on news released on Internet forums. They mention that on days with high message activity on trading forums caused by news, changes in investor's opinions could lead to abnormal industry-adjusted returns. The change in investor's opinions could be the result of new products, releases or other news. Meanwhile the research of Koku et al. (1997) comes closer to the impact of a release, as they investigated the effects of product announcements on stock prices. The reason why the research of Koku et al. (1997) is somewhat more specific with regards to the release of e-cars is that the article shows how and whether firm-related news has an impact on the performance of a stock.

A product announcement is comparable with the release of a new car, which means that their outcomes need to be well considered. According to them preannouncements could have a significant positive effect on stock prices. But, the signalling effect of preannouncements on stock price is industry-specific. Besides a distinction needs to be made between product preannouncements and announcements as no effects in the stock price can be seen in case of the latter. In particular, the results support Klein and Leffler's theory (1981), that preannouncements in the manufacturing industry are effective strategic tools. Whether this also applies to automotive manufacturers remains to be proven during this thesis. According to Lane and Jacobsen (1995), investors vote, that means sell or buy, when a brand extension is released on the basis of their expectations of how the extension will affect the discounted value of future cash flows. These cash flows depend in turn on investor's expectations about future consumer choices in the extended market and in other product markets in which the brand competes. The research of Lane and Jacobsen (1995) about brand extension and stock market reaction connects perfectly to the investigation of the release of e-cars and the impact on stock performances. Well-established automotive manufacturers extend their brand and assortment with the release of an e-car. Lane and Jacobsen (1995) come to the conclusion that the stock market perceives that a leveraged brand benefits or suffers from each of these consumer reactions differentially depending on brand attitude and familiarity. So for automotive manufacturers the performance of the stock after the release of an e-car could be different since consumer's reaction depends on brand attitude and familiarity. In short according to Lane and Jacobsen (1995), all kind of reactions could be expected after the release of an e-car as it depends on characteristics from the customer side as well as the brand side.

The different scientific articles discussed above show a mixed picture of results as some researches are convinced of the effect of news on the performance of a stock, where others doubt these findings and believe that stock prices are determined by other factors. Therefore it might be important to look at the timespans used in the multiple articles, as stocks sometimes drift for a while after news have been released according to Michealy et al. (1995). The variety in results obtained along the articles could be explained by the different timespans. Overall it is hard to conclude if a stock should react positively or negatively to news and or a product announcement as the reaction depends on multiple factors in the market place.

So looking at the impact on the stock's performance, one needs to take into account several factors. Two of these factors, the volume and sentiment are widely discussed in the literature as different perceptions and interpretations have lead to different outcomes. One has to keep in mind that the volume of stocks traded owing to the release should differ from the average volume in order to indicate whether there is a visible reaction or not. In addition, the sentiment that prevails at the equity markets at the moment of release is of interest since it could influence the direction and the size of the reaction. According to Jones and Litzenberger (1970), there are technicians who maintain that an early knowledge of the trend generating effects of new fundamental information can be ascertained by observing recent stock price movements, or the patterns of these movements. In other words a positive reaction after the release of an e-car could be partly biased, as the overall trend and sentiment on the stock market might be positive at that time.

Traded volume

As aforementioned an increase in the volume of the stocks traded of the automotive manufacturer after the announcement of an e-car shows whether there is a significant reaction of investors. The trading volume of a stock reflects investor's activity by summing all market trades (Bamber, 1986). According to Wang (1994) the traded volume in a stock is positively correlated with absolute changes in prices. Indicating that an increase in the trading volume after the release would lead to a drop or rise in stock's price. Karpoff (1987) endorses this as he founds the same positive relation. The traded volume is positively related to the magnitude of the price change and, in equity markets, to the price change per se (Karpoff, 1987). Wang's (2004) model implies that public news that could influence the stock's future cash flows in most cases generates abnormal trading volumes. The asymmetric information that arose from the release should lead to different interpretations of investors and as a result to higher trading volumes. Kim and Verrecchia (1991) add to this as the volume contains the differences among traders which are averaged out in the returns data, the use of volume in conjunction with returns could identify systematic differences in investor's knowledge or other characteristics which result in different reactions to public announcements across firms or across types of announcements. Therefore it is necessary to look at the trading volumes of the automotive manufacturer's stock after the release of an e-car in order to see if the news reaches the investors, lead to changes in perceptions and consequently has any impact. If the volume after the release lies significant above the average daily turnover one could speak of an evident reaction. In addition, Bamber (1986) found an inverse relationship between the trading volume and the size of a firm, besides the volume differs per index and per automotive manufacturer stock. Easly et al. (1996) confirm the finding of Bamber (1986), as their most important empirical result is that the probability of information-based trading is lower for high volume stocks. This makes it judicious to compare the average volume numbers with the volume after the release in order to obtain consistent results.

Volatility index

There is also a possibility that the response of investors will take some time as the release of the new e-car needs to take in. These kinds of reactions are harder to measure, as the performance of the stock could be strongly influenced by a positive or negative sentiment on the index it is listed at that particular moment. Therefore it is important to take into account the predominant sentiment on equity markets at the moment of release. The sentiment on equity markets is partly scaled in the volatility index, which is commonly known as the investor's fear gauge (Whaley, 2000). With partly scaled in the volatility index is meant that the volatility index is an indicator of the sentiment that predominates on the stock market at that moment. Financial news services, now routinely report the level of the Market Volatility Index, or VIX, which is healthy as investors seek for more information with which to assess the state of the economic environment (Whaley, 2009). Poon et al. (2003) stresses the relation between the economy and the VIX as they mention that the financial market volatility can have a wide repercussion on the economy as a whole. The VIX is an index computed on a real-time basis each trading day. The volatility index is originally set with two purposes, to provide a benchmark for expected short-term volatility and to provide an index upon which futures and options contracts on volatility could be written (Whaley, 2009). The index is set by investors and expresses their consensus view about the expected future stock market volatility. The volatility index is calculated on a second by second basis from the implied volatilities of the eight near the money options of the underlying index. An option near the money means that the strike price of the option is nearby the current market price of the underlying security (Whaley, 2000 and Carr and Madan, 2001). According to Cutler et al. (1998), volatility may reflect changes that take place in average assessments of given sets of information regarding fundamental values as investors re-examine existing data or present new arguments. If the stock performance of BMW is investigated, it would mean that the implied volatilities of the eight near the money options of the underlying Germany's DAX Index needs to be taken into account or in more well-known words, the VIX of the DAX Index.

These implied volatilities are then weighted in such a manner that the volatility index represents the volatility of twenty-two trading days, (equally to a 30 days-month calendar) at the money options of the underlying index (Fleming, 1998 and Whaley, 2000). Since the volatility index is based on the prices of options of the underlying index, the volatility index represents a market consensus of the expected volatility of the underlying index. This indicates that for this thesis, the VIX of the German DAX Index will be used if we take the volatility into account for the stocks of automotive manufacturer traded on the German stock market, like Audi, BMW and Volkswagen. The higher the volatility index quotes, the greater the fears in the underlying index (Giot, 2005). According to Giot and Whaley, high levels of the volatility index are coincident with high degrees of market turmoil, whether the turmoil is caused by stock market decline, the threat of war, an unexpected change in interest rates or other newsworthy events, the higher the volatility index, the greater the fear in the market. An important way to judge market anxiety is to examine the persistence with which the volatility index remains above certain extraordinary levels (Whaley, 2009). An unwritten rule is that as the volatility index quotes above 28%, panics sneak into the equity markets, which in most cases is the result of or will lead to a sell-off in the majority of the stocks being traded in the relevant index. Whaley (2009) agrees on this as he shows that high levels of the VIX reflect investor's anxiety regarding a potential drop in the stock market.

In 90% of the trading days on the stock market the volatility index has closed between the 11.70% and the 31.46% since the beginning of reporting in 1993 (Whaley, 2000), where a quotation between 11% and 20% indicates a period of calmness on the stock market. According to his research in 2009, some investors expect that if market volatility increases, investors demand higher rates of return on stocks, so stock prices should fall. This suggests that the relation between the rates of change in the volatility index should be proportional to the rate of return on the underlying stock index (Whaley, 2009). However prudence is necessary with this interpretation of the volatility index as Giot (2005) describes that there is a negative relation between the volatility index and an equity index. Whaley (2009) underlines this as he mentions that the relation is complicated as the VIX is more a barometer of investor's fair of the downside than it is a barometer of investor's excitement in a market rally. Giot (2005) adds to this since the relationship between the volatility index and the relevant equity index is asymmetric negative since the changes in the volatility index are larger as the stock index performs negative in comparison to the changes in the volatility index with a positive perform of the total stock index.

The reason why it is so important to take the VIX Index into account, even though it is asymmetric, is that it provides insights about the sentiment prevailing on the stock market. According to Blair et al. (2010) all relevant information is provided by the VIX, which makes the volatility index the most accurate forecaster for all forecasts horizons and performance measures considered. It is important to emphasize that the VIX is forward looking, that is, it measures volatility that investors expect to see (Whaley, 2009). So on the basis of the volatility index conclusions can be drawn about the sentiment prevailing on the market before and after the release of the e-car. But Campbell and Hetschel (1992) suggest that the volatility feedback normally has little effect on returns, but it can be important during periods of high volatility. So speaking it is possible to say things about the sentiment through the VIX, but the drawbacks of this method should be taken into consideration.

A lower volatility index should indicate a positive sentiment on the stock market and increases the chances that investors will receive the release of an e-car positively. In a period of general optimism or general nervousness a news release could lead to an excessive reaction. This overreaction could be to the downside as well as to the upside. For that reasons, it is important to make a distinction between the impact caused by the announcement and the part of the movement of the stock price, which is likely the result of the market sentiment at that moment. Multiple articles have been written about performances of stocks on particular days. Like Ariel (1990) who describes the performance of stocks in holiday periods or Cross (1973) studying the returns of stocks on Mondays and Fridays. However it is generally known that the range of trading days, a stocks ends in positive or negative territory explains a lot of the sentiment.

Therefore the numbers of days a relevant automotive manufacturer stock price have risen or dropped have to be taken into account as it provides additional information about the sentiment. Since the relation between the volatility index and the index where the stock of the automotive

manufacturer is listed is negatively asymmetric, the information about the stock ending in positive or negative territory increases the completeness of the results. If these winning or losing streaks are measured, the optimism or nervousness in certain sectors becomes clear, which could tell us more about the impact or feeling of investors towards clean vehicles with respect to the automotive sector.

From the literature review becomes clear that researches including automotive manufacturer's market capitalization and automobiles are scarce. The studies including automotive manufacturers and stock prices focus on event studies that investigate the relation between automobiles recalls and the market capitalization. Although there is no other study, examining the relation between different types of car releases and the market capitalization, the aforementioned papers show that possibly founded abnormal returns could be valid as the findings suggest that significant reactions can be expected from the moment firm specific news comes out.

Hypotheses

In this study, attention will be given to the shares of automotive manufacturers before and after the launch of a new model driven by electricity. As has been seen in the literature review, the impact of a release could be diverse, as investors could react enthusiastic, disappointed or don't react at all. The last reaction seems to be the most obvious, as car producers rank the importance of alternative fuel use, as the least likely factor that influences consumer purchase decisions (KPMG, 2014). I want to examine whether investors are as enthusiastic about e-cars as governments and business society seems to be or are as reticent, as consumers currently seem to be. On the other side, if there is no reaction in stock's performance, investors attach little or no value to the electric cars. The reaction and attitude towards e-cars could stem from various reasons.

The results are especially relevant for automotive manufacturers and investors. The founded results should provide insights to automotive manufacturers about the added value in financial terms of an electric car to their assortment. The performance of the stock after the release should be an indication of investor's (dis) appreciation towards auto producer's chosen direction for the future.

In order to investigate the main question "What is the impact of an e-car release on the stock price", the below shown hypotheses have been derived from the papers, articles and sources consulted in the literature review. The answers on these hypotheses combined with the answers of the sub-questions should provide an answer on the main question whether the release of an e-car has an impact on the market capitalization.

Hypotheses

1. The release of an e-car will have a positive impact on the market capitalization of an automotive manufacturer.
2. The release of a new conventional car will have an impact on the market capitalization of an automotive manufacturer.

In addition, from the literature review have become clear that the answers of the second and third sub-questions could function as a control for the founded results of the hypotheses. To discover the impact of the release of an e-car, corrections need to be made for the overall sentiment in the stock market and even more specific the trend in automotive manufacturer's stocks and volatility indices. A deviation from the average traded volume could provide more information about the fact whether the reaction is significant or not. As this has been done and a reaction is visible in the stock's price, one could carefully draw the conclusion that the release has an impact on the market capitalization of an auto producer.

5. Data Description

As previously shown, there are numerous automotive manufacturers with an e-car in their assortment and numerous indicators in the stock market that need to be considered when approaching the financial impact of such a product release. However in order to perform the analysis, some operational definitions are required, as well as a set of indexes and automotive manufacturers.

Financial impact operationalization

Economists are frequently asked to measure the impact of an economic event on the value of the company. MacKinlay (1997) mentioned that the economic impact of an event could be constructed by using security prices observed over a relatively short time period. This method has the main benefit that it is relatively straightforward and could provide conclusive results if the event situation is compared to the normal situation. More specifically has the financial impact of a product announcement been conceptualized and operationalized by Lane and Jacobsen (1995) as they took the stock return as a measure of the financial impact because investors update their expectations about long-term future cash flows, reacting immediately by buying or selling stock as new information becomes public. The underlying idea behind this concept is that publicly traded companies constantly provide information to investors through announcements and quarterly results. The stock price, in return, is a signal to the company whether investor's expectations are accomplished so that shareholders earn their desired rate of return (Lane and Jacobsen, 1995).

As the financial impact of a product announcement can be operationalized through the stock price, the next task is to identify the period over which the stock prices of the firms involved in the event will be examined, called the event window (MacKinlay, 1997). Different sizes of event windows could be used depending on the period of interest, where MacKinlay (1997) suggests that it is customary to define the event window larger than the specific period of interest. The period of interest is often expanded to multiple days including at least the day of announcement and the day after announcement. More days for the announcement and after the announcement give a clearer picture of the differences in the performances of the stock. However to see the financial impact, the analysis should be focused on an eventual exceptional return between the opening stock price the day of the announcement and the closing stock price the day after the announcement. Which means that according to Lane and Jacobsen (1995) the financial impact can be measured with a time span of one day while MacKinlay (1997) indicates that more trading days need to be included to capture the difference between the normal return and exceptional return of a stock. Therefore it is important to make a deliberately choice for the number of trading days included in the event window to operationalize the financial impact of a release.

Financial impact indicators

Although event studies are done with the help of the daily returns of stocks and the market portfolio, it is useful to take several other factors into account when performing the analysis about financial impacts.

The first factor taken into account in the analysis is the index, where the stock is listed. The stock indices used in the analysis have been selected because one or more of the elected automotive manufacturer's stocks are publicly traded in these indices. Because a diversity of businesses composite these indices the daily returns of these indices represents investor's visions and expectations for the economy. Therefore the return of these indices will apply as the normal stock market return, as these indices provide a general picture of the stock market and provide an insight in the sentiment prevailing in the economy at that specific time.

