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The impact of divestment decisions on parent company's shareholders value

Focusing on the US oil and gas industry

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Preface and acknowledgements

The views stated in this thesis are those of the author and not necessarily those of the supervisor, second assessor, Erasmus School of Economics or Erasmus University Rotterdam.
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Abstract

The oil and gas industry has come under increasing pressure for its polluting and depleting nature, which will accelerate a sustainable energy transition. This paper investigates the impact and drivers of US fossil divestments by conducting an event study of 118 announcements. The results provide empirical evidence that divestments in the oil and gas industry lead to a positive market reaction with abnormal returns of 1.18% in. the 3-day event window, suggesting that investors value such sustainable initiatives. From the regression results, evidence was found suggesting that the financial performance of the parent company prior to the divestment tends to have a negative effect on the abnormal returns. It is also found that size and R&D intensity positively influence the market response for sell-offs and negatively for spin-offs. The findings in this paper contribute to a sustainable energy transition by giving companies insight into the impact of divestments, and consequently an incentive to divest their polluting divisions.

Keywords: Divestments, Corporate sustainability, Energy transition, Performance, Sell-offs, Spin-offs
JEL Classification: G34, P28, Q01, Q32, Q42

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1 Introduction

Faced with the challenges posed by the climate change and uncertainty regarding the future of the energy sector coupled with pressure from national governments and private pressure groups, the publicly listed oil and gas companies are under extreme pressure to divest from their fossil fuel assets and focus on renewable energy production such as hydrogen, solar and wind power, and electric batteries (Cohen, 2020). Even recently, Royal Dutch Shell, one of the behemoths of the oil and gas sector, was pressurized by Third point, an activist hedge fund, to split its businesses into a fossil fuel based and a green energy-based business. Although the shareholders ultimately rejected this recommendation, it did prove a point that many oil and gas companies need to make a decision, whether to switch to renewables or focus on the oil and gas sector (Moony & Wilson, 2021). In recent years, countries around the world have been in the process of implementing a sustainable energy transition, a movement in which markets heavily depend on fossil fuels are shifting towards a market driven by more sustainable, low-carbon energy sources. The increasingly developed renewable energy sector combined with associated emerging technologies in this field can serve as an alternative source of energy generation. This is relevant since energy production based on oil and gas will not be competitive in the long run due to resource depletion coupled with its polluting nature. Based on these facts, the oil and gas industry will have to respond to a possible energy transition which will require investments in a sustainable energy plan. In this respect, space will have to be made for sustainability at the expense of fossil fuel activities by means of divestments from polluting branches within a company. This is a hot topic in the world we currently live in and will probably play an even greater role in the future, therefore it is important to identify the trends and investment activities within this industry. The transition to a more sustainable way of energy production is currently even more relevant than ever due to the Russian-Ukrainian war. This war has an enormous impact on the energy sector and the oil and gas industry by the extent to which Russia supplies the rest of the world. Where international companies in many cases chose to divest from the oil and gas industry themselves, the sanctions imposed by the North Atlantic Treaty Organization (NATO) will force more companies to cut ties with Russia and divest polluting divisions. The consequences of the Russian invasion will have an enormous impact on the global oil and gas industry and will increase the pressure on generating and using alternative energy sources, reducing Western countries' dependence on Russian resources. The escalating pressure on the industry and necessity for alternative independent energy production will possibly accelerate the sustainable transition.

Considering this industry and its trends, it is notable that Exxon is the only major oil company which has openly announced its commitment to keep investing in the oil and gas sector for the near and medium future. Last year Engine No. 1, a small activist hedge fund focusing on renewable energy, won a seat on the Exxon Mobil board to force it to divest from its oil and gas sector and focus more on the renewable energy sector and related technologies to mitigate the impact of climate change (Matthews, 2021). The only major publicly listed Western oil company that has announced net zero emission plans and is actively investing in renewable energy is the British BP. They have set the year 2050 to be carbon neutral in its business activities and to meet that promise BP has been investing a lot in its renewable business, even buying up startups and equities in renewables power farms (BP, 2020).

The purpose of this research is to align the possible effects of an energy transition within the oil and gas industry in the US, by means of divestments. The US has seen a surge in corporate divestments over the years, with the aim of creating value through corporate restructuring. In addition to divesting based on financial underlying ideas such as performance, more and more divestments are made based on strategic reasons. In this case, a parent company removes certain subsidiaries due to the lack of a fit of this business unit with the core activities and the main company vision. This paper reveals the effects that a divestment of these subsidiaries has on their parent company by looking at their stock returns around the announcement's dates of the events. The objective is to investigate the abnormal returns caused by corporate divestment activities and elaborate on the effects that a transition to a more sustainable energy source will have on their company. To explain the possible effects this study will analyze and break down the divestment impact on the parent companies based on different explanatory variables to substantiate what the drivers are that cause the stock prices to fluctuate.

While there have been major announcements by pressure groups and governments for oil companies to divest from the oil and gas sector, the oil and gas companies have been resolute. They have been promoting the idea that for the transition between green energy and fossil fuels to occur, the fossil fuels still have a major part to play (Birol, 2020). The experts and fossil fuel executives point out to the recent gas crisis in Europe and Asia as a stark example of what would happen if we do not invest in less polluting fossil fuels to meet the growing energy demands. When the energy transition is happening, and energy demand cannot be met, it could push the cost on energy which would have a negative impact on the living standards of people living in energy deficient areas (Sheppard, 2021). The sanctions imposed on Russia by NATO have triggered a movement for governments and companies to withdraw from Russian oil and gas activities. Royal Dutch Shell and Bp announced that they are divesting from Russian oil and gas. Also, Exxon announced to start a process to unwind their involvement of their oil and gas projects in Russia. The impact of the sanctions and actions taken by international companies are expressed, among other things, in rising oil and gas prices which reflects the level of dependence on Russia in terms of oil and gas. The negligence of further developing and implementing the renewable sources in the energy system combined with the Russian invasion of Ukraine threatens a new crisis.

Rising prices combined with the exhaustible nature of the industry, growing climate issues and rising pressure from governments and public awareness, it all shows in a way that the world is and needs to become more sustainable. Resulting in the fact that companies in this industry eventually must adopt the sustainable trend, causing them to divest from their polluting activities. For this reason, it is important and valuable for companies to know what the effects of such divestments are.

"What are the effects of divestments in the oil and gas industry on the performance of the parent company?"

To answer the research question, this paper will conduct an event study with a sample of 118 divestments in the oil and gas industry in the United States. It will thereby become possible to measure the Cumulative Abnormal Returns (CARs) around the event dates of the divestments. These CARs will reflect the impact of a divestment on the parent company's shareholders value. After conducting the event study, the key drivers of the CARs will be determined based on the impact of multiple variables. This will be done by running an ordinary least squares (OLS) regression with a set of explanatory variables. The significance of the results will be tested by performing both a t-test and a sign-test.

Although the pressure of climate change on companies that emit a lot of carbon dioxide in their day-to-day activities is increasing, there is still a limited amount of research elaborating the effects of companies adopting more sustainable strategies in the oil and gas industry. Therefore, this study will aim to contribute to the existing literature on multiple points. First, a lot of research in de field of divestments and their effects has been done, but little to none of the existing literature focusses on the oil and gas industry in specific, while this is one of the biggest polluting industries. Secondly, as the oil and gas industry moves towards a more sustainable future, investment in research and new technology is essential. This claim is supported by Mitchell et al. (2012) who state that the research and development of new technologies in the oil and gas sector is decisive for survival and future success. To incorporate that into this research, this study will put a focus on the research and development activities of companies within the oil and gas industry. Combined with the other explanatory variables, this provides a unique set of drivers that may lead to new insights. Furthermore, most of existing literature on divestments in this industry is focusing on the performance of the divested subsidiary, where in this study the focus is on the performance of the ultimate parent company. These various new elements and insights will complement the existing literature on divestments and the oil and gas industry.

In this paper, it is found that the announcement of a divestment in the oil and gas industry in the US results in a positive market reaction along with a positive cumulative abnormal return of +1.18% over the 3-day event window, rising to +2.47% over the 11-day window. Across this industry, after sell-offs, spin-offs are the most common form of divestment and significant positive abnormal returns are found for both forms up to and including the 11-day interval. No significant difference was observed between the impact of these forms on the abnormal returns. As explanatory variables, apart from performance, no significant effects on cumulative abnormal returns are found. The results of the regression, including all divestments, indicate that there is a positive relation between abnormal returns and firm size, R&D intensity, and deal value. Regarding the drivers, there are strong assumptions that financial performance has a negative effect on the abnormal returns, as negative effects are found over the 7-day interval and the 11-day interval of 0.21% and 0.32% at a significance level of 5% and 10% respectively. Furthermore, the results suggest that the drivers of sell-offs and spin-offs differ in some respects. Accordingly, firm size and R&D intensity are found to have a positive effect on the abnormal returns of sell-offs, while they have a negative impact on spin-offs.