The second indicator used for the analysis isn't used in other event studies. But the daily returns of the derivative indices of the above-discussed indices that represent the automobile, parts and transport sectors, could simply function as control variable. Additionally the daily returns of these indices could be consulted to explain extraordinary findings. In these derivative indices the stocks of companies active in the automobile, parts and transport sectors are accumulated based on certain weightings. This means that all the publicly traded companies active in these sectors are taken together in these derivative indices. However, this doesn't mean that investors buy their stocks on this derivative platform as the automobile, parts and transport indices are just a representation of the companies in these sectors measured by their weighting. These derivative indices were set up to provide investors a quick overview of which sectors in the economy are performing well on a particular trading day and which aren't. This signifies that as for example BMW, Audi and Volkswagen are performing well on a particular trading day, the value of the DAX Automobile & Parts is likely to increase as these companies have a heavy weighting. However one has to take into account the other publicly traded companies included in the DAX Automobile & Parts index, which could also play a significant role in the performance of the index. Looking at the performance of these derivative indices an image could be formed about the sentiment prevailing in the automobile and transport sector at the time of the release.

The third indicator taken into account in the analysis, but not in the event studies are the values of the market volatility indices, which are commonly known as the VIX's. These indices measure the volatility in the parent indices every trading day. The volatility indices could function as a control variable and could explain abnormal returns on the stock market, especially to the downside. The connections between the volatility market indexes and the parent indexes are straightforward as the VIX DAX measures the volatility of the DAX 30. Though one has to take into account that there isn't a market volatility index or data of the VIX for every main index. However, this shortage is quickly solved as the high correlation between the movements of the parent indices worldwide indicates that the market volatility indices must be highly correlated. The VIX is also seen by investors as the fear index and could be used as indicator for the sentiment revealing on the trading floor. Since the VIX provides information about the sentiment on the stock market it could serve as a control variable for the reaction of a stock before and after the release of an e-car.

The fourth factor that will be used is the traded volume of the automotive manufacturer's stock around the release. If the number of stocks traded around the release lies above the annual average volume of traded stocks, it means that there is more activity in the stock. The higher activity could possibly be due to the release of the new car, as investors reconsider their position on the basis of the new information. Therefore there must be taken into account, whether the larger number of trades in the automotive manufacturer's stock is caused by the release or an external event.

Release definition

The conceptualization of a product release is important as it clarifies the term for the remainder of the paper. A product release is the process of launching a new product for a specific market or user base. According to Frost and Sullivan (2009) a distinction between three phases in the release of a new product should be made. The first phase is the planning of the launch, the second phase exists of the launch execution and the third phase will be the launch monitoring. To investigate the financial impact of a product release the second phase sketched by Frost and Sullivan (2009) seems to be phase of interest. This phase includes the introduction of the product to the market through a press-announcement. The introduction comprises awareness and demand generating campaigns. The release date of a product is seen, as the day the product will be announced to the market by the company. Lane and Jacobsen (1995) indicate that when a brand extension announcement or a new product release occurs, investors vote, that is buy or sell, on the basis of their expectations of how the new product will affect the discounted value of future cash flows. The analysis will focus on this part of the release to measure the performances of automotive producer's stocks before and after the product announcement.

Automotive Producers

Worldwide a lot of companies are active in the automotive industry whereof a large number of companies only operates country specific. As it is hard to obtain data from all companies operating in the automobile industry worldwide and especially the ones that operate country-specific, the analysis makes use of the better-known auto brands. With the better-known brands is meant, the automobile manufacturers that have sold worldwide more than two million units in 2012 (Organisation International Constructors Automobiles, 2013). With this requirement, fourteen automotive manufacturers have been selected to be part of the analysis, however there were two more characteristics that had to be met. The presence of an electric vehicle in their assortment and the company needed to be publicly listed on a stock exchange index. Almost all the fourteen automotive manufacturers fulfilled these requirements with the exception of Chrysler. Since Chrysler has been taken over by the Italian automobile manufacturer Fiat during the crisis of 2008, it is not listed in the Nasdaq anymore. Meaning that Chrysler will be excluded from the analysis. The second step was to eliminate the automotive manufacturers that stick to their core businesses of producing internal combustion engines and haven't released an e-car the past twelve years. Only Suzuki would be eligible for disposal based on this criteria but the Japanese automotive manufacturer recently released the plug-in hybrid Swift. After these elimination rounds the list with automotive manufacturers that fulfilled the criteria was suitably reduced. The last step is somewhat more subjective as a brand has been selected which was subject to a hype, as could be concluded from their stock performances and their increases in sales, such as Audi. Additionally, Mitsubishi has been added as this automotive manufacturer sold the most electric vehicles in the Netherlands last years (Autoweek, 2013). In table A, an overview of the used brands is given.

Toyota	TOPIX	Suzuki	TOPIX
Volkswagen AG	DAX	Renault	CAC
Hyundai	KOSPI	Fiat	FTSEMIB
Ford	NASDAQ	BMW	DAX
Nissan	TOPIX	Mitsubishi	TOPIX
Honda	TOPIX	Audi	DAX
Peugeot (PSA)	CAC	Daimler	DAX
GM	NASDAQ		

Table A. The automotive manufacturers used along the analysis and the indexes these stocks are publicly listed.

Dataset description

Now that the selection of the automotive manufacturers has been clarified, a description of the automotive manufacturers and their release dates will follow below. Because two events were selected for all the automotive manufacturers shown in table A. barring the exceptions, the data descriptions will provide a short discussion about these events. For all automotive manufacturers, the release date of an electric vehicle and the release date of new model of a conventional car have been sought in order to solve the two hypotheses. The data set contains the stock prices plus a number of other characteristics of the selected automotive manufacturers and the indices they are listed for the time period 01-01-02 till 01-01-14. 121 days around the events with daily returns are selected, which will be extensively discussed in the methodology. An overview of all the dates used for the two event studies can be found in appendix A.

Toyota

Toyota Motor Corporation was founded in 1933 and is currently headquartered in Toyota City, Japan. Toyota was one of the first automotive manufacturers that put great emphasis on electric vehicles. Toyota started before the millennium with the Prius, meanwhile the Prius 4 and the plug in hybrid were released in September 2011 (Data-stream, 2014). As the focus lies on full electric vehicles the release date of the Toyota RAV 4 EV is chosen for the event study of e-cars. The first time that investors could become aware of the Toyota RAV 4 EV was on 30-04-12 from a press release (Green car congress, 2012). The release of the Toyota Camry is chosen for the event study of conventional cars. The car was released on multiple places at the same time in the USA on 24-08-11 (Toyota, 2011).

Volkswagen AG

Volkswagen Aktiengesellschaft was founded in 1937 and is currently headquartered in Wolfsburg, Germany. The most popular e-cars under the name of Volkswagen are the e-Up and the e-Golf (Data-stream, 2014). The release of the e-Up is chosen for the e-car event study. The e-Up was released on 14-03-13 in an official press conference in Wolfsburg (Volkswagen, 2013). For the event study of the release of conventional cars, the moment of unveiling of the Volkswagen Jetta is chosen on the Los Angeles Auto Show at 05-01-05 (Auto evolution, 2005).

Hyundai Motor Company

The Hyundai Motor Company is a South Korean automotive manufacturer founded in 1967 and currently headquartered in Seoul (Data-stream, 2014). In an official press release on 19-11-08, Hyundai announced the launch of their Blue Drive strategy an environmental initiative that should make Hyundai the environmental leader (Hyundai Motor Company, 2008). Hyundai showed their first concept of the I-flow, a full electric car, on the Geneva Motor Show 2010. The day of unveiling 01-03-10 is taken as the release date for the Hyundai I-flow (Groenlicht, 2010). Hyundai released the conventional Genesis model on the New York Auto Show at 04-03-07 (Auto blog, 2007).

Ford Motor Company

The Ford Motor Company was launched in 1903. The American automotive manufacturer is currently headquartered in Dearborn (Data-stream, 2014). At the Frankfurt Motor Show in 2009, Ford showed their first battery of electric vehicles, inclusive the Ford Focus Bev on 16-09-09 (Green car congress, 2009). The Ford 427, a purely conventional car was unveiled on the North American Auto Show at 05-01-03 (PRNewswire, 2003), this release date is used for the event study of conventional cars.

Nissan Motor Co., Ltd.

The company was founded in 1933 and is currently headquartered in Yokohama, Japan. Nissan produces electric vehicles under multiple names, however the best-known and best selling model is the Nissan Leaf (Data-stream, 2014). Through an official press release investors were firstly acquainted with the Nissan Leaf on 02-08-09 (Nissan, 2009). A new version of the Nissan Maxima was released just before the debut at the New York Auto Show by the press. The first articles inclusive photos leaked on 19-03-08 and this day is taken as the first day of acquaintance (Car advice, 2008). Nissan and Renault announced a partnership for a zero emission strategy on 09-10-08. The collaboration shows the emphasis of both brands towards more electric cars (Nissan, 2008).

Honda Motor Co., Ltd.

The company was launched in 1937 and is currently headquartered in Tokyo (Data-stream, 2014). Honda started relatively late with electric vehicle technologies. The world debut of the Honda Fit EV was at the Los Angeles Motor Show of 2010. The first day, investors could see the Honda Fit EV was 17-11-10 (Honda, 2010). The new Honda Civic should officially be released on the 2011 Detroit Motor Show. But the media, publicly showed the car a bit earlier as breaking news occurred on the 13-12-10 (Auto-guide, 2010). This date is taking into account for the event study of conventional cars.

PSA Peugeot

PSA PEUGEOT CITROËN

The company is based in Paris and was founded in 1894 (Data-stream, 2014). PSA Peugeot presented their Hx1 concept car in 2011 before the Frankfurt Motor Show to the press on 29-08-11 (Car magazine, 2011). This day is taken into account in the event study for e-cars as from this day investors were able to start assimilate the new information. Peugeot SA released the 407 Elixir for the first time on the Frankfurt Motor Show of 2003 on 13-09-03 (Car enthusiast, 2003). This date is taken into account for the event study of conventional cars. In September 2009, Mitsubishi Motors Corp. and PSA Peugeot Citroen signed a basic agreement to tie up on the development and supply of electric vehicles. Under the agreement, the two firms would develop an electric vehicle based on Mitsubishi's i-MiEV model (Data-stream, 2014).

General Motors

GM

General Motors was founded in 1908, and is currently headquartered in Detroit (Data-stream, 2014). Because GM went almost bankrupt in the financial crisis and had to get a financial injection from the US government, the prices of the stocks of GM are only available since the end of 2010 (Reuters, 2013). Therefore GM is not taken into account for the event study of e-cars, as the daily returns of the stock, around this process do not provide an objective representation of the potential influence of the release in 2006 of the Chevrolet Volt electric car (Chevrolet Volt, 2013). However, GM is taken into account in the event study for conventional cars. The announcement of the release of the Chevrolet Malibu on 20-04-11 is used for the analysis (General Motor, 2011).

Suzuki Motor Corporation

The Suzuki Motor Corporation was founded in 1909 by mister Suzuki and is currently headquartered in Minami-Ki (Data-stream, 2014). Because Suzuki stick relatively long to oil-fuel driven cars, there is no information about an eventual greener strategy or the production process of a full electric vehicle. For this reason, the plug-in Suzuki Swift is used for the event study of e-cars. This Suzuki Swift is partly driven by oil and partly driven by electricity and may be considered as the closest alternative in the assortment of Suzuki Motors Corporation to the other e-cars. The Suzuki Swift plug-in was presented on the Tokyo Motor Show to the press on 21-10-09 (Suzuki, 2009). For the event study about conventional cars, the release of the Suzuki Kizashi on the Frankfurt Motor Show, on 11-09-07 is taken into account (Auto blog, 2007).

Renault S.A

Renault S.A is a French automotive manufacturer, headquartered in Boulogne-Billancourt, founded in 1899 (Data-stream, 2014). Renault forms an alliance with Nissan Motor Co., Ltd. to produce zero emission vehicles (Nissan, 2008). The first production of this collaboration was announced on the Frankfurt Motor Show of 2009, where Renault presented four electric cars under the title Renault Fluence Z.E at 15-09-09 (Gajitz, 2009). The release of a concept car in the Renault Design's lifecycle-based series is taken into account in the event study for conventional cars. The car was revealed on the Frankfurt Motor Show of 2013, on 10-09-13 and the production started later in the year (Renault, 2013).

Fiat SpA

Fiat SpA is an Italian automotive manufacturer founded in 1899, till recently headquartered in Turin (Data-stream, 2014). The Fiat group acquired most assets of Chrysler motors during the financial crisis, before it became the full owner of Chrysler in 2014 (Profnews, 2014). The two brands have been strongly linked, although the Chrysler brand seems to be more innovative with respect to fewer emission technologies. The Fiat 500E was revealed on the Detroit motor show of 2010 on 14-01-10 (Gizmag, 2010). The normal version of the Fiat 500 is taken into account in the event study of conventional cars and was released on the 22-03-07, exactly fifty years after the first Fiat 500 (Gizmag, 2007).

BMW AG

Bayerische Motoren Werke Aktiengesellschaft was founded in 1916 and is currently headquartered in Munich. With the i-line BMW entered the electric car segment. Till now (2014) the i-line consists of the i3 and i8, both released on the Frankfurt motor show in 2009 (Data-stream, 2014). The release of the i-cars, part of the zero emission programs has been set at 15-09-09 (OICA, 2009). The release of the BMW 4-series was officially preserved through BMW for the Detroit Motor Show, but pictures leaked to the press, weeks before (Carscoops, 2012). The day that these pictures came available to the public and appeared on car related websites have been taken as the date of acquaintance (05-12-12).

Mitsubishi Motors Corporation

Mitsubishi Motors Corporation was founded in 1970 and is currently headquartered in Tokyo, Japan. Mitsubishi started their electrical vehicle process with the Mitsubishi I-MiEV. The production car was revealed on the Frankfurt Motor Show of 2007, on 13-09-07 (Electrifying times, 2007). The release of the Mitsubishi Outlander 2007 took place on the New York International Auto Show of 2006 at 14-04-06 (World car fans, 2006). This date is taken into account for the event study of conventional cars. On September 4, 2009, Mitsubishi Motors Corp. and PSA Peugeot Citroen signed a basic agreement to tie up on the development and supply of electric vehicles. But Mitsubishi had already been working on electric vehicles witnessed by the I-MiEV.

Audi AG

The company was founded in 1899 and is currently headquartered in Ingolstadt. Audi Aktiengesellschaft is a subsidiary of Volkswagen AG. Audi produces e-cars under the name Audi e-tron. The models that have been transformed in e-cars are the Audi A1, A3 and spyder and concept e-cars are made of the R8 and RS4 and RS5 (Data-stream, 2014). The models were shown on the Frankfurt Motor Show in 2009 (Monitoring, 2009). Because, the e-tron models were all released for the first time in Frankfurt on 15-09-09, this date is taken into account for the event studies of the e-cars. In the press conference of the 63rd Frankfurt Motor Show, Audi elucidated their new strategy. The release of the AUDI Q7 on the North American International Auto Show of 2003 on 05-01-03 has been used for the event study of conventional cars (Car reviews, 2014 and North American International Auto Show (AIAS), 2014).

Daimler-Benz AG

Daimler-Benz AG is a German automotive manufacturer founded in 1926, currently headquartered in Stuttgart. Mercedes swaggered into the Paris Motor Show of 2012 with world's most powerful electric vehicle. The release date of the Mercedes Benz SLS AMG electric on 29-09-12 will be used for the event study of electric vehicles (Mashable, 2012). The unveiling of the new Mercedes Benz CL class on the Paris Motor Show has been used for the event study of conventional cars. The car was for the first time shown to the public on 13-09-06 (World car fans, 2006).

6. Methodology

In the methodology will be extensively spoken about event studies, the conditions, the limitations as well as the implementation with regards to car releases. With the help of financial market data, an event study measures the impact of a specific event on the market capitalization of a firm. The initial task of conducting an event study is to define the event of interest and identify the period over which the security prices of the firms involved in this event will be examined (Mackinlay, 1997). The event of interest, in this case, is a company-specific event as it concerns the public release of a new car. The prices of automotive manufacturer's stocks will be examined over a long period of time, including the release day and the trading days before and after the release. The event study attempts to measure the valuation effects of a corporate event, such as a merger, earnings and product announcement by examining the response of the stock price around the announcement of the event (Schweitzer 1989). Mackinlay (1997) mentions that to facilitate the examination of the impact of a news announcement on the value of the firm's equity, it is essential to posit the relation between the information release and the change in value of the equity. The news impact can be measured through a comparison between the normal returns and the abnormal returns, whereby the last should occur the trading days around the event.

Normal returns

A number of approaches are available to calculate the normal return of a given security. The normal returns indicate those returns that are obtained without any remarkable events or news releases. Differences in calculating the normal return should be made between economical and statistical models, where the economical models provide more opportunities to calculate more precise measures but miss statistical assumptions so that statistically motivated models dominate as these models eliminate the biases (MacKinlay, 1997). For this event study, the statistical market model will be used, which relates the return of any given security to the return of the market portfolio.

$$R_{it} = \alpha_i + \beta_i R_{MIt} + \mu_{it}$$

The parameter R_{it} indicates the return of company i, on time t, which in this event study will be the percentage change between today's closing price and the closing price of the previous day of the stock of company i. The market model parameters **α** and **β** in the model will be estimated with the help of Eviews over the duration of the control period. The number that **α** takes, signifies the excess return of stock i, on top of the return of the overall stock market. The value that **β** takes, indicates how sensitive stock i is with respect to the overall stock market, where i's stocks are traded.

This means that if **β** takes the value of 2 (**β**=2), and the overall stock market, rises with 1%, company i's stock price is expected to rise with 2%. The R_{MIt} stands for the return of the overall stock market, company i is traded on time t. The model's linear specification follows from the assumed joint normality of asset returns (MacKinlay, 1997). The last term μ_{it} of the market model is negligible on average, as it is assumed to be equal to zero according to Fama (1998).

The next two steps that should be taken to execute the above mentioned market model, are the identification of the daily stock returns and the determination of a control period. To obtain the missing values of **α** and **β** through the market model for normal returns, the daily returns of the selected automotive manufacturers (R_{it}) should be calculated as the dataset contains only the daily closing prices of the stocks. Additionally, the daily returns of the indices (R_{MIt}) where the automotive manufacturer's stocks are listed should be calculated. These daily returns are calculated by taking the percentage change between today's closing price and the closing price of the previous day. The daily returns of all the automobile brands and indices used in the analysis have been calculated for the period of the 1st of January 2002 to the 1st of January 2014, to be sure that the final results of the event study will be representative, with the exception of General Motors (as stock prices are only available since 2010). However, to calculate the **α** and **β** through the above-mentioned formula of the statistical market model for normal returns, a specification of an observation interval must be set, the control period.

Now that the daily returns of the stocks and indices are known, the next step that should be taken in the event study is the selection of the number of days that the control period should include. The determination of a control period ensures that the **α** and **β** can be estimated through the market model of normal returns based on the daily returns (R_{it} and R_{MIt}). According to van der Sar (2014) it is most common as the control period includes 100 trading days. The control period is preferably well before the event, so that the control period and event window, whereby the last one will be explained below, do not overlap. So that the parameters of the normal return market model (**α** and **β**) aren't influenced by the daily returns around the event (MacKinlay, 1997).
For this study the control period starts 110 trading days before the announcement and ends 11 trading days before the product announcement [-110, -11]. This means that the control period contains the daily returns of 110 trading days before the event to 11 trading days before the event. The daily returns of the automotive manufacturer's stocks and indices included in the control period of the event study should give an indication of the normal return of the particular stock and the overall market portfolio.

When R_{it} and R_{MIt} are filled in the market model over the control period [-110, -11], ordinary least squares (OLS), under general conditions, is a consistent estimator for the market model parameters **α** and **β** (MacKinlay, 1997). The parameters **α** and **β** are estimated with the help of Eviews, based on the daily returns (normal returns) through out the control period.

Abnormal returns

The formula utilized to calculate the abnormal returns around the event date build forth on the normal performance market model discussed in the section above. Using the market model for normal returns to estimate the parameters **α** and **β**, one can calculate further to measure and analyse the abnormal returns. With the help of the formula shown below and the inputs from the normal performance market model, the abnormal returns (can be calculated.

$$ar_{it} = R_{it} - (\hat{\alpha}_i + \hat{\beta}_i * R_{MIt})$$

The abnormal return is the disturbance term of the market model calculated on an out of sample basis (MacKinlay, 1997). The carets above **α** and **β** indicate that these model parameters in the formula of abnormal returns are estimated. The market model parameters **α** and **β** are estimated with the help of the normal daily returns through Eviews over the control period [-110, -11]. Subsequently the estimation given by Eviews of **α** and **β** through the efficient ordinary least squares (OLS) are filled in the formula of abnormal returns (. The abnormal return of company i, at time t, are then calculated by subtracting the second term (**α** + **β*** daily return of the market portfolio i at time t (R_{MIt})) of the first term (daily return of company i at time t (R_{it})). For this sum the daily returns of the automotive manufacturer i's stock and the daily return of the overall stock market where i's stock is listed are used over the test period [-10, 10]. The ascertainment of the test period follows below. According to MacKinlay (1997), the abnormal returns will be jointly normally distributed with a zero conditional mean and conditional variance throughout the market model. In this way can be measured whether there is an abnormal reaction of company i's stock visible around the event of the product announcement.

Test period

The test period includes the daily returns of the company's stocks and the overall market portfolio's for 10 trading days before the product announcement to 10 trading days after the product announcement. Thereby the test period includes the day of the announcement (event), which is always considered as t=0 in an event study. In the test period [-10, 10] abnormal returns could occur. These abnormal returns should be derived from the new information that becomes available on the market. The expected fluctuations around the event, provides insights in the existence of information effects and identifies factors that should explain the changes in the firm's valuation. According to MacKinlay (1997) it is typical that that the control period [-110, -11] used for the normal performance market model and the test period [-10, 10] used for the examination of the abnormal returns do not overlap. This design provides estimators for the parameters of the normal return model, which are not influenced by the returns around the event. If the periods would overlap it would be problematic because the methodology of the market model is build around the assumption that the event returns are captured by the abnormal returns.

Event window

The event window comprehends a short period of trading days in the test period [-10, 10], where significant abnormal returns potentially caused by the event are examined. For the event window a small timespan is recommended as markets process new information immediately (van der Sar, 2014). According to Chaney and Devinney (1991), the implication is that the information in the new product announcement event is capitalized quickly. However, it is typical to set the event window length to be larger than one trading day. This facilitates the use of abnormal returns around the event day in the analysis (MacKinlay, 1997). Therefore, some event studies use an event window of 3 days [-1, 1], so that the days around the event are included, as well as the event day. Lane and Jacobsen (1995) mention that event windows of different lengths of trading days could be tried [-3, 3] and [-5, 5], to see whether with more days included a significant reaction could be seen. For this event study an event window of [-3, 3] is utilized, which is the most common (Van der Sar, 2014).

Average abnormal returns

Because tests with one event observation aren't likely to be useful, it is necessary to aggregate the abnormal returns The abnormal return observations must be aggregated in order to draw overall inferences for the event of interest (MacKinlay, 1997). Since the abnormal returns of the companies included in the analysis are known from the market model formula for abnormal returns, the average abnormal returns could be simply calculated with the formula below. The provides insights about all the reactions seen in stocks of the companies taken into account over the test period [-10, 10]. The average abnormal return is calculated for all the twenty-one trading days included in the test period with the following market model formula for average abnormal returns.

$$AR_t = \frac{(ar_{1t} + ar_{2t} + ar_{3t} + \ldots + ar_{jt})}{Jt}$$

The abnormal returns of the companies used along the analysis are taking together and separately calculated for all the twenty-one trading days included in the test period. The sum of the abnormal returns is then divided by the number of companies included in the analysis, which in this event study will be 14 automobile producers. The 's that are derived for each trading day in the test period [-10, 10] should say something about the daily returns and the overall reactions of investors with respect to the product release of automotive manufacturers. However according to MacKinlay (1997), the aggregated abnormal returns are no longer applicable, when the event windows of the included securities overlap in calendar time, since the co-variances between the abnormal returns will no longer be 0, in such a case. As in this study, four event windows do overlap because four e-cars were released on the Frankfurt Motor Show of 2009 this possibly forms a problem. However, because the co-variances between the abnormal returns of these four overlapping event windows are 0 or differ for a negligible amount from 0 (Appendix F, Table F), can be concluded that the abnormal returns are independent across the securities. So that the maintained distributional assumptions imply that the abnormal returns and the aggregated abnormal returns still will be independent across the securities (MacKinlay, 1997). The independency across the securities ensures that the results are applicable and are caused through the different market portfolios, which had to be used for the different securities. The differences in the market portfolios result from the fact that the automotive manufacturer's stocks are listed in different stock indexes.

Significance

To test the significance of the average abnormal returns a t-test should be used. The formula shown below will be used to clarify whether the fluctuations in the stock's price around the event date are significantly different from the normal daily returns of automotive manufacturer's stocks and thus can be labelled as significant abnormal returns.

$$T_{ARt} = \frac{AR_t}{\left(\frac{S_t}{\sqrt{N}}\right)} \cong T_{0.05;N_{-1}}$$

The T_{ARt} need to be higher than the critical value of $T_{0.05;N_{-1}}$ in order to conclude that the event has led to significant abnormal returns in comparison to the normal situation without an event. Because this t-test is two-sided (van der Sar, 2014), the average abnormal returns, measured with T_{ARt} are also significant, if the value is smaller than the critical $T_{0.05;N_{-1}}$ in a negative value. If the T_{ARt} is significant, the event has a significant influence on the performance of the company's stock. To obtain the standard deviation (S_t) of the aforementioned t-test, the following formula (next page) will be used so that the T_{ARt} could be derived.

$$S_t = \frac{1}{N-1} * \sum_{i=1}^{N} (ar_{it} - AR_t)$$

This formula shows that there will be a different standard deviation (S_t) for all the twenty- one trading days included in the test period [-10, 10]. The different S_t values are necessary to correct for the possibly larger changes in the price of a stock as the event date is approaching or just passed (van der Sar, 2014). Meaning that the last two formulas of the market model are important in order to make a distinction between significant reactions and insignificant reactions. In most articles the timespan of the event window, will be chosen based on the number of trading days around the event that the average abnormal returns assumes a significant t-value (Chaney and Devinney, 1991). In event studies, the conclusion whether an event has an obvious impact on the returns of companies stocks depends on the significance of the outcomes in the relatively short event windows [-1, 1], [-3, 3] or [-5, 5].

Cumulative abnormal returns

From the average abnormal returns the cumulative abnormal returns () can be calculated. The aggregation is along two dimensions, namely through time and through the securities. The concept of a cumulative abnormal return is necessary to accommodate a multiple period event window (MacKinlay, 1997). The over the time interval [K, L] shows whether the stocks of the companies included in the analysis accomplish a positive or negative return around the particular event over the test period. Since the co-variance terms are equally to 0, inferences about the cumulative abnormal returns can be drawn from the results of the formula shown below. As can be seen in the formula below, the abnormal returns will be cumulated day by day for all the twenty-one trading days in the test period [-10, 10], in the case the test period is used as time interval.

$$CAR_{iKL} = \sum_{t=K}^{L} AR_{it}$$

The last value on the tenth day after the event shows whether the cumulated abnormal returns are positive or negative. From this values investors could decide whether it rewards to invest in the company's stock around the next equivalent event or not.

Conditions event studies

To test whether the results are valid, the following points for attention should be monitored along the event study analysis (van der Sar, 2014). The control period [-110, -11] should include enough and an equal number of trading days during the analysis. The choice of the market index should be justifiable. Which is done in this analysis since the market portfolios used in the market model, are the indices where the stocks are listed. Therefore the daily returns of the market index and the daily returns of the stocks are correlated, so that the estimations of the **α** and **β** are reliable. The last point of the attention is the stationarity assumption. This means that the estimated values of **α** and **β** in the control period [-110, -11] must also hold in the test period [-10, 10], which of course includes the event period [-3, 3]. To test whether the results meet this requirement, the Dicky-Fueller tests for the availability of a unit root.

According to MacKinlay (1997) further issues that arise when conducting an event study can be summarized by the sampling interval, event date uncertainties and robustness. With regards to the sampling interval, daily intervals are the most common, as daily intervals increase the power of the results, the stock returns are examined on a daily base. Whenever there is uncertainty with respect to the event date, the event window needed to be expanded with more trading days. As the event window utilized in this paper will be [-3, 3], the eventual presence of this problem will be automatically solved.

Event studies are based on the assumptions that returns are jointly normal and temporally independently and identically distributed (MacKinlay, 1997). Additionally, the robustness of the results will be tested on behave of trends in the stock market, as is described in the section below.

Besides this market model method that looks at the reaction of investors for all the automotive manufacturers simultaneously it is interesting to look at the reactions individually. The daily returns can be compared with the position of the VIX, as the **α** and **β** of the individual stocks are known, to see whether the stock fluctuations are extraordinary or normal. The possible presence of a trend in the automotive manufacturers and parts indexes can also be of value for the interpretation of the results. Differences in the trends between the overall stocks market and the automotive and parts index could be used to test the robustness of the results founded in the event studies. The presence of a trend and the determination of the sentiment will be based on a period of rising or falling returns and the VIX (Baker and Wurgler, 2007).

The traded volume of the stocks around the release will be compared to the annual average number of stocks traded in order to see whether there is an increase in investor's activity thanks to the release.

7. Data analysis

To answer the main question: “What is the impact of the release of a clean vehicle on the performance of the stock price of the relevant automotive manufacturer?” in a scientific manner, the stock prices of the aforementioned automotive manufacturers have been examined through an event study. From this examination, different results have been obtained to answer the hypotheses. In the data analysis the following aspects will be discussed. First, a description of the research method will be given. Further, the hypotheses will be discussed in part A, where as the sub-questions will be treated in part B and as last a discussion of the findings will be provided. To give a refresher, the hypotheses used to answer the main question are as followed.