This paper is structured in five different chapters. In Chapter 1, the subject will be introduced. In Chapter 2 an overview of relevant existing literature will be given and discussed. The collected data with associated descriptive statistics will be discussed in Chapter 3. Next, Chapter 4 will elaborate the research methodology. Chapter 5 will display and discuss the empirical results and robustness checks. Finally, in the last Chapter the limitations of the research will be discussed, and a recommendation will be made for future research in this field.

2 Literature Review

After addressing the relevance of climate issues and the focus of this research, this section will review the existing literature on the various topics that will be examined. The question that arises is whether we will be able to scale up renewable technologies at a rate that will enable them to meet current and future energy demand. A shift to more sustainable energy sources could lead to a reduction in the flow of investment to the oil and gas industry and a reversal in which large companies divest themselves of their polluting divisions. Most of the existing literature on divestments evaluates the impact of divestments from funds invested in the oil and gas sectors or from the perspective of the acquirers. Limited research is done from the perspective of parent companies in the oil and gas industry and what the impact would be if they divest from this sector (Trinks et al., 2018; Maina, Murray & McKenzie, 2018; Egli et al., 2022).

2.1 Divestments

Divestments can be defined as a process of adjusting the firm's ownership by selling an asset, subsidiary, investment, or equity by the parent company to maximize the shareholders' value or to achieve other goals such as paying down debt or creating a more focused or specialized firm (Brauer, 2006; Kolev, 2016). In simple words divestment is the opposite of investment because instead of investing, putting in capital, you are selling the investment, taking out the capital.

Where M&A was first seen as the most effective way to create value through synergies, divestments are also increasingly seen as opportunities for value creation. It is becoming clear that in some cases it is no longer optimally efficient for a company to manage all business units by itself. This is addressed in a study by Kaul (2012) who argues that non-core activities and non-related businesses can be better managed independently. In recent decades, corporate divestments have become more common and widely used by many companies as a strategy to restructure the business model with the primary aim of creating value for shareholders (Majoni et al., 2014). The value that is created for the shareholder is realized by divesting certain business units and refocusing on optimizing the core business. Divestments are usually performed to maximize shareholders value but, sometimes - due to the necessity for cash, and social economic motives - a divestment can be structured in another type of way. Different divestment types have their own benefits and disadvantages, and companies choose the type of divesture depending upon their needs (Singhvi, 1984).

2.1.1 Divestment forms

Based on the research of Slovin, Sushka and Ferraro (1995), this study will look at the different types of divestments: Spin-offs, Equity carve-outs and Sell-offs. Since companies in the oil and gas industry in most cases want to get rid of their polluting divisions completely for reputational purposes, most divestments here will be sell-offs. However, in some cases a divestment in this industry will also take place through a spin-off or equity carve out. To provide a clear picture of the various forms of divestment with their own effects and uses, they are summarized in table 1. The most commonly used forms of divestments in this industry will be included and analyzed in a later phase of this research.

Table 1. Different divestment types

Type	Definition	Cash generation for parent	Tax treatment	Ownership of division with parent
Sell-off	A part of the assets (e.g., division) is sold to another firm. The acquirer gains control over the assets.	Yes	Tax consequences if sold at a gain	No
Spin-off	A new legal subsidiary is created, and the parent company's shareholders receive the new shares as stock dividend.	No	Tax-free	Yes
Equity carve-out	A part of the shares in the subsidiary is sold on the stock exchange to new shareholders. The parent retains control over subsidiary.	Yes	Often Tax-free	Yes
Split-ups	The parent company is split into two or more separately managed firms. Parent company's shareholders can exchange their shares for shares in the new firms. The parent company ceases to exist.	No	Tax free	Yes
Split-offs	A new legal subsidiary is created, and the parent company's shareholders have the possibility to exchange their parent company's shares for shares in the subsidiary.	No	Tax-free	Yes

Table 1. This table provides a summary of the different types of divestitures and their characteristics. The first column indicates the type of divestment after which it is briefly explained in column 2. Cash generation for the parent refers to the consequences of a divestment based on yield, expressed in "Yes" for cash generation and "No" for none cash generation. A tax-free spin-off refers to a parent company who spins-off a busines unit as a new legal subsidiary without a tax treatment. The last column refers to the degree of ownership after performing a divestment.

Spin-offs

A spin-off is a typical form of a divestment in which the parent company creates a new stand-alone entity by selling new shares. The creation of a spin-off will typically be performed when a particular division creates more value to the parent company when operating independently. Klepper and Sleeper (2005) found that spin-offs are often about pursuing ideas related to new niche markets or technologies that are not a priority for the parent company. These spin-offs are often sought close to the core business activities of the parent company instead of radical innovative changes in product or service. To increase the chance of success Pratiwi et al. (2017) state that when a spin-off is done, the new company that is created must analyze the internal and external environment for the possibilities of sustainable development.

Within the oil and gas industry there is a large niche market for development of sustainable energy sources, which will play a decisive role in meeting the future energy demand (Panwar, Kaushik & Kothari, 2011). In the past, the most important strategic decision in the international oil and gas industry was vertical integration (Inkpen & Ramaswamy, 2017). With a future energy transition to sustainable sources in mind, a horizontal diversification to renewable energy is a strategic opportunity for the oil and gas industry to continue to participate in the future (Hartmann et al., 2021). Such a horizontal diversification can be realized by performing a spin-off. When the parent company is healthy and well-managed, a spin-off will often result in above average performance in terms of growth and long-term survival (Eriksson & Kuhn, 2006).

Sell-offs

With a sell-off as form of divestment, the parent company sells assets of its own to another company. The sale often consists of real estate or equipment and involves cash. This form is typically used when companies want to break away from certain business activities or parts of it by selling them. Subsequently they will be more liquid and able to reap the benefits of new investment opportunities with the proceeds from the sale. An asset sell-off of a subsidiary by the parent company can increase the value of the parent company since the subsidiary will be managed financially better and more efficiently, which leads to increased focus and better utilization of the assets present in the parent company (Kaiser & Stouraitis, 2001). Particularly in the oil and gas industry, a sell-off allows companies to separate themselves from divisions that cause a bad reputation. As for a bad reputation due to polluting activities, a company can sell these polluting branches to interested acquires or it can disassemble the branches. The disassembly of drilling platforms in the North Sea, for instance, is an expensive process that often involves external parties to carry out the process but sends out a positive sustainable signal. In view of the Russian invasion, international companies are withdrawing from the Russian oil and gas industry. The US oil major Exxon Mobil has announced to stop the operations of Russian oil and gas mining projects and to undertake no further investments in new ventures in Russia.

Research of Kiymaz (2006) who studied the announcement impact on sell-offs, found a significant positive announcement effect for both the sell and buy side of the divestment. Other research into the announcement effect of sell-offs has shown a more positive stock market response for companies with a long-term strategy compared to companies with a short-term view (Tehranian, Travios & Waegelein, 1987). A popular explanation of the positive impact of a sell-off is put forward by Brauer (2006) who argues that the gains arise from improved corporate efficiency. This corporate efficiency, through sell-offs, is achieved by improving financial resource allocation by eliminating negative synergies (Afshar et al., 1992).

H1. The announcement of a divestment in the US oil and gas industry, has a positive impact on the stock price of the parent company.

H2. Sell-offs generally yield more positive abnormal returns relative to spin-offs within the oil and gas industry.

In order to get an overview of the previously comparable literature with its corresponding findings, one can use the meta-literature overview shown below in table 2. This table shows the main guidelines and findings of the former studies to give an indication of differences and similarities compared to this paper.