A. Hypotheses

1. The release of an e-car will have a positive impact on the market capitalization of an automotive manufacturer.
2. The release of a new conventional car will have an impact on the market capitalization of an automotive manufacturer.

To analyse the main question and the above-mentioned hypotheses a dataset with multiple characteristics of the selected automotive manufacturers have been set up. To analyse the financial impact through automotive manufacturer’s stock prices, the prices and the daily return over a time range 01-01-02 to 01-01-14 have been acquired from data-stream (2014). The prices of the automotive manufacturer’s stocks were used to obtain the daily returns, which function in the market model as the dependent variable. The outcome of the dependent variable is based on the **α** and **β** in the model plus the return of the overall stock market, where the stock is traded. Therefore the prices of these indices have been acquired from data-stream (2014) as well, so that the daily returns of the market portfolio could be calculated, which function as an independent variable in the market model. Knowing this, Eviews have been used to calculate the **α** and **β** over the control period. The **α** and **β** were used to obtain the abnormal returns.
The outputs of Eviews for the two event studies are provided in appendix B.
Additionally to control for a possible positive or negative trend in automotive manufacturer’s stocks at the moment of release and the traded volume, attention will be paid to the derivative automobile and parts indices. In this way, the results generated from the market model will be controlled for noise, which influences different sectors and the overall stock market. This check is necessary to see whether the differences in stock prices are the result of the disclosure of the new car or can be explained by the trend prevailing on the stock exchange indices. These findings are treated in part B, as they form the answers on the sub-questions.

The dates of the different events have been obtained from different automotive news sites and automotive shows, such as the Frankfurt, Paris and the Tokyo motor show. A distinction has been made between the release of conventional cars and electric vehicles in order to see whether there are differences with respect to investor's reactions. Full electric vehicles have been chosen, as full electric technologies belong to the newest developments and are seen as the product of the future (KPMG, 2014). Most automotive manufacturers were ready to apply these technologies to their vehicles before 2014. One remark has to be made with respect to the choice for electric vehicles, as there is one automotive manufacturer where it isn't clear if they have produced an electric car, therefore the release of a plug-in hybrid is taken into account for Suzuki Motor Corporation. The release date of a new vehicle is during the analysis taken as the day of the press release. From this day on, investors may be aware of the product and are able to adjust their expectations. This means that if a new car is revealed on an automotive show, the first day of that automotive show, known as press day, is taken as the release day since from this day investors could start assimilate the new information. If these press days were not organised or information was unavailable, the first general public day of the automotive show have been taken as release date, as in this case this would be the first day that investors gained access to the new information. If the model was released after the press days, that particular day of release has taken into account in the analysis. For models that weren't released on an automotive show, the automotive manufacturers have organised a press conference to publish the new vehicle, which means that in these situations, the day of the press unveiling is taken as the date of release. The moment these announcements became public have been taken as the event date, t=0. From this day on, investors can assimilate the new strategies, and decide what this would mean for future cash flows and thus their expectation of the prospective stock price.

To see whether the obtained results of the event study for e-cars can be fully attributed to the release of the e-car, the volume, trend and sentiment prevailing on the overall stock market will be compared to the average volume, trend and sentiment of automotive manufacturer's stocks in the sub-questions part (B). From this investigation, becomes clear how investor's on general value the automotive sector. Additionally, the trend and sentiment will show whether the obtained results are fully due to the release of a car or are partly influenced by the trend and sentiment.

I. Release of an e-car

The first part of the analysis examines whether the release of an electrical vehicle has a positive influence on the value of an automotive manufacturer's stock price. As aforementioned, this will be investigated with the help of an event study. One remark has to be made with respect to Suzuki Motor Corporation, as this automotive manufacturer hasn't released a full electric car. Therefore the release date of the plug-in hybrid has been used, as this car came closest to the electric vehicles of other automotive manufacturers. One has to take into account that the reactions differ per automotive manufacturer and the below shown results apply to the release of an e-car in general. The abnormal return observations must be aggregated in order to draw overall inferences for the event of interest (MacKinlay, 1997).

DATE	CAR	AR	T	Abs T	Critical T-value
-10	-0,746%	-0,746%	-2,6067	2,61	2,160368656
-9	-0,912%	-0,165%	-0,3814	0,38	
-8	-1,514%	-0,603%	-1,7038	1,70	
-7	-0,825%	0,689%	1,3654	1,37	
-6	-0,809%	0,016%	0,0386	0,04	
-5	-1,062%	-0,253%	-1,4772	1,48	
-4	-1,051%	0,011%	0,0161	0,02	
-3	-1,162%	-0,111%	-0,4023	0,40	
-2	-1,001%	0,161%	0,6351	0,64	
-1	-0,220%	0,781%	1,0654	1,07	
0	-1,357%	-1,138%	-2,7006	2,70	
1	-1,340%	0,017%	0,0371	0,04	
2	-2,379%	-1,039%	-2,3584	2,36	
3	-3,100%	-0,721%	-2,1681	2,17	
4	-3,168%	-0,069%	-0,2200	0,22	
5	-2,840%	0,328%	0,6346	0,63	
6	-3,089%	-0,249%	-0,8597	0,86	
7	-3,051%	0,038%	0,0962	0,10	
8	-3,827%	-0,777%	-2,5885	2,59	
9	-4,255%	-0,427%	-0,9023	0,90	
10	-3,703%	0,551%	1,0658	1,07	

Table B. The outcomes of the market model for the financial impact of the release of an e-car.

In table B, the final results of the event study for e-cars are shown. Table B, includes all the subjects of relevance, as discussed in the methodology, to draw an overall inference of the e-car release. The first column ranks the trading days included in the test period [-10, 10]. The second column comprises the cumulated abnormal returns. The average abnormal returns accomplished during the test period [-10, 10] are summed trading day by trading day, resulting in the cumulated percentage changes, known as the CAR. In the third column the average abnormal returns are given, which consist of the abnormal returns of the fourteen individual automotive manufacturers per trading day of the test period. These individual abnormal returns are accumulated and divided by the number of companies included in the event study so that the average abnormal return is acquired. These average abnormal returns (AR) are necessary to do overall inferences about the release event. Column four shows the T- values of the average abnormal returns on the trading day of relevance. The T- values are set in absolute numbers in the fifth column, so that these values can be compared with the absolute critical T- value shown in the upper right corner of table B. The T-value of interest needs to be higher than the critical value of T in order to conclude that the event has led to significant abnormal returns in comparison to the normal situation without an event.

The results clarify that the release of an electric vehicle in general leads to significant abnormal returns on the release-day and even in the days after the release. The abnormal return is the actual ex-post return of the security over the event window minus the normal return of the firm's stock over the event window. The normal return is defined as the expected return without conditioning on the event taking place (MacKinlay, 1997). The average abnormal return on the day of the event (t=0) is significant at a 5% significance level (2.70 > 2.16). If the control period will be set at [-3, 3], which is a commonly used timespan (van der Sar, 2014), it becomes clear that on the second and third trading day after the release-event (t=2 and t=3) significant (at a 5% significance level) abnormal returns (2,36 > 2.16 and 2.17 > 2.16) are accomplished as well. The release of an electric vehicle has a significant influence on the daily returns of the stock price of an automotive manufacturer. One could conclude that the release of an electric vehicle or plug-in hybrid has a significant financial impact on the day of the release (t=0) and the second and third trading day after the release (t=2 and t=3), which is translated in the abnormal returns for automotive manufacturer's stocks. For the other trading days included in the test period [-10, 10], with the exception of the tenth-trading day pre and the eight-trading day post the event no significant abnormal returns are accomplished within the test period. Whether the significant abnormal returns on the tenth-trading day before the event and the eighth-trading day after the event have something to do with the release of the e-car is hard to construe. Besides, these trading days fall outside the event-window [-3, 3] and are therefore not relevant for interpretation.

From the CAR becomes clear that the cumulated returns in the test period [-10, 10] around the release date are one average quite negative (-3.703%). On the ninth trading day after the release the CAR is even more negative (-4.255). This means that, without taking the trend into account, investors evaluate the release of an electric vehicle or plug-in hybrid as a negative event for the future cash flows of automotive manufacturers. So, the first hypothesis will be rejected as it assumes that the release of an electric vehicle has a positive effect on the market capitalization of an auto producer.

For the first analysis, all the points of attention mentioned in the methodology are taken into account. The result of the Dicky-Fuller test for e-cars can be found in appendix B1.

2. Release of a conventional car

This part of the analysis examines the effects of a release of a conventional car on the market capitalization of an automotive manufacturer. To test whether a significant abnormal return will be accomplished in the event window [-3, 3], as has been the case with electric vehicles, the same statistical market model has been used. For this part of the analysis, there have been tried to make use of the release dates of complete new models, as much as possible, as has been the case for hypothesis one, so that the outcomes are comparable. With complete new models is meant a model that is new in the assortment of an automotive manufacturer. The critical T-value in the second analysis is a bit lower since there are more degrees of freedom included. The Chevrolet Malibu made by GM is included in the analysis of conventional cars, as it was released after the data of GM stock prices became available (>2010), which brings the degrees of freedom on 15 companies in comparison to the 14 companies in the first hypothesis. One has to take into account that the results could differ if one looks at the separate reactions of automotive manufacturer's stock prices, because this analysis is based on the aggregated reactions of the releases of conventional cars in general. The concept of a cumulative abnormal return is necessary to make statements over the event of relevance (MacKinlay, 1987).

DATE	CAR	AR	T	Abs T	Critical T-value
-10	-0,098%	-0,098%	-0,3378	0,34	2,144786688
-9	-0,579%	-0,481%	-1,4570	1,46	
-8	-0,855%	-0,276%	-1,4883	1,49	
-7	-1,200%	-0,345%	-1,2811	1,28	
-6	-1,308%	-0,109%	-0,3301	0,33	
-5	-1,811%	-0,502%	-2,7732	2,77	
-4	-1,747%	0,064%	0,3857	0,39	
-3	-1,529%	0,218%	0,5432	0,54	
-2	-1,461%	0,068%	0,2018	0,20	
-1	-1,386%	0,076%	0,2381	0,24	
0	-1,016%	0,370%	1,0285	1,03	
1	-0,320%	0,695%	2,4377	2,44	
2	-0,699%	-0,379%	-0,8346	0,83	
3	-0,655%	0,044%	0,1114	0,11	
4	-0,851%	-0,196%	-1,1409	1,14	
5	-0,792%	0,059%	0,1737	0,17	
6	-0,907%	-0,115%	-0,4323	0,43	
7	-0,522%	0,386%	1,2006	1,20	
8	-0,322%	0,200%	0,5131	0,51	
9	0,660%	0,982%	1,5848	1,58	
10	1,094%	0,434%	2,0190	2,02	

Table C. Results of the market model for the financial impact of the release of a new conventional car.

In table C, the final results for the event study of conventional cars are shown. Table 2 has the same format as table C, as the same subjects of relevance are presented. The days included in the test period [-10, 10] are ranked in the first column. The second column contains the cumulated average abnormal returns (CAR) and the third column contains the average abnormal returns (AR) per trading day during the test period. The fourth and fifth column, show the T-values (normal and absolute) of the average abnormal returns per trading day along the test period. In the upper right corner of table C, the critical T-value is provided.

The values in table C show that in general the release of a new conventional car does lead to one significant (at a 5% significance level) abnormal return within the event window [-3, 3]. The abnormal return stands for the actual ex-post return of the security over the event window minus the normal return of the firm's stock over the event window. The normal return is defined as the expected return without conditioning on the event taking place (MacKinlay, 1997). On average, a significant difference between the actual return and the expected normal return is accomplished on the first trading day (t=1) after the release event. At a 5% significance level with 15 companies included in the analysis, the trading day after the release-day (t=1) accomplishes a significant average abnormal return (2.44>2.14). Within the test period [-10, 10], a significant (at a 5% significance levels) abnormal return is accomplished for the fifth trading day before the event (t=-5) as well, but whether this abnormal return is caused by the release is doubtful and need to be examined by controlling for the trends in automotive manufacturer's stocks around those dates. However, the interpretation of this result is of less importance as it falls outside the event window [-3, 3]. Remarkable is that if the daily returns of Fiat SpA and Renault would be excluded from the analysis of conventional cars, the day of the event would obtain a significant abnormal return as well. The lagging daily returns of Fiat and Renault on the event day have a major impact on the average abnormal returns (AR). One could tentatively conclude that the release of a new conventional car leads to a significant positive abnormal return for the first trading day after the release day.

From the value of the CAR on the tenth trading day after the event can be seen that the cumulated abnormal returns over the testing period [-10, 10] are on average positive (1.094%). The positive CAR is caused due to the positive abnormal returns accomplished after the release-event of the new conventional car. This means that investors in general receive the release of a new conventional model positively. It is right to conclude that the release of a new conventional car has a positive impact on the market capitalization of an automotive manufacturer as one average abnormal return is accomplished at a 5% significance level on the first trading day after the release day.

For the second analysis, all the points of attention mentioned in the methodology are taken into account. The result of the Dicky-Fuller test for conventional cars can be founded in appendix B1.

B. Subquestions

From here on, the subquestions will be treated that were set in the introduction to find an answer on the main question. To give a refresher, the sub-questions set are the following.

1. What is the influence of company specific news on the stock price?
2. What is the general trend in automotive manufacturer's stocks?
3. What is the traded volume around the release of the e-cars?

I. What is the influence of company specific news on the stock price?

In an efficient market, security prices at any given time fully reflect all available information. Stock markets are efficient because indices are paradigmatic examples of competition. Although meanings differ along articles, the majority agrees with Fama's (1991) modern financial markets theory, that stock markets rapidly absorb new information. For automotive manufacturers stocks, traders react and act immediately as new information becomes available (Hoffer, Pruitt and Reilley, 2005). The share price changes and trading volume activities are driven by information flows. Koku et al. (1997) prove that firm related news has an impact on the performance of a stock. These findings prove the relevance of the event study for the release of an e-car however, the sentiment prevailing at the stock market needs to be taken into account as well. According to Jones and Litzenberger (1970), the effects of new fundamental information can be ascertained by observing recent stock price movements, so that a negative/positive reaction after the release of an e-car could be partly biased, as the overall trend and sentiment on the stock market might be negative/positive at that time.