Table 2. Meta-literature overview

Author(s) (Publication year)	Time period	Region/ Country	Method	Estimation period	Results	Remark
Afshar, Taffler & Sudarsanam (1992)	1985-1986	UK	Market model	-180 to -41	CAR(-5,+5) = -0.02 CAR(-10,+10) = 0.86	178 sell-offs
Desai & Jain (1999)	1975-1991	US	Market model	-300 to -51	CAR(-1,+1) = 3.84	155 spin-offs
Huson & MacKinnon (2003)	1984-1994	US	Market model	-250 to -50	CAR(-40,-1) = 0.23 CAR(+1,+20) = 0.36	84 spin-offs
Veld & Veld-Merkoulova (2004)	1987-2000	Europe	Market model	-220 to -21	CAR(-1,+1) = 2.62 CAR(-10,-1) = 0.77	156 spin-offs
Kiymaz (2006)	1989-2002	Announcements in The Wall Street Journal	Market model	-241 to -61	CAR(-1,+1) = 3.16 CAR(-30,-2) = 0.79	205 sell-offs
Dasilas et al. (2011)	2000–2009	Europe and US	Market model	-210 to -11	CAR(-1,+1) = 4.95 CAR(-1,0) = 5.51	239 spin-offs
Sun (2012)	1995-2004	Taiwan	Market model	-150 to -30	CAR(-1,+1) = 0.24 CAR(-5,+5) = 0.44	157 sell-offs
Zakaria & Arnold (2012)	1980-2011	Malaysia	Market model	-220 to -21	CAR(-1,+1) = 5.06 CAR(-5,+5) = 6.07	36 spin-offs
Majoni et al. (2014)	1995-2011	South Africa	Arbitrage Pricing Theory	-500 to +500	CAR(-250, 0) =-0.89 CAR(-500, 0) =-0.64	19 sell-offs and 25 spin-offs
Sabet, Agha & Heaney (2018)	1989-2011	US	Market model	-269 to -11	CAR(-1,+1) = 1.95 CAR(-10,+10) = 2.55	1503 divestments (no distinction)
Dordi and Weber (2019)	2012-2015	Announcements in The Wall Street Journal and Financial Times	Capital Asset Pricing Model (CAPM)	-260 to -10	CAR(-1,+1) = -0.327 CAR(-10,+10) = -0.792	24 divestments (no distinction)

Table 2. This table provides an overview of previous literature on the announcement effects of divestments. The "Time period" indicates the years in which the divestments of the sample occurred. "Region/Country" refers to the sample of divestments used for the study. The method is considered, which refers to the model used in the event study. The estimation period is given in days and the results from the CARs are expressed in %. The last column indicates which form of divestment is being examined and the size of the sample that is used.

2.2 Fossil fuel divestment movement

In recent years there has been an increasing awareness within politics to minimize further lasting damage to the climate by leaving most of the fossil fuels in the ground (IEA, 2021). The growing public attention for fossil divestments is due to the worrying position in which the agreements of the Paris Agreement currently find themselves. This is an agreement signed by the member of the United Nations Framework Convention on Climate Change (UNFCCC) to act against climate change (UNFCCC, 2015). The fossil fuel divestment movement started in 2010 and tries to make society aware of the damage caused by fossil sources to the climate. It's a growing movement in recent years with an increasingly broad reach and growing number of followers, who stand for shifting investments from fossil fuel to more sustainable investments to reduce CO2 emissions (Ayling & Gunningham, 2017).

In 2020, Blackrock, which is the largest asset manager in the world, made an announcement that it will sell its majority of fossil fuel shares. The effects of this announcement on the stock prices of companies active in the fossil fuel industry was studied by Bassen, Kaspereit and Buchholz (2020). In this study, a negative announcement effect was found, with the share prices of these related companies falling. This was in line with the findings of Dordi and Weber (2019), who found that announcements of prominent institutional investors to divest from their fossil fuel shares, resulted in a lower share price of the parent company. The Dutch pension fund PFZW also got out of oil investments due to increasing pressure for sustainable investments and billions in losses caused by the collapse of oil prices due to the corona crisis. The ambitions to exit had been set earlier, but were accelerated by the crisis, and the fund set new tightened targets for the fund's sustainable investment policy.

Due to the increasing awareness of the climate problematics, which is largely driven by the CO2 emissions released during the generation of fossil fuels, interest in this industry will decline and so will future investment. Plantinga and Scholtens (2020) examine the performance of portfolios that exclude fossil firms and compare them to unrestricted portfolios. They find that they do not differ significantly in terms of risk and return and that divesting from fossil fuel production does not cause financial damage to the investor. Sabet, Agha and Heaney (2018) conducted a study on the market reaction to divestments of US listed oil and gas companies. In this study, it was found that these fossil divestments lead to a significant positive market reaction with cumulative average abnormal returns of +1.95% over the 3-day event window.

2.2.1 Corporate Social Responsibility

The human footprint on the natural world has increased significantly since 1950 and negative trends regarding the emission of greenhouse gases and the ever-growing world population are the starting points of the growing attention and developments around global sustainability (Steffen et al., 2015).

Corporate social responsibility (CSR) is a term that has gained a growing and central role in the business world in the past decade. There is a wide variety of definitions of CSR, the only problem is that there is no universally accepted definition of the concept and no consensus on the meaning of CSR (Khan et al., 2012). This indifference makes measuring CSR a difficult task. Elhauge (2005) came up with a commonly used simple definition of CSR: Corporate profit sacrificing in the public interest and considering social and moral norms. Over the years, companies from various industries have been increasingly adopting implementing social responsibility into their day-to-day operations and strategies. Related studies by, among others, McWilliams, Siegel, and Wright (2006) emphasize that implementing CSR in strategic investment decisions is an important component for building a sustainable reputation. Research by Godfrey, Merrill, and Hansen (2009) elaborates on this and states that the engagement of CSR is a form of reputation building and that this has an insurance-like effect on the stock price. This means that any loss of market value, as a result of a negative event, can be minimized by implementing CSR. Clarkson (1995) claims that if a company is to survive long-term and achieve positive results, it is essential to implement stakeholder interests in their business models and strategies.

Divestment of certain polluting departments within a company can be seen as CSR, by reducing a company's carbon footprint. The oil and gas industry have been pressured to implement and adopt CSR into their business strategy for many years. This industry is inherently complex, and the operations and decisions made here have global reach and impact on a wide range of different stakeholders. The implementation of CSR systems can not only be implemented at industry or company level but must also be embraced further down the supply chain by other actors who are directly or indirectly confronted with the activities in the oil and gas industry (Berkowitz, Bucheli & Dumez, 2017). When this implementation continues and is acted upon, this can manifest itself within this industry through divestment of polluting processes to create space for more sustainable and socially responsible projects.

2.2.2 Climate Agreements

On October 31, 2021, the Glasgow Climate Conference, better known as COP26, was held. This conference was hosted by the United Nations on the situation regarding climate change. This conference addressed, among other things, the importance of climate finance for developing countries and focused on completing and sustaining the commitments made at the Paris climate conference. In 2015, this international treaty, the Paris Climate Agreement, was drawn up to combat global warming by reducing excessive CO_2 emissions from fossil fuels. One of the most important agreements made during this event is that the average global temperature increase must remain below 2 degrees Celsius and that it should be lowered even further in the future (Horowitz, 2015). Trump announced at the first of June 2017 that the US would withdraw from the Paris agreement. This had to do with the nature of the agreement, which would affect the oil and gas industry of the US too much. Following Joe Biden's inauguration on January 20, 2021, the US was reunited in the accord. This period can influence the results as the oil and gas industry was under less pressure to become more sustainable and stick to their CO2 emissions. As a result, it is possible that divestments occurred less quickly in the sector or have less impact in the years after. Santi (2020) states in his research that the impact of investor climate sentiment on stock returns is stronger in the periods following major events related to climate issues. The impact of the Paris climate agreement, the rise of the fossil fuel divestment movement and the occurrence of abnormally high temperatures are all examples of such events

2.2.3 Energy transition

A transition from fossil fuel-based energy production to a more sustainable and clean production of energy is unavoidable and essential to be able to fulfill the agreements made in Paris and Glasgow. The sustainable energy sector should play a more important role as an alternative energy source in the future. Based on current knowledge and growth, it should be possible for the sustainable energy sector to supply at least 35% of the global energy supply by 2050, according to research by the international energy agency (IEA). Based on the research of Abánades (2016), this transition and the development of this industry is only possible through stronger innovative efforts in this sector. This can be achieved when the current oil and gas industry divests parts of their fossil resources and refocuses on sustainable energy generation.

2.2.4 Oil and gas industry

Many indexes that track the stock markets are also under incredible pressure to not include the oil and gas companies in their indexes to stop the funds from helping any future expansions in the oil and gas industry. Recently for climate funding in COP26 it was announced that funding for mitigating the impact of climate change has reached around 130 trillion USD, these include major finance institutions, banks, pension funds, and many hedge funds (Jessop & Shalal, 2021). If the major funds, banks, and financial institutions stop investing in these companies, more capital would be available to be invested in the renewable sectors which are promising to help fight the climate change (McKibeen, 2018). Only one of the major U.S. banks, Goldman Sachs, has not promised to stop the funding for oil and gas companies in the near future (Metcalf & Lacqua, 2021).

Oil industry

The oil industry in de US has made a huge leap over the past 10 years. This industry can be divided into two different groups, the upstream and downstream production. For example, the upstream producers include the primary activities of developing and producing petroleum and gases, and downstream includes the companies that trade the oil, refineries, and consumers.

According to IEA (2021), the COVID pandemic, combined with the growing focus on reducing CO2 emissions, has slowed the expansion of oil production in the coming years. This movement of the oil production pullback is also reflected in the investment behavior in the oil sector. More investments are going into the research and development of renewable energy sources, leading to a one-third decrease in operator spending by 2021 (IEA). Research by Basher and Sadorsky (2006) shows that fluctuating oil prices play an important factor in the stock market. Broader research also finds that economies are highly dependent on oil prices due to the extent to which oil is the basis of energy generation.

Figure 1. Oil production, United states 1990-2021. (IEA, 2022).

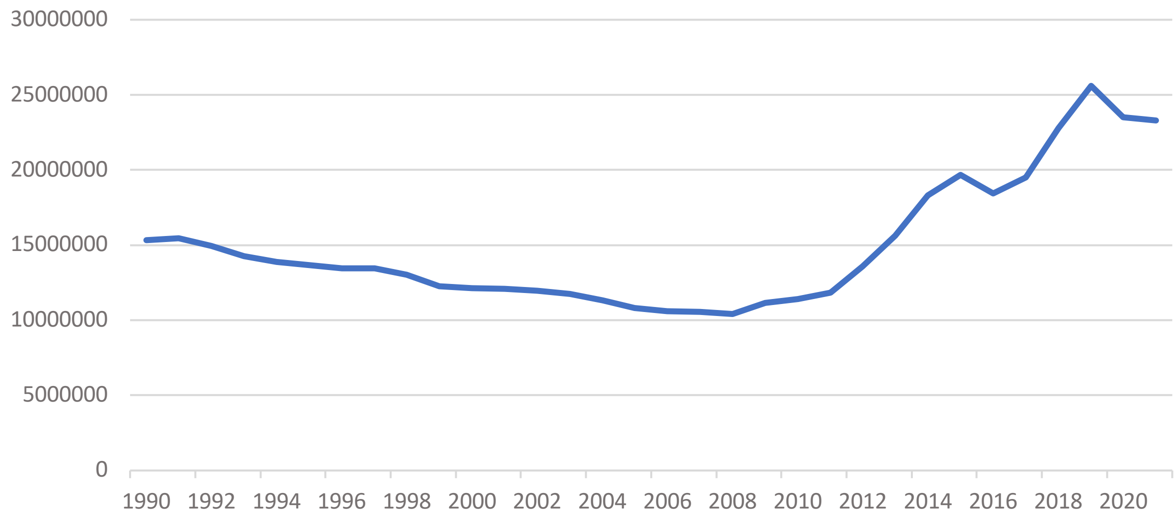

Figure 1. This line shows the development of the amount of oil product in the US between 1990 and 2021. The production amount is given in Exajoule (EJ), where Exa (E) represents a factor of 10^{18} and Joule (J) is used to denote the unit of energy.

Gas industry

Natural gas is the fastest growing source of all the fossil fuels, and responsible for supplying 23% of the energy demand (IEA, 2021). Besides the fastest growing it is also the cleanest regarding carbon emissions. Since gas supplies can be stored and are operationally flexible, this source can easily respond to short-term fluctuations in demand. The gas industry in de US has experienced strong growth in recent years by absorbing the demand of the decline in coal power production.

Figure 2. Natural gas production, United Stated 1990-2021. (IEA, 2022)

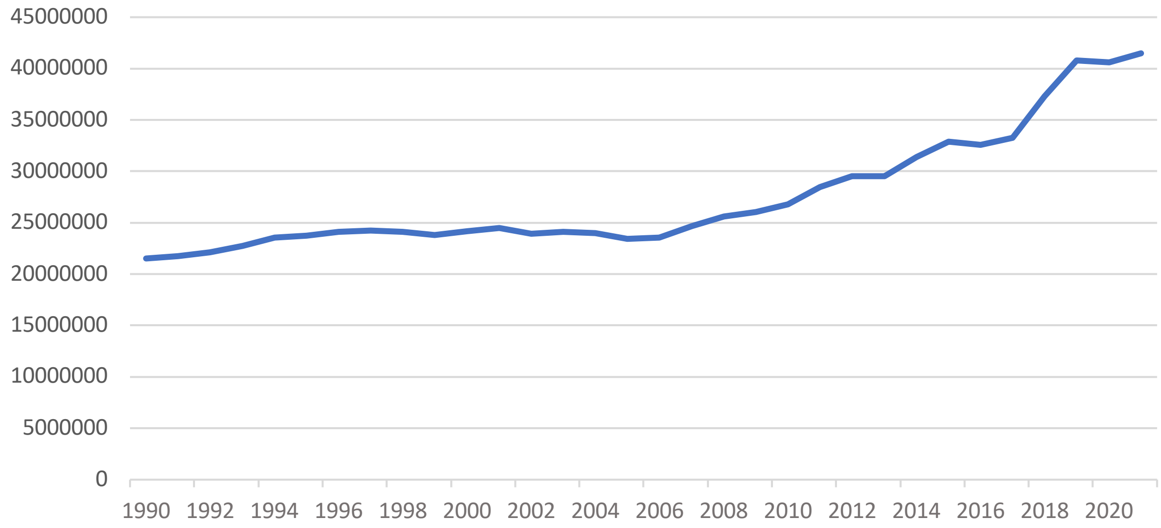

Figure 2. This line shows the gas production in the US between 1990 and 2021. The amount of oil production is given in Terajoules (TJ) based on the Gross calorific values, which is observed by looking at the total amount of heat released when a unit of fuel is burned.

2.3 Divestment motives and variables

Research shows that divestment decisions are influenced by a variety of interrelated factors. To identify the drivers of divestment, these factors and their impact on divestment decision-making must be examined. Some important motives to divest can involve the regulations of a particular region, cutting out loss making parts of the company, pressure from shareholders, management increasing its focus on specializing in one part of the market in which it is operating.

The extent to which divestments in the oil and gas industry make sense, depends upon why these companies are planning on divestment. If they are doing it to create shareholder value, the evidence does provide good reason for the parent company to divest from its traditional business in many other segments of the economy (Veld & Veld-Merkoulova, 2009). Another study pointed out that companies divest for need of liquidity (Schlingemann, Stulz & Walkling, 2002).

As stated before, oil and gas companies are under increasing scrutiny not because they have not generated any shareholder returns, in fact the oil and gas companies have been the best performing sector in the most recent quarter of 2021 (Rapier, 2021), but it is because the sector in which they are operating is known to be the main underlying driver of climate change. To substantiate the results, this study will look at various motives and variables that are expected to influence the impact of a divestment.

Parent size

Wu (2006) argues in his research that larger companies have more resources to be corporate socially responsible combined with the outside pressure to engage in these types of activities. This may imply that larger companies might divest certain divisions based on motives that do not necessarily create value for the company and its shareholders. Research of Moeller, Schlingemann and Stulz (2005), found significant larger abnormal returns for smaller acquiring firms than for larger firms. Larger companies have more knowledge and resources in-house and will use this to optimize the subsidiary's performance (Chiao et al., 2008). The competitiveness and size of the parent company determines the extent to which the subsidiary can learn from the knowledge and experience of the parent. In this way, subsidiaries often depend on the influence and knowledge transfer of the parent company (Sheng et al., 2015). When a larger company divests a business unit there is a greater chance of value creation from the subsidiary. This is because most of the time the parent company is not exploiting the potential of a relatively small unit, as their focus is on larger departments with more revenue and profit potential. In larger companies, small departments are often divested; the lower relevance of these subsidiaries causes barriers to be removed and a divestment to take place (Benito, 1997; Belderbos & Zou, 2009). From this it can be argued that when larger parent companies divest, there is less focus and energy put into the divestment at the expense of the deal value and therefore profit generated. Divestments of smaller firms may therefore result in more positive cumulative abnormal returns. This is substantiated by Bauguess et al. (2009) who argue that insiders of larger firms tend to accept smaller premia more quickly and therefore miss out on maximizing shareholders value.

H3. Smaller parent companies show higher abnormal returns surrounding the divestment announcement.

Research & Development

The oil and gas industry has been changing in recent years. Future oil and gas resources will be even deeper and more difficult to find and in environments that are considerably more difficult to reach and access than before (Managi et al., 2004). Due to the further depletion of these fossil resources, the severity of a switch to renewable energy increases. To maintain efficient production standards and meet demand, investments in R&D of renewable energy sources are increasing strongly in this sector. Multiple studies have shown that these increasing investments in R&D will increase a company's profitability and hence its attractiveness (Shah, 2008). These findings are supported by Apergis and Sorros (2014) who stated that technological innovations of fossil energy firms will play an increasingly important role for the profitability of the industry, partly due to the growing pressure for companies to be sustainable and concerned with the climate. Studies of Longwell (2002) and Mitchell et al. (2012)

take it a step further and argue that due to the changes in the industry, R&D of new technology has a pivotal role in the success or failure for the future of oil and gas companies.