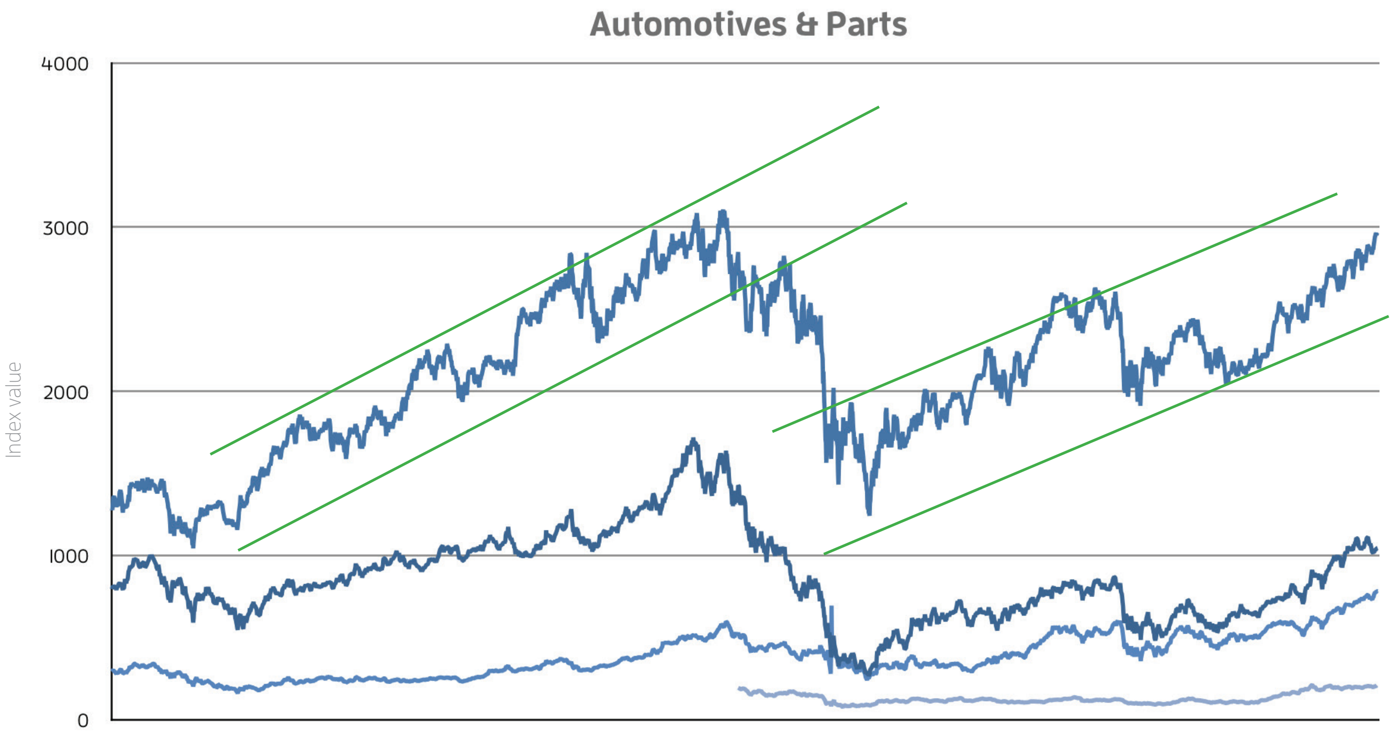
2. What is the general trend in automotive manufacturer's stocks?

To control whether the results of the event studies can be fully contributed to the release of e-cars, the trend and sentiment of automotive manufacturer's stocks need to be analysed. A weaker sentiment in automotive manufacturer's stocks with respect to the sentiment of the overall market portfolio at the time of the e-car releases may function as another explanation for the founded cumulated negative abnormal returns. Trends and the sentiment have clearly discernible, important, and regular effects on individual firms and on the stock market as a whole (Baker and Wurgler, 2007).The presence of a trend feeds the suggestion that a hard to define portion of the founded price changes in automotive manufacturer's stocks are possibly due a positive or negative trading sentiment in the sector. According to Jones and Litzenberger (1970) traders seek for stock price trends, as these trends could have a potential effect on the intrinsic value of a firm's common equity.

The negative cumulated abnormal returns in the event study for electric cars may possibly be partly expound by a negative trend and sentiment prevailing in the automotive and parts market at the time of release. Baker and Wurgler (2007) mention that in particular, stocks of high volatility, unprofitable or stocks of firms in financial distress are likely to be disproportionally sensitive to broad waves of sentiment. Haugh, Mourougane and Chatal (2010) indicate the financial distress of automotive manufacturers in the years 2008 and 2009, exactly the years that the majority of the automotive manufacturers revealed their electric cars. Additionally, from the individual returns shown in table B (appendix C) could be understood that automotive manufacturer's stocks have been volatile around the release of the e-cars in 2008/ 2009, judging on the large price fluctuations. So although it seems impossible to attribute a specific portion of the price change of an automotive manufacturer's stock to the trend, it is necessary to be aware of the trend, before premature conclusions are drawn from the event study.

In the event studies, the individual returns of automotive manufacturer's stocks in a normal situation have been compared to the individual returns of the stocks in the situation an e-car is released. The actual returns, which included the release of e-cars, were compared to the expected normal returns that would have occurred without the releases. The expected normal returns are calculated pertaining to the returns of the overall market portfolio. From this comparison have been concluded that automotive manufacturer's stocks perform significantly worse in the case an e-car is released with respect to the normal situation. However, the negative abnormal returns accomplished by automotive producer's stocks around the release dates could be fully caused by the release but the event study doesn't take into account an eventually negative trend in the automotive and parts sector. The presence of a negative trend during the release periods could partly clarify the cumulated negative absolute returns of the automotive manufacturer's stocks in the event study of e-cars. If investors had a negative attitude towards automotive and part's stocks at the time of the releases, a so to say negative trend or sentiment would prevail, which makes it argumentative to suggest that this would be partly the cause for the lower than expected returns.

To determine and analyse possible trends in automotive manufacturer's stocks over the years, the values of the derivatives of the French Cac, German Dax, American Nasdaq and Tokyo's Topix, that comprise the automotive and parts manufacturers are examined over the time period 01-01-02 to 01-01-14. These indexes are commonly known as the automotive and parts indexes. From graph A, becomes clear that the indexes composed of the stocks of automotive and parts manufacturers are in general on the rise, with the exception of the periods around the credit crisis (Diamond and Rajan, 2009) and the European debt crisis (Lane, 2012). The green lines indicate that the indexes are moving in a long upward trend several times during the research period (01-01-02 to 01-01-14).



Graph A. The evolution of stock prices of automotive and parts manufacturers for the Cac, Dax, Nasdaq and Topix over the time period 01-01-02 till 01-01-14.

Automotive and parts index performance

To investigate whether a negative sentiment or trend in the automotive and parts index occurs at the time of the releases, which possibly influences the daily returns of the stocks an example including the releases of four automotive manufacturers will be used.

Additionally, the performances of the relevant overall market portfolio will be compared to the performances of the automotive and parts indexes in order to find more insights about the obtained results from the event study. In the remainder of the chapter, the term general index is used for the overall market portfolio (in the example, the following indexes form a representation of the overall stock market: the France Cac, American Nasdaq and the German Dax). With the automotive and parts indexes, the derivative indexes of the above-mentioned Cac, Nasdaq and Dax are meant, which consist of companies active in the automotive and parts industries.

Auto producers	Date test periods	Returns individual stock	Returns Gen Index	Returns A&P Index	Gen > A&P
Ford	02-09-09 to 30-09-09	2,560%	5,654%	6,241%	-
Renault	01-09-09 to 29-09-09	6,862%	6,437%	8,542%	-
BMW	01-09-09 to 29-09-09	8,887%	7,250%	4,843%	+
Audi	01-09-09 to 29-09-09	1,699%	7,250%	4,843%	+

Table D. In this table, the auto producers, the dates of the test periods and the returns over the test period of the individual stocks, the general indexes where the stocks are listed and the returns of the automotive and parts indexes (A&P Index) where the auto producers are also listed, is given. These numbers are given for the auto producers that released an e-car on the Frankfurt Motor Show 2009. In the last column, the comparison between the return of the general index and A&P index is given.

In table D, the returns of individual auto producer's stocks over the total length of the test period [-10, 10] are given. Meaning that the percentage change is taken between the closing price of the stock on the first trading day of the test period (t=-10) and the closing price of the stock on the last trading day of the test period (t=10). The same has been done for the general index where the stock is listed, which is the Nasdaq for Ford, the Cac for Renault and the Dax for BMW and Audi. Lastly, these returns have also been calculated for the automotive and parts indexes over the test period.

In the trading weeks pre and post (01/02-09-09 to 29/30-09-09) the Frankfurt Motor Show of 2009 (start at 15-09-09), where the electric cars of Ford, Renault, BMW and Audi were released, the automotive and parts indexes seem to be in an upward trend. The automotive and parts index of the Nasdaq had won above 6%, the derivative of the Cac had won more than 8%, and the automotive and parts index of the Dax won almost 5% in the test period. These returns need to be compared with the returns of the general indexes over the test period. The general indexes are in an upward trend as well in the test period, which is also underlined by the decreasing value of the VIX (See appendix D). The general index of the Nasdaq performed a win of more than 5% in the two trading weeks pre and posts the start of the Frankfurt Motor Show of 2009, the Cac gained more than 6% and the Dax won something more than 7%. From these findings (summarized in table D) could be concluded that the automotive and parts indexes performs better than the general index in terms of returns in the case of Ford and Renault and worse in the case of BMW and Audi over the test period.

The comparison

These comparisons provide insights in a possibly weaker performing automotive and parts sector. This is the case as the return over the test period [-10, 10] of the automotive and parts index is lower than the return of the general index over the test period. The automotive and parts index of the Dax (+ 4,843%) performs weaker in terms of returns than the general Dax (+7,250) over the test period, starting at 01-09-09 and ending at 29-09-09. This finding shows that it is likely that a specific part of the negative abnormal returns in the event study of e-cars should be assigned to an underperformance of the automotive and parts sector on the stock market in comparison to the general indices. The negative absolute returns observed around the release of an e-car are therefore not fully attributable to the release-event of the electric car. There should be taken into account that an indefinable portion of the lower actual returns of automotive manufacturer's stocks is due to the underperformance of the automotive and parts sector.

However for five of the in total fourteen investigated e-car releases it is the case that the automotive and parts index performs weaker than the general index (remainder of table D is shown in appendix C). Meaning that for more than the half of the release events this argument is invalid so that the negative abnormal returns can't be contributed to a weaker sentiment or trend in the automotive and parts indexes. So for more than the half of the investigated e-car releases, the cumulated negative abnormal returns are fully caused by the e-car release. In this way, an audit has been performed for the prevailing sentiment in automotive manufacturer's stocks over the same time that the cumulated negative abnormal returns of the event study of e-cars have been obtained. The third analysis has shown the trend in automotive manufacturer's stocks and the robustness of the results founded in the event study of electric cars.

3. What is the traded volume around the release of e-cars?

The last sub-question that must be considered is about the traded volume of stocks around the releases of the e-cars. From the findings in appendix E, becomes clear that there is no clear relation visible between the traded volume and the release day of an e-car. However for the majority of the automotive manufacturer's stocks, the traded volumes are remarkable higher in the trading days around the event than the average number of stocks traded in the year of the release. Fetching from the literature review, the trading volume of a stock reflects investor's activity by summing all market trades (Bamber, 1986). According to Wang (1994) the traded volume in a stock is positively correlated with absolute changes in prices. Although there is no clear relation between the release and the increase in the volume traded it is remarkable that for most of the automotive manufacturers the traded volume of the days around the release lies above the annual average traded volume, indicating investor's activity. From the traded volumes can be concluded that investors do react (positive or negative) on the release of an e-car, as more activity in the stock is visible.

Discussion

The results of the analyses evince some remarkable outcomes. The aim of automotive manufacturers towards fewer emissions for future cars doesn't seem to be appreciated by investors. The results provide evidence that the release of an electric vehicle or plug-in hybrid car leads to negative abnormal returns for automotive manufacturer's stocks. In the days after the event and especially on the day of the release an automotive manufacturer could expect a decrease in its market capitalization, according to the founded results. In the twenty-one trading days around the release, the stocks of auto producers, showing their electric vehicle, accomplish a negative return. The negative receive of investors towards electric vehicles could work as a disincentive for auto producers to invest in cleaner technologies. The reaction of investors corresponds to the desire of car buyers, which still prefer conventional cars above electric vehicles (KPMG, 2014). However the tension towards conventional cars are an eyesore to governments, as they do and have done everything in their ability to promote the sales and production of e-cars (Åhman, 2006).

The dataset proves that the release of a conventional car is positively received through investors. With a 5% significance level, a significant abnormal return is accomplished, for the first day after the release. The results of the trading day after the release are straightforward. The CAR is positively over the test period, meaning that investors value the brand extension in the core business positively. The positive daily returns after the release, complete significant, underline the preference from investors towards conventional cars. Because these brand extensions are closer to the successful core business in comparison to the electric vehicles it seem to be that these extensions are higher priced through investors. Lane and Jacobsen (1995) confirm this vision as they found that extensions of core businesses are appreciated through investors. Extensions of brands that are close to the core business create a positive excess stock return. Thus, according to them, the stock market reaction confirms that these brands do what they are supposed to do, that is, help in extension markets without suffering from the adverse consequences of leveraging.

The results of the first sub-question come forth from the literature review and the underline the influence of company specific news on stock performances. These findings make the analysis worthwile and indicate the relevance of event studies for company news.

The second sub-question looks at the trend and sentiment prevailing for automotive manufacturer's stocks at the moment of the e-car release. Graph A shows that the automotive manufacturer's stocks generally move in a positive trend in the years of research with the exceptions of the periods around the credit crisis and the debt crisis. The comparisons made in the analysis show that for more than the half of the investigated e-car releases, the cumulated negative abnormal returns are caused by the e-car release. For the results in the e-car event study of Volkswagen, PSA, Daimler, BMW and Audi should be taken into account that an indefinable portion of the lower actual returns of automotive manufacturer's stocks is possibly due to the underperformance of the automotive and parts sector. With some caution can therefore be concluded that investors receive e-car releases poorly even in a positive momentum.

From the answer of the third sub-question becomes clear that for most of the automotive manufacturer's stocks the traded volume of the days around the release lies above the annual average traded volume, indicating investor's activity. This shows that investors do react and that the reactions are caused by the release, making the obtained results of the hypotheses even more viable.

The main outcomes of this research are in line with the findings of KPMG's survey (2014), which shows that automotive manufacturers are still inclined towards conventional cars. This inclination is caused through the predilection of car buyers towards conventional cars (KPMG, 2014) and the provisional preference of investors for newly released cars with internal combustion engines.

8. Conclusion

This thesis has attempted to show whether investors appreciate the introduction of e-cars. To see whether conventional automotive manufacturers will be rewarded in terms of a larger market capitalization if the concepts to produce an e-car are released, the following question has been answered. “What is the impact of the release of a clean vehicle on the performance of the stock price of the relevant automotive manufacturer?”
It is evident that the release of an electric vehicle or plug-in hybrid leads to negative abnormal returns for the stocks of automotive manufacturers. Especially on the day of release, an automotive manufacturer should expect a decrease in the market capitalization. Investors receive e-car releases poorly, as the stock performance in the majority of cases is worse than average even in a positive market climate. The negative stock performances after the launch of an electric vehicle in comparison to the positive responses to conventional cars releases indicate that product extensions closer related to the core business are more appreciated by investors. This response of investors seems justifiable, as it correspondents with the current customer’s preferences for conventional cars (KPMG, 2014).

The policy implications arising from investor’s responses are considered below. A declining market capitalization in the trading days after the release of an e-car displays the existing contrasting interests between economical rational acting investors and governments plus a group of environmentally conscious consumers, which pursue sustainable mobility. Investors evaluate the release of an electric vehicle or plug-in hybrid as a negative event for the future cash flows of automotive manufacturers, whereas the release of a new conventional car has a positive impact on the market capitalization of the automotive manufacturer. Where governments try to encourage automotive manufacturers to invest and put effort in the development of e-cars through financial incentives, investors give with this reaction a disincentive for automotive manufacturers to continue their e-car developments. It is distressing that investors, which base their buy/sell decision on their expectation of future cash flows, sell their shares at the moment that automotive manufacturers present the anticipated car of the future. It is poignant, that share prices respond in this way to the announcement of an e-car. The my- opic and emotional mind-set of investors seems to be purely driven by the pursuit of short-term profits since the anticipated car of the future is slightly dismissed. It might be that this expressive reaction of big money parties has been a liability for a fast transition from conventional cars to e-cars. But how does it come, that we as ordinary people, look at the e-car as the car of the future, we have to wait so long until e-cars are in great demand while investors show no sign of appreciation for a vision towards the future?

With various measures governments have tried to promote the development and sale of e-cars. By making it financially attractive for the consumer to buy an e-car, governments seem to have laid the base for a further coming-in of e-cars. Governments seem to have not only stimulated sales with these financial incentives, but also augment the awareness of the presence of the e-car as the car of the future. Because the transition from the conventional car to the e-car takes place both in the consciousness of the man as in the technical field, governments seem to have beaten the first battle here to a lasting effect of sustainable automotive mobility. However, e-cars comprise too many precarious points in the technical field to let the transition proceed quickly and smoothly. From the reaction of investors and the increasingly becoming more financially savvy consumer, fed by the crisis, appears that the enthusiasm for e-cars falls shorts in expectations probably because of these shortcomings. The driving range and the number of charging points has proved to be a barrier to adoption, as many cars are unable to go beyond 160 kilometres (KPMG, 2014). The e-car price and range, two essential purchase criteria, will certainly affect customer-purchasing behaviour and thus might limit the number of sales (Grünig et al., 2011). In addition, account should be taken for the long development cycles which signify that some of the new advances may take as much as 5 to 10 years to evolve. The current business structure within the automotive sector is built on cost efficiency and long depreciation cycles. However it is the lack of breakthroughs in technology and costs the last years that has tempered the primer positive outlook for e-cars. I believe that if investors and parties with big money did not have such large interests in conventional cars, these shortcomings would be long since solved. However, by now these shortcomings and the shortfall of breakthroughs bother a fast implementation of the e-car. The choice of investors and a large group of financial conscious consumers to prefer the conventional car above the e-car to obtain short-term returns and financial gains seems thus morally questionable but fully justifiable and rational.

Governments should play an increasing role of importance in the encouragement of technical implementation through large scale united investments and stimulations, to overcome investor's reticent attitudes and bridge the gap between conventional cars and e-cars. Although, free market forces are considered as efficient and it is questionable whether market intervention leads to the desired result, I think that in this case investor's negative reactions function as disincentives and should be classified as short sighted and a failure of financial markets. This means that corrective government interception seems to be an appropriate way to push the automotive market in the correct and desired direction. Roles should be reserved for economies with a large market for automotive manufacturers, disposing of a strong financial background, flexible production lines and skilled workers (Özel et al., 2013), such as America, Europe and Asia. If these economical and political powerhouses could unanimously implement the same set of stimulations, the complexity of the worldwide e-car market for automotive manufacturers would be significantly reduced, which should be beneficial for the transition process. The reduced complexity for automotive manufacturers and decreased diversity of legislation through the united stimuli in the fields of market support, including industry and market expertise (Åhman, 2006) should encourage auto producers to dissolve the shortcomings of e-cars quickly. As a result, the sales of e-cars should increase, persuading investors to come on board with the big money. These should be the necessary ingredients to smooth out the rough edges that stand a successful transition in the way from a by finite oil driven conventional car to a car which will determine the street scene of the future, the e-car.

A shortcoming arises from the fact that some of the automotive manufacturers are conglomerates selling multiple products and brands, which might have caused biased results. Further research is necessary to find out whether investors haven't changed their view with respect to e-cars, as the world is constantly developing. It is likely that e-cars become widely more accepted, but to what extent? Other suggestions for further research depend more on researcher's desires, as the effects in stock price performances of different classes or specific brands could be solely investigated.

9. Limitations

The limitations of this study are mainly hidden in the shortcomings of the data. The dataset includes the majority of the automotive manufacturers, which sold more than 2 million units in the year 2012. However, for some of these automotive manufacturers the stock prices over the total time range of the study aren't available. Through the lack of for example the stock prices of GM before 2010, the release date of the Chevrolet Volt, one of the first full electric vehicles couldn't be included in the event study. Additionally, some of the automotive manufacturers included in the study are conglomerates, selling a wide-range of products, which aren't specifically related to the core business of producing cars. Some of these automotive manufacturers sell cars under multiple brands, like Volkswagen AG. Volkswagen AG owns and sells cars of the brands, Audi, Bentley, Bugatti, Lamborghini, Porsche, Seat and Skoda. Because the cash flows of multiple products and brands are captured in one stock price, returns obtained in the event study might be biased because of happenings with one of the other products sold under the name of the relevant automotive manufacturer. However, if this is the case, and the extent to which this is the case, is impossible to measure.
Another limitation of the study lies in the releases of the cars. The majority of the cars have been released on motor shows, but in some of the cases it is uncertain how many and what cars are released by the automotive manufacturer on that particular show.

Summarizing, the limitations of this study are mainly caused through a lack of data or non-transparent data.

10. Further research

Further research is necessary, to find out whether investor haven't changed their view with respect to e-cars and are still reticent towards automotive manufacturer's stocks that just released an e-car. The event studies are entirely based on instantaneous shots on the stock market and investor's insights can quickly turn as external factors change. The last years have increasingly confirmed that central bank's economic stimulations could stow stock markets. But did the increasing government stimulations for alternative fuels the last years had have the same affect for listed automotive manufacturers producing an e-car? Because it's been almost five years since the majority of the e-cars have been released that were taken into account in the event study and governmental stimulations have been extended ever-since, an investigation for possibly changed attitude of investors might be a suggestion for further research.

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Appendix A

This table shows the days included in the control period, 110 days to 11 days before the event. On the left side of the table, the relevant automotive manufacturer is shown, plus the release date that is taken into account in the event study. This release date is the determiner for the selected start and end of the control period and test period.
On the right side of the table, the periods, 10 days before the event to 10 days after the event are given. In this period it becomes clear whether the automotive manufacturer's stock accomplishes an abnormal return.

*Holiday included in the test period, which is replaced by the nearest trading day
with a price rash

E-CARS

Type	Start test	End test	Start abnormal returns	End abnormal returns
Toyota RAV 4 EV Release date 30-04-12	28-11-11	13-04-12	16-04-12	14-05-12
VW E-Up Release date 14-03-13	11-10-12	27-02-13	28-02-13	28-03-13
Hyundai I-Flow Release date 01-03-10	28-09-09	12-02-10	15-02-10	16-03-10*
Ford Focus Elec Release date 16-09-09	15-04-09	01-09-09	02-09-09	30-09-09
Nissan Leaf Release date 02-08-09	27-02-09	16-07-09	17-07-09	14-08-09
Honda Fit EV Release date 17-11-10	16-06-10	02-11-10	03-11-10	01-12-10
PSA Hx1 Release date 29-08-11	28-03-11	12-08-11	15-08-11	12-09-11
Suzuki Swift plug-in Release date 21-10-09	20-05-09	06-10-09	07-10-09	05-11-09*
Renault Z.E Fleunce Release date 15-09-09	14-04-09	31-08-09	01-09-09	29-09-09
Daimler Benz SLS AMG E Release date 01-10-12* through weekend	30-04-12	14-09-12	17-09-12	15-10-12
Fiat 500 E Release date 14-01-10	13-08-09	30-12-09	28-12-09*	28-01-10
BMW i8 Release date 15-09-09	14-04-09	31-08-09	01-09-09	29-09-09
Mitsubishi I-MiEV Release date 13-09-07	12-04-07	29-08-07	30-08-07	28-09-07*

Conventional Cars

Type	Start test	End test	Start abnormal return	End abnormal return
Toyota Camry Release date 24-08-11	23-03-11	09-08-11	10-08-11	07-09-11
GM Malibu Release date 20-04-11	17-11-10	05-04-11	06-04-11	04-05-11
VW Jetta Release date 05-01-05	04-08-04	21-12-04	22-12-04	19-11-05
Hyundai Genesis Release date 04-03-07	02-10-06	16-02-07	19-02-07	19-03-07
FORD 427 Release date 06-01-03* through weekend	05-08-02	20-12-02	23-12-03	20-01-03
Nissan Maxima Release date 19-03-08	17-10-07	04-03-08	05-03-08	02-04-08
Honda Civic Release date* 10-01-11	09-08-10	24-12-10	27-12-10	24-01-11
PSA 407 Release date 13-09-03	14-04-03	29-08-03	01-09-03	29-09-03
Suzuki Kizashi Release date 11-09-07	10-04-07	27-08-07	28-08-07	25-09-07
Renault Design lifestyle Release date 10-09-13	09-04-13	26-08-13	27-08-13	24-09-13
Daimler CL Class Release date 15-09-06	12-04-06	29-08-06	30-08-06	27-09-06
FIAT 500 New Release date 22-03-07	19-10-06	07-03-07	08-03-07	05-04-07
BMW 4 Series Release date 05-12-13	04-07-12	20-11-12	21-11-12	19-12-12
Mitsubishi Outlander Release date 14-04-06	11-11-05	30-03-06	31-03-06	28-04-06
AUDI Q7 Release date 06-01-03*	05-08-02	20-12-02	23-12-02	20-01-03

Appendix B

E-views output α and β of E-CARS

Dependent Variable: **TOYOTA**		Sample: 1 100		
Method: Least Squares		Included observations: 100		
Date: 06/24/14 Time: 12:39		TOYOTA = C(1) + C(2)*TOPIXTO		
	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	0.001211	0.000928	1.304981	0.1950
C(2)	1.439931	0.102509	14.04683	0.0000
R-squared	0.668149	Mean dependent var		0.003334
Adjusted R-squared	0.664763	S.D. dependent var		0.015817
S.E. of regression	0.009158	Akaike info criterion		-6.528549
Sum squared resid	0.008219	Schwarz criterion		-6.476446
Log likelihood	328.4275	Hannan-Quinn criter.		-6.507462
F-statistic	197.3134	Durbin-Watson stat		2.115521
Prob(F-statistic)	0.000000			

Dependent Variable: **VW**		Sample: 1 100		
Method: Least Squares		Included observations: 100		
Date: 06/24/14 Time: 12:52		VW = C(1) + C(2)*DAXVW		
	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	0.001263	0.001305	0.967979	0.3354
C(2)	0.729122	0.154635	4.715123	0.0000
R-squared	0.184912	Mean dependent var		0.001750
Adjusted R-squared	0.176595	S.D. dependent var		0.014334
S.E. of regression	0.013007	Akaike info criterion		-5.826914
Sum squared resid	0.016579	Schwarz criterion		-5.774810
Log likelihood	293.3457	Hannan-Quinn criter.		-5.805826
F-statistic	22.23238	Durbin-Watson stat		1.531648
Prob(F-statistic)	0.000008			

Dependent Variable: **HYU**		Sample: 1 100		
Method: Least Squares		Included observations: 100		
Date: 06/24/14 Time: 13:07		HYU = C(1) + C(2)*KOSPI		
	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	0.001023	0.002378	0.430101	0.6681
C(2)	1.155759	0.207651	5.565864	0.0000
R-squared	0.240185	Mean dependent var		0.000411
Adjusted R-squared	0.232432	S.D. dependent var		0.027111
S.E. of regression	0.023752	Akaike info criterion		-4.622495
Sum squared resid	0.055288	Schwarz criterion		-4.570391
Log likelihood	233.1247	Hannan-Quinn criter.		-4.601407
F-statistic	30.97884	Durbin-Watson stat		1.655152
Prob(F-statistic)	0.000000			

Dependent Variable: **FORD**		Sample: 1 100		
Method: Least Squares		Included observations: 100		
Date: 06/24/14 Time: 13:17		FORD = C(1) + C(2)*NASFORD		
	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	0.003071	0.003732	0.823067	0.4125
C(2)	1.485593	0.258999	5.735911	0.0000
R-squared	0.251341	Mean dependent var		0.006124
Adjusted R-squared	0.243701	S.D. dependent var		0.042472
S.E. of regression	0.036936	Akaike info criterion		-3.739471
Sum squared resid	0.133697	Schwarz criterion		-3.687368
Log likelihood	188.9736	Hannan-Quinn criter.		-3.718384
F-statistic	32.90068	Durbin-Watson stat		2.022950
Prob(F-statistic)	0.000000			

Dependent Variable: **NISSAN**		Sample: 1 100		
Method: Least Squares		Included observations: 100		
Date: 06/24/14 Time: 13:28		NISSAN = C(1) + C(2)*TOPIXNS		
	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	0.003710	0.002485	1.492711	0.1387
C(2)	1.659094	0.146200	11.34808	0.0000
R-squared	0.567861	Mean dependent var		0.006620
Adjusted R-squared	0.563452	S.D. dependent var		0.037413
S.E. of regression	0.024719	Akaike info criterion		-4.542681
Sum squared resid	0.059882	Schwarz criterion		-4.490577
Log likelihood	229.1340	Hannan-Quinn criter.		-4.521593
F-statistic	128.7790	Durbin-Watson stat		1.676824
Prob(F-statistic)	0.000000			

Dependent Variable: **HONDA**		Sample: 1 100		
Method: Least Squares		Included observations: 100		
Date: 06/24/14 Time: 13:26		HONDA = C(1) + C(2)*TOPIXHO		
	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	0.001223	0.001095	1.117667	0.2664
C(2)	1.241945	0.100927	12.30539	0.0000
R-squared	0.607093	Mean dependent var		0.000178
Adjusted R-squared	0.603083	S.D. dependent var		0.017321
S.E. of regression	0.010913	Akaike info criterion		-6.177984
Sum squared resid	0.011670	Schwarz criterion		-6.125881
Log likelihood	310.8992	Hannan-Quinn criter.		-6.156897
F-statistic	151.4226	Durbin-Watson stat		1.869580
Prob(F-statistic)	0.000000			

Dependent Variable: **PSA**		Sample: 1 100		
Method: Least Squares		Included observations: 100		
Date: 06/24/14 Time: 13:36		PSA = C(1) + C(2)*CACPSA		
	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	0.000526	0.001358	0.387184	0.6995
C(2)	1.371240	0.092494	14.82518	0.0000
R-squared	0.691616	Mean dependent var		-0.002230
Adjusted R-squared	0.688470	S.D. dependent var		0.024102
S.E. of regression	0.013452	Akaike info criterion		-5.759540
Sum squared resid	0.017734	Schwarz criterion		-5.707437
Log likelihood	289.9770	Hannan-Quinn criter.		-5.738453
F-statistic	219.7860	Durbin-Watson stat		1.951344
Prob(F-statistic)	0.000000			