Research of Alazraque-Cherni et al. (2016), who performed a study on China, found that a drop in the oil prices leads to a decrease in R&D investments for renewable energy technology. With the ever-increasing oil prices due to resource depletion, this will increase investment in R&D and make renewable energy more accessible for large-scale use by reducing costs. In the long term, this movement of rising oil and gas prices will continue which will result in an increase in the R&D intensity of the industry. Larger R&D intensive industries often have to deal with a rapidly changing and competitive market, which can increase the pressure on the parent company and ultimately lead to divestment of its position (Mariotti & Piscitello, 1999).

H4. Parent companies with relatively higher R&D expenditures will generate higher cumulative abnormal returns.

H5. Smaller firms will generally have higher R&D intensity.

Divestment size

Divestments that contain a large deal value tend to destroy more value for the acquiring companies. This is supported by Loderer and Martin (1990) who found that acquirers derive less financial benefit from acquisitions with larger deal sizes. When looking at it from the seller's perspective, it can be argued that larger divestments can have a greater impact on the parent company through more structural changes and hence refocusing on its core business in a more efficient way. This is supported by Klein (1986) who found that the relative size of divestments has a positive effect on abnormal returns. Furthermore, Hearth and Zaima (1984) compare portfolios of small and large divestments and found that portfolios of larger divestments outperform portfolios of smaller divestments. A divestment is usually performed to create value for the parent company and its shareholders, a relatively larger divestment can result in greater value creation. Papers by Lang, Poulsen, and Stulz (1995) and Finlay, Marshall, and McColgan (2018) argue that deal size is positively related to the announcement returns of a divestment due to the financing advantages of larger divestments.

H6. The deal size of the divestment has a positive effect on the shareholders' value of the parent company.

Risk

Research by Schlingemann et al. (2002) argued that a company's debt level and its state of liquidity are important determinants, which need to be considered when analyzing a firm or its activities. Bowman (1980) described debt as an important factor when considering firm risk and securities-related matters. To determine the degree of risk within a company, one can look at a company's debt levels. Gleason et al. (2000) found that companies with higher levels of debt experienced significantly higher cumulative abnormal returns around the announcement date of a divestment. Also, the research of Lasfer, Sudarsanam and Taffler (1996) argues that highly indebted firms that are closer to financial distress, prior to a sell-off, generate higher returns than healthy firms.

Performance

Previous research of Ravenscraft and Scherer (1991) has shown that there is a difference in divestment activities between high profit companies and low profit companies. They find a divestment probability of 2% for high profit companies and a probability of 30% for low profitable companies, indicating a divestment trend for underperforming companies. With respect to performance multiple financials can be considered such as profitability, liquidity, and leverage. Together, these different financials can provide a picture of the company's health, its ability to capitalize on opportunities, and to meet creditors' financial commitments. When the parent company is divesting a relatively lower financially performing business unit, it could cause the remaining part of the company and its assets to improve in terms of economic profitability (Vidal & Mitchell, 2018). They also find that such a divestment creates value by lowering financing costs of raising capital.

Divesting any department within a company is unlikely when excellent financial performance is delivered by the core business processes of the parent company (Montgomery, Cynthia, & Thomas, 1988). Lui (2007) examined the effect of the parent company's performance prior to the announcement using return on assets and showed that firms with lower return on assets before the announcement obtained more positive abnormal returns. This is in line with Hillier, McColgan and Werema (2009) who found that operating performance before the sell-off announcement are negatively related to abnormal returns.

H7. There is a negative relation between the prior financial performance of the parent company and market reaction to a divestment announcement.

3 Data

This study examines the extent to which a divestment exerts an effect on its parent company and the impact of various company variables. This research uses a sample of divestments within the oil and gas industry whose parent companies are located within the United States. To thoroughly analyze these divestments as events and their effects, several data groups are required. Beside the event data the market data is needed for analyzing the cumulative abnormal returns around these different events. Finally, the various financial and accounting data must be gathered to run a regression and control for their impact on the abnormal returns around the event dates.

3.1 Divestment data

The divestment data with their announcement dates were compiled using the Thomson One Database. Thomson One offers a suitable database for this research by providing industry specific search criteria for the oil and gas industry in the US, allowing the industry to be sub-divided into different branches with the corresponding SIC codes. Since a transition from fossil sources to more sustainable sources have become increasingly important and necessary in the last decades, this study uses divestments within the period between January 1st, 2000, till December 1st, 2020. By using a wide window, the impact on the parent companies can be observed throughout the years. To make the sample as representative and accurate as possible for the purpose of this research, only divestments of publicly listed parent companies are included. Also, divestments that have not yet been completed are excluded from the sample. In addition, hostile takeovers were excluded from the sample to avoid potential negative effects on the robustness of the analysis. After excluding some divestitures based on missing parent company data or SEDOL codes, a sample of 1933 events were obtained. The impact of a relatively small divestiture will normally be smaller than the impact of a larger divestiture. To get the most accurate understanding of the impact of an event, overlapping events of the same parent company are excluded to ensure that a divestiture does not fall into the estimation window of a subsequent event. When determining the impact, the transaction values of all divestitures were extracted from the Thomson One Database in addition to the event data. Missing transaction values along with a lack of event information reduced the sample to 118 events. This is a steep drop in observations due in part to a severe lack of research and development data in Thomson one, DataStream, and Orbis for the respective companies.

Table 3. Overview of divestment sample

Sampling criteria	N
Starting Sample Mergers & Acquisitions	44711
United States of America	15984
Publicly listed	8558
Divestments	
Sell-offs, Spin-offs, equity-carveouts	4347
Deal Attitude (friendly)	4187
Deal status (completed)	3312
Announcement date 2000 to 2020	1933
Unavailable Financial data	167
Excluding overlapping windows of the same parent	118

Table 3. This table shows how the divestment sample was obtained. By excluding divestments based on the sample criteria, a final sample was obtained where N represents the number of divestments. For example, the sample drops from 15984 observations to 8558 observations because only publicly listed firms are included in the sample.

3.2 Market data

Market data in this study refers to the daily stock prices of the various parent companies whose divestments are included in the sample. By analyzing the fluctuation in these stock prices of the parent company around the announcement date of the divestment, the market reaction can be determined. Parent company stock prices are collected from the days that are within the estimation window and from the days surrounding the event to analyze the impact on different event windows. In this manner the normal returns are derived from the stock prices in the estimation window and using these returns the abnormal returns over the different event windows can be estimated. This research uses the market model to calculate the abnormal returns. Since the sample of this study consists of US companies and most oil and gas companies in the sample are relatively large, the S&P500 is used as the market index. The S&P500 represents the best fit as a benchmark for the study and most closely aligns with the average market capitalization of the used sample of divestments. Both the stock price data as the market data is collected using DataStream.

3.3 Financial data

To perform a regression analysis there must be controlled for several explanatory variables that are predicted to have an impact on the cumulative abnormal returns based on previous research. These financial data of the parent companies is collected through Thomson One and DataStream. To test the hypotheses, several sets of accounting data of the parent companies were collected. The explanatory variable size is represented by a logarithm of total assets and used in the analyses. To measure R&D, the financial data on research and development expenses is extracted from DataStream. Since larger companies are wealthier than smaller companies, they also have a larger budget to invest in R&D. For this reason, the research and development expenses will be divided by the total revenue of the parent company. In addition, the deal value of the divestments is included. For the deal value, the transaction value of the divestment is divided by market equity value of the parent company to get a better perspective on the relative size and potential impact. The risk of the parent company is determined by taking total debt as a percentage of the parent company's capital. As measurement of financial performance of the parent companies, we obtained the returns on assets (ROAs) which is one of the most widely used measurements of financial performance. Since the variables are denominated in US dollars they might be skewed, taking the logarithm will make those variables more normally distributed. In addition, winsorization checks for outliers to ensure that the influence of any extreme values is minimized.

Table 4. Summary statistics

	Events	**Mean**	**Std. Dev.**	**25% percentile**	**Median**	**75% percentile**
Size	118	16.56	2.64	14.91	17.19	18.81
R&D expenses	118	370814.50	711614.90	28000	116000	476000
Deal value	118	581	1420	39,50	192	525
Risk	118	36.18	23.79	18.13	34.06	49
Performance	118	2.40	14.68	-0.17	6.18	9.54

Table 4. This table provides an overview of the independent variable of the sample. The variable "*Deal value*" is displayed in millions of US dollars. For the variables *Size, R&D and Deal value*, the logarithms were taken. The variables *Performance* is winsorized at 1 and 99% cuts. Further transformations and explanations of the variables can be found in the appendix in tables 13 and 14.

4 Methodology

In this research, an event study is conducted to examine the effects of divestments on their parent company’s shareholders value. First, the announcement effect of multiple divestitures on the parent's stock price will be determined, using an event study. Subsequently, the drivers behind the obtained abnormal returns will be examined using an OLS regression.

4.1 Event study

For analyzing the different hypotheses and relations between the stock prices and divestments within the oil and gas sector, this research will use an event study approach. Based on the efficient market hypotheses, it is assumed that new information is immediately included in the stock prices. To begin the event study, the event dates of the various divestments must be determined. From the data obtained through Thomson One, the event date in this study is determined based on when the divestment news became publicly known and is described as the announcement date. Flammer (2013) dealt in her paper with the fact that potential event uncertainty is not considered when taking a single announcement date. On this basis, it is recommended that the event should be widened by creating event windows that look at multiple days surrounding the announcement date. For this purpose, the multi-day intervals [-1, 1], [-3, 3], [-5, 5] and [-10, 10] are used in this study. These wider intervals are included to control for over or under reaction of the market, to the divestment. To make these different event windows of interest, an estimation window must be set up to compare the returns. Huson and MacKinnon (2003) applied an estimation window of [-250, -50] for their research on the impact of divestment on the parent company. For this research a window of [-200, -50] is chosen, in which there is no overlap between the estimation window and the event window of the divestment. The window is reduced by 50 days since 150 observations give a reliable estimate of normal returns. This reduction also reduces the probability that several divestments from the same parent company will have overlapping windows, which allows for more events to be included in the sample.

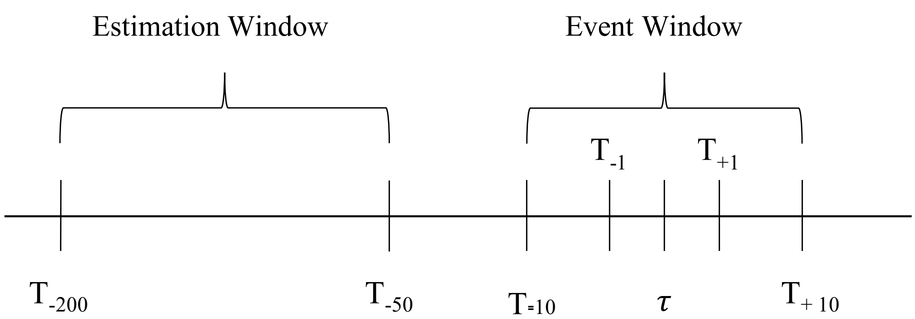

Figure 3. Imaged view of the estimation window and the various event windows. For the event window, T_{-1} to T_{+1}indicates the 3-day window and $T_{-10}$to T_{+10}indicates the 21-day window. In addition, intervals between these ends are also examined.

After establishing the estimation window and the event windows, the abnormal returns of the shares must be determined. MacKinlay (1997) defines normal return as the expected return without conditioning on the event taking place. Therefore, the abnormal returns are calculated as follow:

$$AR_{it} = R_{it} - E(R_{it}) \qquad (1)$$

AR are the abnormal returns, where *i* denotes a specific event of the abnormal return and *t* stands for the time of the event. The realized returns of event *i* on day *t* are reflected by R_{it} and the expected returns of event i on day t are by $E(R_{it})$. In this research, the market model is elaborated as a measure to calculate the normal or expected returns. When using the market model, a stable linear relationship is assumed between the market return and the stock returns and has been used in studies by Armitage (1995), Mackinlay (1997) and Flammer (2003), among others.

$$E(R_{it}) = (\ \alpha_i +\ \beta_i R_{mt}) \qquad (2)$$

The expected return ($E(R_{it})$) will be calculated using the parameters α_i and β_i and the market portfolio (R_{mt}). To derive general conclusions on the event, the abnormal returns should not be calculated per day but over the different event windows entirely. This can be done by aggregating AR_{it} through time or cross-sectional. Respectively by calculating the cumulative abnormal returns as shown in equation 3 or by calculating the average abnormal return as shown in equation 4.

$$CAR_{i(t1,t2)} = \sum_{t=1}^{t_2}(AR_{it}) \qquad (3)$$

$$AAR_t = \frac{1}{N}\sum_{i=1}^{N}(AR_{it}) \qquad (4)$$

Subsequently, the cumulative average abnormal returns can be calculated using equations 3 and 4. This can be done by averaging the cumulative abnormal returns or by taking the sum of the average abnormal returns as shown in equations 5 and 6.

$$CAAR_{(t1,t2)} = \sum_{t=1}^{t_2}(AAR_t) \qquad (5)$$

$$CAAR_{(t1,t2)} = \frac{1}{N} \sum_{t=1}^{N} CAR_{i(t1,t2)} \qquad (6)$$

Equations 5 and 6 can be used to draw overall conclusions regarding the divestment events. In order to determine whether the results found, and conclusions drawn matter, a parametric t-test must be conducted to show whether the cumulative average abnormal returns are statistically different from zero. Before we can perform this test, the variance of the cumulative average abnormal return must be obtained using equation 7 below.

$$var\left(CAAR_{(t1,t2)}\right) = \frac{1}{N^2} \sum_{t=t1}^{N} \sigma^2{}_{i(t1,t2)} \qquad (7)$$

The variance obtained in the above equation allows us to perform the t-test and test the null hypothesis to check for significance.

$$t\ test = \frac{CAAR(t1,t2)}{\sqrt{var\left(CAAR(t1,t2)\right)}} \qquad (8)$$

In addition to the t test from equation 8, robustness is then tested through the sign-test used by Corrado and Zivney (1992). With this test, the signs of the abnormal returns are summed and considered whether there is an equal probability that they are positive or negative. When using daily stock returns, the sign-test is considered more appropriate.

$$fsign = \left[\frac{N+}{N-} - 0{,}5\right] \frac{\sqrt{N}}{0{,}5} \qquad (9)$$

N+ serves as the number indication of positive observations and N- as the number of negative observations. This nonparametric sign test provides insight into the extent to which abnormal stock price performance can be found significant.

4.2 OLS regression analysis

To gain a better insight into the relationship between the different events and stock returns, an OLS regression is performed. For instance, the market may react differently to divestment of larger firms or when divestments are larger in deal size. In addition, there may be differences in reaction between divestment types. To explore these relations, the computed CARs are used as dependent variables in the OLS regression. The independent variables are based on the characteristics of the parent company. This set of independent variables include, firm size, R&D expenses, deal value, risk, and performance. Furthermore, the year of the divestment and the parent company are included as fixed effects. As starting point we consider the following equation:

$$Y = \alpha + \beta X + \varepsilon \tag{10}$$

In equation 10, the Ordinary least square is shown as a linear function where the dependent variable Y is the sum of the constant α, the independent variable βX and the standard error ε. This regression represents a linear relationship and estimates parameters that minimize the difference between the observed and estimated value of Y. This model only indicates a single independent variable, since multiple variables are being examined, we extend this model slightly to the following:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_k X_k + \varepsilon \tag{11}$$

In this equation, betas represent the parameters that OLS estimates, and epsilon refers to the standard error. This model will be further developed, implementing the independent variables and fixed effects to observe their impacts on the CARs. This will be reflected in equation 12 where the CARs are inserted as dependent variables.

$$\begin{aligned} CAR_i \ = \beta_0 + \ \beta_1 Size_i + \ \beta_2 R\&D_i + \ \beta_3 Deal\ value_i \ + \beta_4 Risk_i \ + \\ \beta_5 Performance_i + Year_t + Firm_i + \varepsilon_i \end{aligned} \tag{12}$$

In equation 12, CAR_i represents the cumulative abnormal returns of each divestment of each individual firm. In this equation β_0 refers to the model estimation constant, $Size_i$ refers to the parent company size, $R\&D_i$ to the total investment in research and development, $Deal\ value_i$ to the size of the divestment, $Risk_i$ as measurement of debt and $Performance_i$ to the return on assets. Furthermore, $Year_t$ and $Firm_i$ control for year and firm fixed effects. As the differences in the impact of the independent variables on the abnormal returns between sell-offs and spin-offs also need to be examined, separate regressions will be conducted for this purpose. An OLS regression is conducted in which a split is made in the total sample between divestment announcements of sell-offs and spin-offs. The same model is used for sell-offs and spin-offs where the same independent variables and fixed effects were included in the model.

The OLS regression is a common method to estimate the parameters of a linear regression model and has several important underlying assumptions. First, the linear regression model should be linear in parameters. Second, the error term is normally distributed and has a conditional mean of zero. Third, there is no multicollinearity issue in the data. Finally, the error terms have a constant variance and are uncorrelated with each other.