Dependent Variable: **SUZUKI**		Sample: 1 100		
Method: Least Squares		Included observations: 100		
Date: 06/24/14 Time: 14:08		SUZUKI = C(1) + C(2)*TOPIXSU		
	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.000206	0.001294	-0.159036	0.8740
C(2)	1.156888	0.109759	10.54028	0.0000
R-squared	0.531319	Mean dependent var		-0.000233
Adjusted R-squared	0.526537	S.D. dependent var		0.018810
S.E. of regression	0.012943	Akaike info criterion		-5.836746
Sum squared resid	0.016417	Schwarz criterion		-5.784643
Log likelihood	293.8373	Hannan-Quinn criter.		-5.815659
F-statistic	111.0975	Durbin-Watson stat		1.926576
Prob(F-statistic)	0.000000			

Dependent Variable: **RENAULT**		Sample: 1 100		
Method: Least Squares		Included observations: 100		
Date: 06/24/14 Time: 14:15		RENAULT = C(1) + C(2)*CACREN		
	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	7.28E-05	0.002764	0.026323	0.9791
C(2)	1.803519	0.183595	9.823369	0.0000
R-squared	0.496140	Mean dependent var		0.003987
Adjusted R-squared	0.490999	S.D. dependent var		0.038339
S.E. of regression	0.027353	Akaike info criterion		-4.340213
Sum squared resid	0.073320	Schwarz criterion		-4.288110
Log likelihood	219.0107	Hannan-Quinn criter.		-4.319126
F-statistic	96.49858	Durbin-Watson stat		2.270045
Prob(F-statistic)	0.000000			

Dependent Variable: **DAIMLER**		Sample: 1 100		
Method: Least Squares		Included observations: 100		
Date: 06/24/14 Time: 14:28		DAIMLER = C(1) + C(2)*DAXDAI		
	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.001391	0.001136	-1.224236	0.2238
C(2)	1.155681	0.207651	5.565864	0.0000
R-squared	0.646645	Mean dependent var		-0.000297
Adjusted R-squared	0.643039	S.D. dependent var		0.018971
S.E. of regression	0.011335	Akaike info criterion		-6.102106
Sum squared resid	0.012590	Schwarz criterion		-6.050003
Log likelihood	307.1053	Hannan-Quinn criter.		-6.081019
F-statistic	179.3412	Durbin-Watson stat		2.250557
Prob(F-statistic)	0.000000			

Dependent Variable: **FIAT**		Sample: 1 100		
Method: Least Squares		Included observations: 100		
Date: 06/24/14 Time: 14:48		FIAT = C(1) + C(2)*FTSEMIB		
	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	0.001646	0.001843	0.893087	0.3740
C(2)	1.209459	0.140752	8.592839	0.0000
R-squared	0.429692	Mean dependent var		0.002670
Adjusted R-squared	0.423872	S.D. dependent var		0.024236
S.E. of regression	0.018396	Akaike info criterion		-5.133551
Sum squared resid	0.033165	Schwarz criterion		-5.081448
Log likelihood	258.6776	Hannan-Quinn criter.		-5.112464
F-statistic	73.83688	Durbin-Watson stat		1.912002
Prob(F-statistic)	0.000000			

Dependent Variable: **BMW**		Sample: 1 100		
Method: Least Squares		Included observations: 100		
Date: 06/24/14 Time: 14:55		BMW = C(1) + C(2)*DAXBMW		
	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	0.000170	0.001678	0.101477	0.9194
C(2)	1.017342	0.102669	9.908905	0.0000
R-squared	0.500475	Mean dependent var		0.002302
Adjusted R-squared	0.495378	S.D. dependent var		0.023421
S.E. of regression	0.016637	Akaike info criterion		-5.334535
Sum squared resid	0.027127	Schwarz criterion		-5.282432
Log likelihood	268.7268	Hannan-Quinn criter.		-5.313448
F-statistic	98.18640	Durbin-Watson stat		1.876350
Prob(F-statistic)	0.000000			

Dependent Variable: **MITSUBISHI**		Sample: 1 100		
Method: Least Squares		Included observations: 100		
Date: 06/24/14 Time: 15:06		MITSUBISHI = C(1) + C(2)*TOPIXMIT		
	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.000402	0.001064	-0.377617	0.7065
C(2)	0.884856	0.095137	9.300837	0.0000
R-squared	0.468851	Mean dependent var		-0.001321
Adjusted R-squared	0.463431	S.D. dependent var		0.014458
S.E. of regression	0.010591	Akaike info criterion		-6.237853
Sum squared resid	0.010992	Schwarz criterion		-6.185749
Log likelihood	313.8926	Hannan-Quinn criter.		-6.216765
F-statistic	86.50557	Durbin-Watson stat		2.249683
Prob(F-statistic)	0.000000			

Dependent Variable: **AUDI**		Sample: 1 100		
Method: Least Squares		Included observations: 100		
Date: 06/24/14 Time: 15:12		AUDI = C(1) + C(2)*DAXAUDI		
	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	0.000604	0.002209	0.273335	0.7852
C(2)	0.335455	0.135195	2.481270	0.0148
R-squared	0.059110	Mean dependent var		0.001307
Adjusted R-squared	0.049509	S.D. dependent var		0.022471
S.E. of regression	0.021908	Akaike info criterion		-4.784130
Sum squared resid	0.047036	Schwarz criterion		-4.732026
Log likelihood	241.2065	Hannan-Quinn criter.		-4.763042
F-statistic	6.156703	Durbin-Watson stat		2.038520
Prob(F-statistic)	0.014794			

E-views output α and β of Conventional Cars

Dependent Variable: **TOYOTA**		Sample: 1 100		
Method: Least Squares		Included observations: 100		
Date: 06/24/14 Time: 13:41		TOYOTA = C(1) + C(2)*TOPIXTO		
	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-8.70E-06	0.000951	-0.009145	0.9927
C(2)	1.043211	0.098606	10.57953	0.0000
R-squared	0.533170	Mean dependent var		-0.001206
Adjusted R-squared	0.528406	S.D. dependent var		0.013754
S.E. of regression	0.009445	Akaike info criterion		-6.466823
Sum squared resid	0.008743	Schwarz criterion		-6.414720
Log likelihood	325.3411	Hannan-Quinn criter.		-6.445736
F-statistic	111.9265	Durbin-Watson stat		1.743501
Prob(F-statistic)	0.000000			

Dependent Variable: **GM**		Sample: 1 100		
Method: Least Squares		Included observations: 100		
Date: 06/13/14 Time: 13:51		GM = C(1) + C(2)*NASDGM		
	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.001176	0.001446	-0.813408	0.4180
C(2)	0.731650	0.163525	4.474237	0.0000
R-squared	0.169624	Mean dependent var		-0.000252
Adjusted R-squared	0.161151	S.D. dependent var		0.015627
S.E. of regression	0.014313	Akaike info criterion		-5.635545
Sum squared resid	0.020076	Schwarz criterion		-5.583441
Log likelihood	283.7772	Hannan-Quinn criter.		-5.614458
F-statistic	20.01879	Durbin-Watson stat		2.024386
Prob(F-statistic)	0.000021			

Dependent Variable: **VW**		Sample: 1 100		
Method: Least Squares		Included observations: 100		
Date: 06/13/14 Time: 14:09		VW = C(1) + C(2)*DAX_VW		
	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.000786	0.001215	-0.647266	0.5190
C(2)	0.807997	0.141756	5.699916	0.0000
R-squared	0.248979	Mean dependent var		-8.32E-05
Adjusted R-squared	0.241316	S.D. dependent var		0.013877
S.E. of regression	0.012087	Akaike info criterion		-5.973507
Sum squared resid	0.014318	Schwarz criterion		-5.921404
Log likelihood	300.6754	Hannan-Quinn criter.		-5.952420
F-statistic	32.48905	Durbin-Watson stat		1.972966
Prob(F-statistic)	0.000000			

Dependent Variable: **HYU**		Sample: 1 100		
Method: Least Squares		Included observations: 100		
Date: 06/13/14 Time: 15:58		HYU = C(1) + C(2)*KOSPI		
	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.001654	0.001073	-1.540348	0.1267
C(2)	0.861449	0.132880	6.482896	0.0000
R-squared	0.300140	Mean dependent var		-0.001152
Adjusted R-squared	0.292998	S.D. dependent var		0.012733
S.E. of regression	0.010707	Akaike info criterion		-6.216086
Sum squared resid	0.011234	Schwarz criterion		-6.163982
Log likelihood	312.8043	Hannan-Quinn criter.		-6.194999
F-statistic	42.02794	Durbin-Watson stat		1.597788
Prob(F-statistic)	0.000000			

Dependent Variable: **FORD**		Sample: 1 100		
Method: Least Squares		Included observations: 100		
Date: 06/13/14 Time: 14:29		FORD = C(1) + C(2)*NASDFORD		
	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.001021	0.001138	-0.896698	0.3721
C(2)	0.806458	0.123228	6.544411	0.0000
R-squared	0.304122	Mean dependent var		8.93E-05
Adjusted R-squared	0.297021	S.D. dependent var		0.013424
S.E. of regression	0.011255	Akaike info criterion		-6.116228
Sum squared resid	0.012414	Schwarz criterion		-6.064124
Log likelihood	307.8114	Hannan-Quinn criter.		-6.095141
F-statistic	42.82931	Durbin-Watson stat		2.349758
Prob(F-statistic)	0.000000			

Dependent Variable: **NISSAN**		Sample: 1 100		
Method: Least Squares		Included observations: 100		
Date: 06/13/14 Time: 14:45		NISSAN = C(1) + C(2)*TOPIXNIS		
	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	0.000741	0.001967	0.376717	0.7072
C(2)	1.174515	0.105902	11.09056	0.0000
R-squared	0.556562	Mean dependent var		-0.001992
Adjusted R-squared	0.552037	S.D. dependent var		0.029164
S.E. of regression	0.019519	Akaike info criterion		-5.015022
Sum squared resid	0.037339	Schwarz criterion		-4.962919
Log likelihood	252.7511	Hannan-Quinn criter.		-4.993935
F-statistic	123.0005	Durbin-Watson stat		2.279086
Prob(F-statistic)	0.000000			

Dependent Variable: **HONDA**		Sample: 1 100		
Method: Least Squares		Included observations: 100		
Date: 06/30/14 Time: 13:59		HONDA = C(1) + C(2)*TOPIXHO		
	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	0.000633	0.000997	0.634406	0.5273
C(2)	1.252407	0.103557	12.09384	0.0000
R-squared	0.598790	Mean dependent var		0.001266
Adjusted R-squared	0.594696	S.D. dependent var		0.015640
S.E. of regression	0.009957	Akaike info criterion		-6.361269
Sum squared resid	0.009716	Schwarz criterion		-6.309165
Log likelihood	320.0634	Hannan-Quinn criter.		-6.340181
F-statistic	146.2610	Durbin-Watson stat		1.697372
Prob(F-statistic)	0.000000			

Dependent Variable: **PSA**		Sample: 1 100		
Method: Least Squares		Included observations: 100		
Date: 06/13/14 Time: 15:03		PSA = C(1) + C(2)*CACPSA		
	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-2.31E-05	0.001604	-0.014390	0.9885
C(2)	0.773049	0.125935	6.138478	0.0000
R-squared	0.277717	Mean dependent var		0.001232
Adjusted R-squared	0.270347	S.D. dependent var		0.018624
S.E. of regression	0.015908	Akaike info criterion		-5.424157
Sum squared resid	0.024801	Schwarz criterion		-5.372054
Log likelihood	273.2078	Hannan-Quinn criter.		-5.403070
F-statistic	37.68091	Durbin-Watson stat		2.273422
Prob(F-statistic)	0.000000			

Dependent Variable: **SUZUKI**		Sample: 1 100		
Method: Least Squares		Included observations: 100		
Date: 06/30/14 Time: 14:12		SUZUKI = C(1) + C(2)*TOPIXSU		
	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	0.000539	0.001445	0.373060	0.7099
C(2)	0.944121	0.130772	7.219613	0.0000
R-squared	0.347201	Mean dependent var		-0.000257
Adjusted R-squared	0.340540	S.D. dependent var		0.017743
S.E. of regression	0.014408	Akaike info criterion		-5.622209
Sum squared resid	0.020345	Schwarz criterion		-5.570105
Log likelihood	283.1104	Hannan-Quinn criter.		-5.601121
F-statistic	52.12282	Durbin-Watson stat		1.668414
Prob(F-statistic)	0.000000			

Dependent Variable: **RENAULT**		Sample: 1 100		
Method: Least Squares		Included observations: 100		
Date: 06/30/14 Time: 14:32		RENAULT = C(1) + C(2)*CACREN		
	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	0.000755	0.001657	0.455343	0.6499
C(2)	1.396570	0.152344	9.167228	0.0000
R-squared	0.461651	Mean dependent var		0.002284
Adjusted R-squared	0.456158	S.D. dependent var		0.022355
S.E. of regression	0.016486	Akaike info criterion		-5.352818
Sum squared resid	0.026635	Schwarz criterion		-5.300715
Log likelihood	269.6409	Hannan-Quinn criter.		-5.331731
F-statistic	84.03807	Durbin-Watson stat		1.978864
Prob(F-statistic)	0.000000			

Dependent Variable: **DAIMLER**		Sample: 1 100		
Method: Least Squares		Included observations: 100		
Date: 06/30/14 Time: 14:41		DAIMLER = C(1) +C(2)*DAXDAI		
	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.001306	0.001013	-1.289361	0.2003
C(2)	0.893595	0.082719	10.80280	0.0000
R-squared	0.543550	Mean dependent var		-0.001333
Adjusted R-squared	0.538892	S.D. dependent var		0.014920
S.E. of regression	0.010131	Akaike info criterion		-6.326555
Sum squared resid	0.010059	Schwarz criterion		-6.274451
Log likelihood	318.3277	Hannan-Quinn criter.		-6.305468
F-statistic	116.7004	Durbin-Watson stat		2.326777
Prob(F-statistic)	0.000000			

Dependent Variable: **FIAT**		Sample: 1 100		
Method: Least Squares		Included observations: 100		
Date: 06/16/14 Time: 16:06		FIAT = C(1) + C(2)*FTSEMIB		
	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	0.002365	0.001384	1.708527	0.0907
C(2)	1.762342	0.218567	8.063182	0.0000
R-squared	0.398828	Mean dependent var		0.002794
Adjusted R-squared	0.392694	S.D. dependent var		0.017750
S.E. of regression	0.013833	Akaike info criterion		-5.703759
Sum squared resid	0.018752	Schwarz criterion		-5.651655
Log likelihood	287.1879	Hannan-Quinn criter.		-5.682672
F-statistic	65.01490	Durbin-Watson stat		2.357985
Prob(F-statistic)	0.000000			

Dependent Variable: **BMW**		Sample: 1 100		
Method: Least Squares		Included observations: 100		
Date: 06/13/14 Time: 16:03		BMW = C(1) + C(2)*DAXBMW		
	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	0.000113	0.001169	0.096385	0.9234
C(2)	1.132399	0.103123	10.98109	0.0000
R-squared	0.551660	Mean dependent var		0.001165
Adjusted R-squared	0.547085	S.D. dependent var		0.017313
S.E. of regression	0.011651	Akaike info criterion		-6.046997
Sum squared resid	0.013304	Schwarz criterion		-5.994894
Log likelihood	304.3498	Hannan-Quinn criter.		-6.025910
F-statistic	120.5842	Durbin-Watson stat		2.157067
Prob(F-statistic)	0.000000			