5 Results

This chapter will elaborate on the results of this research. In the first part, the results related to the event study will be presented. Next, an ordinary least squares regression will be elaborated and explained. Finally, correlations and robustness checks will be covered and explained. The findings in this chapter will ultimately form the basis for testing the hypotheses and answering the formulated research question.

5.1 Event study results

This research uses a sample of 118 different divestments in the US. For each of these divestments, the abnormal returns have been examined based on the market model, where each divestment leads to its own abnormal return. To draw conclusions from these returns, one needs to look at the average abnormal returns and the cumulative average abnormal returns. Based on these values, the market reaction can be determined. To capture a first impression of the developments in the abnormal returns, figure 4 provides a visual representation of the observed average and cumulative abnormal returns within the observed event window. From these developments of abnormal returns, it is notable that positive average abnormal returns are observed starting from 3 days before the event occurs. These returns continue to grow in a positive direction until the announcement date, after which they decrease slightly but remain positive. This positive reaction is better visible in the curve of the cumulative average abnormal returns. From this curve it is clearly visible that from -3 onwards an upward trend starts which continues to grow until 10 days after the announcement. This indicates on average a positive announcement effect of the divestments. It was chosen to examine the announcement effect based on different event windows to check for under or over reaction of the market, these windows will be analyzed and elaborated on later in this chapter.

Figure 4. Development of abnormal returns

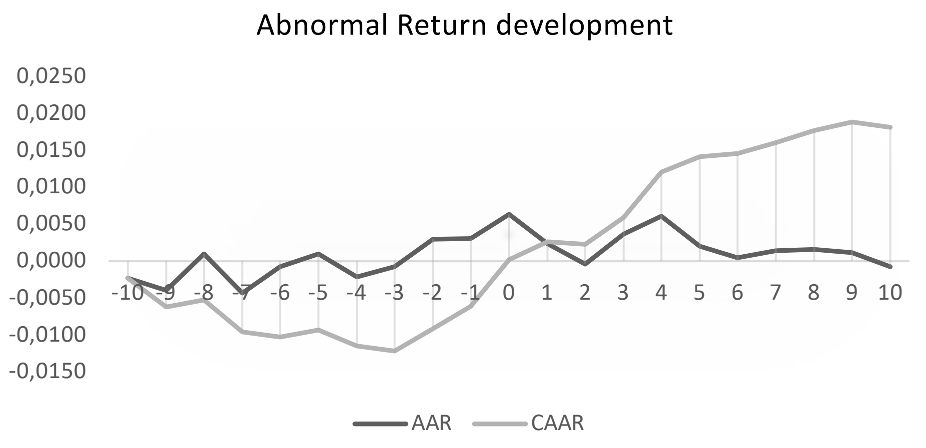

Figure 4. The development of the average abnormal returns (AAR) and the cumulative average abnormal returns (CAAR) of the entire sample of divestments. The x-axis displays the relevant days related to the event windows and on the y-axis the abnormal returns are shown. The abnormal returns on the y-axis must be multiplied by 100 to get percentages.

The graphs of the average abnormal return and the cumulative average abnormal return shown in figure 4 are illustrated below in table 5 by means of numerical data. From this table it is clearly visible that in the days before the divestment the abnormal returns were the most negative ones. From the start of the 7-day event window, the divestment seems to be absorbed by the market and initiates an upward trend of positive abnormal returns. This trend is even more evident in the second column where cumulative abnormal returns are displayed. This shows that the abnormal returns only become positive following the announcement date, after which an upward trend begins. On the announcement day, a cumulative average abnormal return of +0.02% is found which increases to +1.81% on day 10. We can draw the conclusion that there is a positive announcement effect leading to positive abnormal returns, which are most positive after the divestment has been announced.

Table 5. Abnormal returns

Event Day	AAR	CAAR
-10	-0.23%	-0.23%
-9	-0.39%	-0.62%
-8	0.10%	-0.53%
-7	-0.43%	-0.96%
-6	-0.07%	-1.03%
-5	0.10%	-0.93%
-4	-0.22%	-1.14%
-3	-0.07%	-1.21%
-2	0.30%	-0.92%
-1	0.31%	-0.61%
0	0.64%	0.02%
1	0.24%	0.26%
2	-0.04%	0.23%
3	0.37%	0.60%
4	0.61%	1.21%
5	0.21%	1.41%
6	0.05%	1.46%
7	0.14%	1.60%
8	0.16%	1.77%
9	0.12%	1.88%
10	-0.07%	1.81%

Table 5. This table shows the results of the average abnormal results (AAR) and the cumulative average abnormal returns (CAAR) of the total sample. The market model is used to generate the abnormal returns. In the left column, the event days refer to the days surrounding the announcement of the divestment, where 0 indicates the actual announcement day. The AARs and CAARs are expressed in %.

These daily AARs and CAARs give an indication of the effect, but for the remainder of this study, several different event windows will be used to measure the effect. Based on previous literature, the multi-day event windows: 3-day interval [-1.+1], 7-day interval [-3,+3], 11-day interval [-5,+5] and 21-day interval [-10,+10] will be considered. These different windows will provide insight into the movement of the market response over time. For each event window, the total sample of divestments consisting of sell-offs, spin-offs and equity carveouts are considered. In addition, the sell-offs and spin-offs are examined individually to look at differences between them. These differences will also be displayed and discussed in table 6 below.

Table 6. Event study results

	All	Sell-offs	Spin-offs	Difference
Event window [-1,+ 1]				
CAAR	1.18%**	1.06%*	2.12%	1.05%
	(0.0484)	(0.0956)	(0.230)	(0.5797)
T-test	1.995	1.681	1.264	0.5554
Sign test	2.021	1.734	1.293	0.743
Event window [-3,+ 3]				
CAAR	1.76%***	1.48%**	3.97%*	2.49%
	(0.010)	(0.0359)	(0.115)	(0.2476)
T-test	2.614	2.126	1.699	1.162
Sign test	3.374	3.035	1.642	0.834
Event window [-5,+ 5]				
CAAR	2.47%***	2.11%**	5.42%**	3.31%
	(0.0032)	(0.0168)	(0.050)	(0.2075)
T-test	3.012	2.4305	2.175	1.2676
Sign test	3.406	2.812	2.341	1.238
Event window [-10,+10]				
CAAR	1.83%**	1.57%	3.92%	2.35%
	(0.0132)	(0.2288)	(0.254)	(0.5428)
T-test	1.616	1.211	1.198	0.610
Sign test	2.563	2.348	1.153	0.288

Table 6. This table provides an overview of the event study results of the total sample, sell-offs, and spin-offs. CAAR refers to the cumulative average abnormal returns of these samples over the windows: [-1,+1], [-3,+3], [-5,+5] and [-10,+10]. The rightmost column addresses the difference between sell-offs and spin-offs. The p values of the corresponding CAARs are shown in parentheses. ***,**,* indicates the significance level of 1%, 5% and 10% respectively.

To test hypothesis 1, significant positive cumulative average abnormal returns must be found with respect to the entire sample. The results displayed in table 6 show that positive significant returns are found for all four event windows. It is found that divestment announcements in a 3-day interval led to an abnormal return of +1.18% which is found significant at a level of 5%. In the 7-day and 11-day intervals, abnormal returns of +1.76% and +2.47% are even found, both at a significance level of 1%. Finally, in the last interval, announcements are considered to cause abnormal returns of +1.83% at a significance level of 5%.

These findings state that overall, the market reacts positively to the announcement of divestments in the oil and gas industry. Based on the t-test, the results obtained are found to be significant in all intervals with at least a level of 5%. In addition, a sign test was performed to check whether the negative and positive observations are of the same size. Also, the sign test finds the analyzed positive results at each interval to be significant. Therefore, it can be concluded that hypothesis 1 can be accepted.

To test whether these findings also apply to the divestment types individually, will become clear by analyzing the announcement effect of sell-offs and spin-offs separately. Hypothesis 2 can be tested on this basis which considers the differences in announcement effects between these two. For the announcement effects of sell-offs, positive returns are found for the different windows. In the first 3 intervals, abnormal returns of +1.06%, +1.48% and 2.11% are obtained with significance levels of 10%, 5% and 5% respectively. Indicating possible similarity with the previous results of the total sample. However, the abnormal return +1.57% in the 21-day interval is not found significant. Although we do see positive abnormal returns for this group of announcements, the declining significance levels of the first three windows combined with a lack of significance in the last window means that it cannot be claimed with complete certainty that the announcement of sell-offs has a positive effect. However, there are strong reasons to assume this.