Dependent Variable: **MITSUBISHI**		Sample: 1 100		
Method: Least Squares		Included observations: 100		
Date: 06/13/14 Time: 16:11		MIT = C(1) + C(2)*TOPIXMITSUBISHI		
	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.003508	0.002705	-1.296916	0.1977
C(2)	1.239533	0.225935	5.486246	0.0000
R-squared	0.234966	Mean dependent var		-0.001548
Adjusted R-squared	0.227160	S.D. dependent var		0.030502
S.E. of regression	0.026814	Akaike info criterion		-4.379963
Sum squared resid	0.070463	Schwarz criterion		-4.327860
Log likelihood	220.9982	Hannan-Quinn criter.		-4.358876
F-statistic	30.09889	Durbin-Watson stat		1.941821
Prob(F-statistic)	0.000000			

Dependent Variable: **AUDI**		Sample: 1 100		
Method: Least Squares		Included observations: 100		
Date: 06/16/14 Time: 16:18		AUDI = C(1) + C(2)*DAXAUDI		
	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.000764	0.000782	-0.976420	0.3313
C(2)	0.056502	0.024859	2.272879	0.0252
R-squared	0.050074	Mean dependent var		-0.000823
Adjusted R-squared	0.040381	S.D. dependent var		0.007978
S.E. of regression	0.007815	Akaike info criterion		-6.845683
Sum squared resid	0.005986	Schwarz criterion		-6.793580
Log likelihood	344.2842	Hannan-Quinn criter.		-6.824596
F-statistic	5.165978	Durbin-Watson stat		1.371043
Prob(F-statistic)	0.025217			

Appendix BI

E-views output DF test E-Cars

Null Hypothesis: AAR has a unit root		
Exogenous: Constant		
Lag Length: 0 (Automatic - based on SIC, maxlag=4)		
	t-Statistic	
Elliott-Rothenberg-Stock DF-GLS test statistic	-4.953326	
Test critical values:	1% level	-2.685718
	5% level	-1.959071
	10% level	-1.607456
*MacKinnon (1996)		

DF-GLS Test Equation on GLS Detrended Residuals		Date: 06/30/14 Time: 15:38		
Dependent Variable: D(GLSRESID)		Sample (adjusted): 2 21		
Method: Least Squares		Included observations: 20 after adjustments		
Variable	Coefficient	Std. Error	t-Statistic	Prob.
GLSRESID(-1)	-1.163262	0.234845	-4.953326	0.0001
R-squared	0.560548	Mean dependent var		0.000649
Adjusted R-squared	0.560548	S.D. dependent var		0.007995
S.E. of regression	0.005300	Akaike info criterion		-7.593445
Sum squared resid	0.000534	Schwarz criterion		-7.543659
Log likelihood	76.93445	Hannan-Quinn criter.		-7.583727
Durbin-Watson stat	1.883711			

E-views output DF test Conventional Cars

Null Hypothesis: AAR has a unit root		
Exogenous: Constant		
Lag Length: 0 (Automatic - based on SIC, maxlag=4)		
	t-Statistic	
Elliott-Rothenberg-Stock DF-GLS test statistic	-2.936833	
Test critical values:	1% level	-2.685718
	5% level	-1.959071
	10% level	-1.607456
*MacKinnon (1996)		

DF-GLS Test Equation on GLS Detrended Residuals		Date: 06/30/14 Time: 15:35		
Dependent Variable: D(GLSRESID)		Sample (adjusted): 2 21		
Method: Least Squares		Included observations: 20 after adjustments		
Variable	Coefficient	Std. Error	t-Statistic	Prob.
GLSRESID(-1)	-1.163262	0.234845	-4.953326	0.0001

R-squared	0.309540	Mean dependent var	0.000266
Adjusted R-squared	0.309540	S.D. dependent var	0.004372
S.E. of regression	0.003633	Akaike info criterion	-8.348712
Sum squared resid	0.000251	Schwarz criterion	-8.298926
Log likelihood	84.48712	Hannan-Quinn criter.	-8.338993

Appendix C

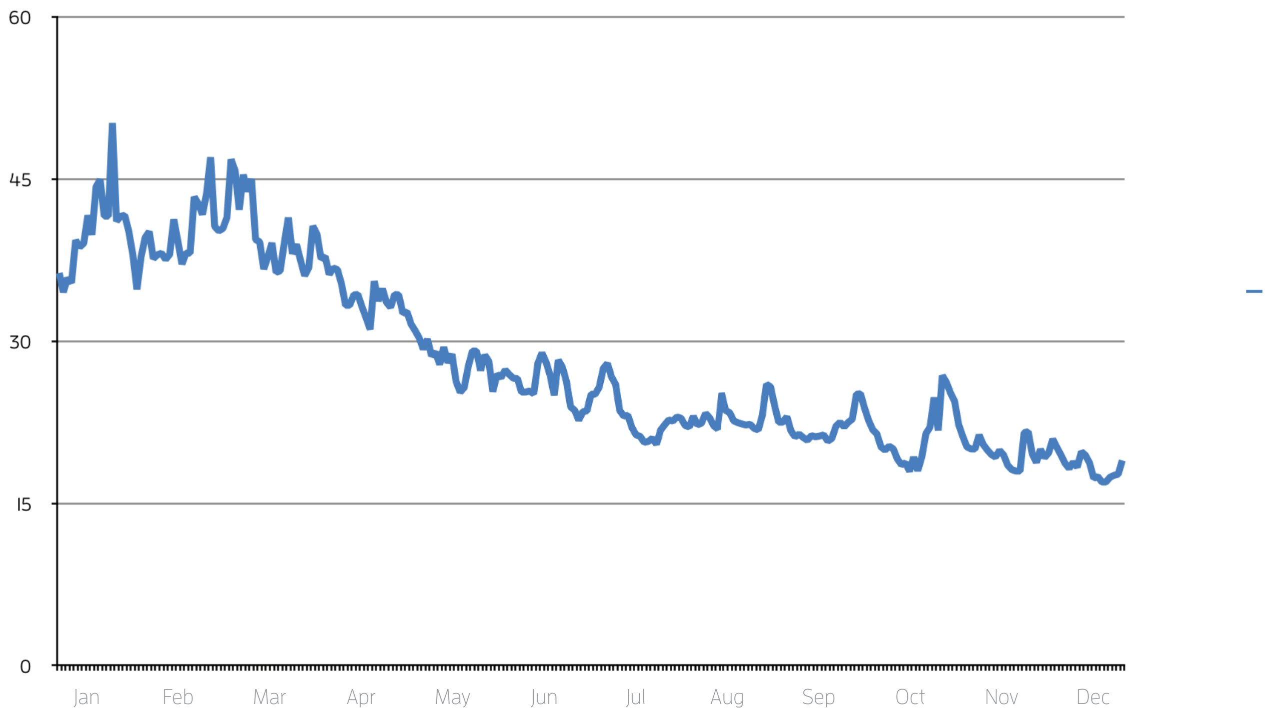
Remainder of table D.

Auto producers	Dates test periods	Returns individual stock	Returns Gen Index	Return A&P Index	Gen > A&P
Toyota	16-04-12 to 14-05-12	-1,223%	-5,866%	-2,680%	-
Volkswagen	28-02-13 to 28-03-13	-7,155%	0,692%	-5,642%	+
Hyundai	15-02-10 to 16-03-10	-5,603%	3,410%	N.A	N.A
Ford	02-09-09 to 30-09-09	2,560%	5,654%	6,241%	-
Nissan	17-07-09 to 14-08-09	28,120%	10,848%	18,930%	-
Honda	03-11-10 to 01-12-10	13,028%	7,838%	13,932%	-
PSA	15-08-11 to 12-09-11	-23,091%	-11,863%	-17,899%	+
Suzuki	07-10-09 to 05-11-09	5,185%	-1,211%	2,665%	-
Renault	01-09-09 to 29-09-09	6,862%	6,437%	8,542%	-
Daimler	17-09-12 to 15-10-12	-4,020%	-1,924%	-3,824%	+
Fiat	28-12-09 to 28-01-10	-15,021%	-7,293%	N.A	N.A
BMW	01-09-09 to 29-09-09	8,887%	7,250%	4,843%	+
Mitsubishi	30-08-07 to 28-09-07	3,727%	3,086%	N.A	N.A
Audi	01-09-09 to 29-09-09	1,699%	7,250%	4,843%	+

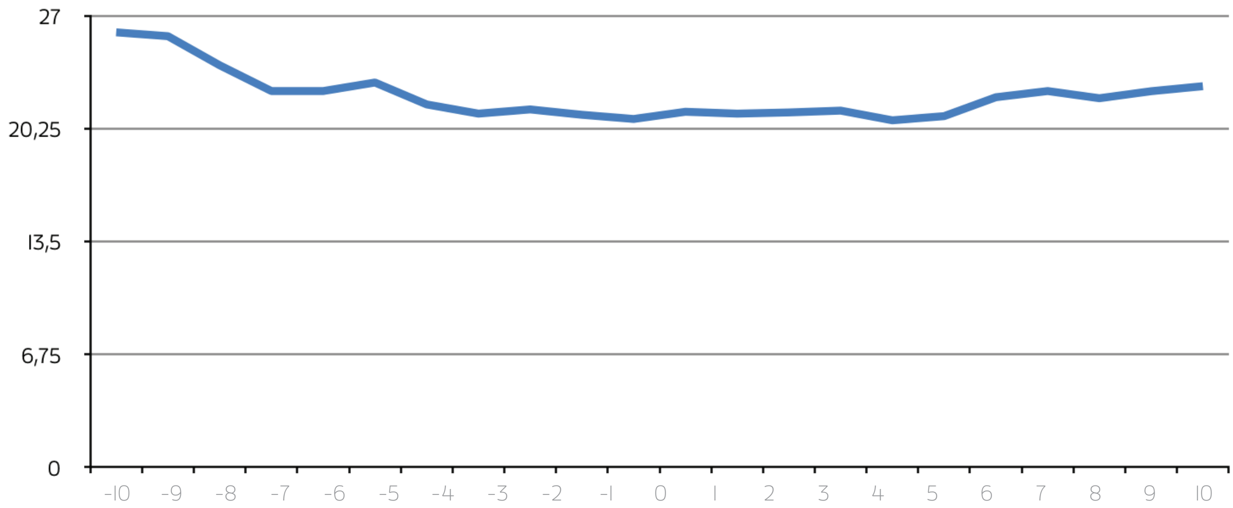
Remainder of table D. In this table, the auto producers, the dates of the test periods and the returns over the test period of the individual stocks, the general indexes where the stocks are listed and the returns of the automotive and parts indexes (A&P Index) where the auto producers are also listed, is given. These numbers are given for the auto producers that released an e-car. In the last column, the comparison between the return of the general index and A&P index is given.

Appendix D

The overall stock markets prevail an increasingly becoming more positive sentiment, with the indices moving in an upward trend in the period of the example starting at 01-09-09 and ending at 29-09-09. It is important to consider this positive sentiment for the analysis, as it shows that investors are enthusiastic to invest in all kinds of sectors. The positive sentiment becomes clear from rising indexes, but from a short recap from the literature review could be understood that the sentiment becomes also visible through the volatility market index (VIX). Therefore an additional measurement in the form of the VIX is given in the appendix to affirm the positive sentiment on general stock markets through all possible channels. The volatility index is an indicator of the sentiment that predominates on the stock market at that moment. The higher the volatility index quotes, the greater the fears in the underlying index (Giot, 2005). A quotation between 11% and 20% indicates a period of relative calmness on the stock market. A decreasing value of the volatility index should indicate a more positive becoming sentiment on the stock market. The volatility market index of the American stock markets is taken, as this is although undescribed, seen as the most important measure for the volatility on the stock markets world wide.



Graph B. Volatility over the year 2009 shows a decreasing trend. Meaning that the sentiments in the stock markets are becoming more positive during the year progresses.



Graph C, shows the volatility over the month September of 2009, as this is the test period [-10, 10] used for the releases. From the graph becomes clear that the VIX flirted with 20-value border during the test period, which is seen as the border of relative calmness on the stock market.

From both graphs becomes clear that the VIX is decreasing over the time and thus the sentiment on the stock market improving.

Appendix E

Traded volume * 1000 during test period [-10, 10]

Days	Toyota	Hyundai	Ford	Nissan	Honda	PSA	Suzuki	Renault	Daimler	Fiat	BMW	Mitsubishi
-10	5545	630	102771	15180	12750	2698	2739	2943	41	13283	9	904
-9	6705	893	65920	15693	13546	3232	1823	4018	34	15709	17	1490
-8	7816	723	87170	12795	11054	3064	1533	3185	26	31707	4	1103
-7	6564	696	42540	13313	8533	5620	2525	3326	46	66672	11	1263
-6	8445	664	45510	15389	6674	6596	1734	1993	74	27099	5	905
-5	5129	685	47496	21055	5741	4346	2493	1698	25	41440	21	1074
-4	5952	627	34041	11551	3856	3972	1840	4395	57	44449	34	663
-3	4322	1639	48788	10552	4815	4780	2584	2636	35	38000	21	932
-2	4275	564	34524	17789	3587	5111	1504	2062	44	59388	10	1154
-1	11619	490	50771	45961	7025	4532	3463	2509	29	39262	18	1232
0	7922	1209	107443	28832	5094	2146	2405	2227	30	41189	7	803
1	5105	738	103372	30581	8399	3999	2490	4346	28	44139	16	1458
2	7959	654	53331	28496	6013	3376	1755	3540	8	22237	17	880
3	5704	557	52822	19825	4632	4518	1521	9730	29	65140	11	1058
4	6569	821	55582	21563	5916	3414	1253	2310	28	50940	10	626
5	14668	1167	139441	22596	4658	3964	2048	1940	27	96917	8	560
6	10921	669	88411	19834	3039	3953	3283	2452	30	91961	7	557
7	5324	1387	61909	21759	3462	3675	1366	3109	20	144589	9	1208
8	7264	2226	45884	12582	7373	4096	2128	2418	17	132446	7	2206
9	8642	972	46728	8267	5550	5371	2729	2055	29	138407	6	3684
10	7523	1133	95960	16039	5819	5119	1804	1772	17	100619	7	9002
Average	7378	1057	76449	24351	6460	3337	2666	2907	49	61600	10	2456

Table E, shows the volume of traded stocks per automotive manufacturer in the test period [-10, 10] of the release of an e-car. The traded volumes of Volkswagen and Audi are not available for the test period therefore these brands are not included in table E. In the last line the annual average of the traded volume of the relevant automotive manufacturer is shown. The annual average number of stocks traded can be compared to the number of stocks traded during the test period [-10, 10] to see whether there is a deviation.

Appendix F

Co-variances abnormal returns car releases on the Frankfurt Motor Show 2009

E-cars

Cov Renault/Ford	0,000
Cov Renault/BMW	0,000
Cov Renault Audi	-0,000
Cov Ford/BMW	-0,000
Cov Ford/Audi	0,000
Cov BMW/Audi	-0,000

Co-variances abnormal returns car releases around the same period

Conventional cars

Cov Audi/Ford	-0,000

Table F. The co-varieances between the abnormal returns of the automotive manufacturers are close to or equal to 0, showing that the securities are independent.