Similar results are found for spin-offs where the significance relative to the whole sample weakens somewhat. However, what is remarkable here is that the abnormal returns found for spin-offs are substantially higher than those for sell-offs. For spin-offs in the 7- and 11-day intervals, abnormal returns of +3.97% and +5.42% were found, which are both twice as high as the abnormal returns of sell-offs in these windows. However, this may be somewhat invalidated by the fact that fewer announcements were available for spin-offs in the oil and gas industry. In addition, it can also be inferred from the difference column, at the far right, which shows the differences between divestitures and spin-offs, but does not appear to be significant for any interval. This applies to both the values from the t-tests and the sign tests. Based on these findings, we can argue that there is a difference in the degree of abnormal returns between sell-offs and spin-offs, but because these differences do not appear to be significant, it cannot be assumed that sell-offs generally yield more positive abnormal returns relative to spin-offs within the oil and gas industry. Therefore, we must reject hypothesis 2.

Table 7. Abnormal returns Paris Agreement

	[-1,+1]	[-3,+3]	[-5,+5]	[-10,+10]
Before PA				
CAAR	1.16%*	1.66%**	2.26%**	1.89%
	(0.100)	(0.044)	(0.021)	(0.191)
T-test	1.649	2.043	2.355	1.317
Sign test	1.982	2.831	2.613	2.356
After PA				
CAAR	1.25%	2.08%**	3.23%**	1.61%
	(0.232)	(0.050)	(0.049)	(0.446)
T-test	1.223	2.040	2.067	0.774
Sign test	0.698	1.841	2.273	0.976

Table 7. This table shows the cumulative average abnormal returns (CAAR) of divestments before and after the Paris Agreement (PA). This involves looking at intervals: [-1,+1], [-3,+3], [-5,+5] and [-10,+10]. The p values of the corresponding CAARs are shown in parentheses. ***,**,* indicates the significance level of 1%, 5% and 10% respectively. The Paris Agreement took place on December 12, 2015. Before PA refers to all divestments up to December 12, 2015, and After PA refers to all divestments that took place after December 12.

To consider the impact of climate events raised by Santi (2020), the table above considers the difference in market reaction to divestments before and after the Paris Agreement. From the results table 7 we can observe a more positive market reaction to the divestments in the first three intervals in the years after the Paris Agreement. However, this is not supported in the 21-day interval and therefore we cannot assume with certainty that the reaction is more positive. Nevertheless, there are strong indications that the market reacts more positively to divestments in the oil and gas industry after the Paris Agreement, resulting in more positive abnormal returns for the parent firms.

5.2 Regression results

An attempt will be made in this subsection of the results to explain the determinants of the cumulative average abnormal returns. To do this, an ordinary least squares regression has been performed in which the explanatory variables discussed in the literature will be examined. Using the OLS regression, the unknown parameters are estimated in a linear model. In this regression, the cumulative average abnormal returns obtained from the event study will serve as dependent variables. The impact of the independent variables will be considered separately for each event window. The results of the regression of the total sample are shown in table 8.

Table 8. Results regression all divestments

All Divestments				
	CAAR(-1,+1)	CAAR(-3,+3)	CAAR(-5,+5)	CAAR(-10,+10)
Size	0.0040 (0.503)	0.0039 (0.472)	0.0066 (0.365)	0.0079 (0.396)
R&D	0.0428 (0.423)	0.0117 (0.579)	-0.0223 (0.652)	0.0454 (0.155)
Deal value	0.0043 (0.318)	0.0018 (0.630)	0.0076 (0.129)	0.0026 (0.599)
Risk	-0.0003 (0.409)	-0.0005 (0.219)	-0.0008 (0.275)	0.0001 (0.890)
Performance	-0.0012 (0.222)	-0.0021** (0.018)	-0.0032*** (0.005)	-0.0020 (0.131)
Constant	-0.0040 (0.967)	-0.0037 (0.966)	-0.1439 (0.190)	-0.0238 (0.888)
Year effects	Yes	Yes	Yes	Yes
Firm effects	Yes	Yes	Yes	Yes
R-squared	0.2764	0.2841	0.2595	0.2087
N	118	118	118	118

Table 8. This table shows the OLS regression results of the total sample of divestments. The four columns evaluate the abnormal returns of the different event windows: [-1,+1], [-3,+3], [-5, +5] and [-10,+10]. These CAARs are used as dependent variables and the variables: *Size, R&D, Deal value, Risk* and *Performance* as the independent variables. Controlled for year and firm effects when represented by *Yes*. Heteroskedasticity is tested and is present in the windows: [-1,+1], [-3,+3], [-5,+5] and [-10,+10], therefore robust standard errors are used. ***,**,* indicates the significance level of 1%, 5% and 10% respectively. The number of divestments is expressed per column by N.

Firm size, measured as the logarithm of the total assets was expected to have a negative impact on the market reaction of a divestment announcement. However, from the results of the regression, weak but positive effects were found over all windows. The results shows that the cumulative average abnormal returns in the 3-day event window increases with 0,40% for every 1% increase in firm size. A similar effect of size on abnormal returns is found in the other event windows. Although these effects are not found to be significant in any window, it does indicate that abnormal returns are more positive for larger companies. These contradicting results cause hypothesis 3 to be rejected.

Where there were no positive abnormal returns expected for size, they were expected for R&D. Among the 3-day and 7-day event window, abnormal returns increase by +4.28% and +1.17% respectively for every 1% increase in research and development expenses. These results are consistent with the expectation that parent companies with relatively higher R&D expenditures will generate higher cumulative abnormal returns. However, in the 11-day interval they become negative and since there is no significance at any interval, it cannot be stated that higher R&D expenditures yield more positive abnormal returns and therefore hypothesis 4 must be rejected.

Deal value as a percentage of the market value of the parent company shows a positive impact on abnormal returns varying between +0.18% and +0.76% at the 7-day and 11-day interval respectively. Although the results in each window are in line with one another, they lack significant and therefore it cannot be stated that deal value effects the market reaction to divestments announcements. In the absence of this effect, hypothesis 6 must be rejected and it cannot be claimed that the deal size of the divestment has a positive effect on the shareholders' value of the parent company.

Similar to risk, performance also seems to have a negative influence on the abnormal returns. In all windows, a negative impact of performance is found ranging from -0.32% to -0.12%. At the 7-and 11-day interval, negative effects are observed to be the most negative at which the abnormal returns decrease with -0.21% and -0.32% respectively, for every 1% increase in performance. These negative effects are found to be significant at a level of 5% and 10% respectively. This provides strong evidence that worse performance prior to an announcement result in higher abnormal returns. However, hypothesis 7 can only be partially accepted due to the lack of consistent significance across all intervals.

To better examine and understand the effects of these explanatory variables, a split between sell-offs and spin-offs was made to subsequently look at the different effects by performing separate regressions for sell-offs and spin-offs. These are shown in table 9 using A for the sell-offs and B for the spin-offs.

Table 9. Results regression Sell-offs & Spin-offs

A: Sell-offs

	CAAR(-1,+1)	CAAR(-3,+3)	CAAR(-5,+5)	CAAR(-10,+10)
Size	0.0038 (0.547)	0.0049 (0.391)	0.0087 (0.254)	0.0095 (0.325)
R&D	0.0456 (0.388)	0.0241 (0.584)	-0.0116 (0.813)	0.0632 (0.119)
Deal value	0.0060 (0.211)	0.0047 (0.298)	0.0111 (0.112)	0.0049 (0.536)
Risk	-0.0003 (0.398)	-0.0007* (0.092)	-0.0010 (0.239)	-0.0003 (0.689)
Performance	-0.0012 (0.371)	-0.0014 (0.223)	-0.0029** (0.049)	-0.0003 (0.689)
Constant	-0.0138 (0.899)	-0.0130 (0.892)	-0.0183 (0.158)	-0.0010 (0.595)
Year effects	Yes	Yes	Yes	Yes
Firm effects	Yes	Yes	Yes	Yes
R-squared	0.3001	0.2631	0.2288	0.1962
N	97	97	97	97

B: Spin-offs

	CAAR(-1,+1)	CAAR(-3,+3)	CAAR(-5,+5)	CAAR(-10,+10)
Size	0.0110 (0.586)	-0.0073 (0.764)	-0.0180 (0.588)	-0.0385** (0.049)
R&D	-0.0290 (0.119)	-0.0296 (0.258)	-0.0207 (0.647)	-0.0458** (0.035)
Deal value	0.0014 (0.877)	-0.0009 (0.932)	0.0028 (0.582)	0.0065 (0.479)
Risk	-0.0006 (0.633)	-0.0015 (0.279)	-0.0021 (0.296)	-0.0016 (0.269)
Performance	-0.0051** (0.011)	-0.0052** (0.035)	-0.0034 (0.350)	-0.0039** (0.024)
Constant	-0.0789** (0.014)	-0.0429 (0.266)	-0.0459 (0.943)	-0.0318 (0.268)
Year effects	Yes	Yes	Yes	Yes
Firm effects	Yes	Yes	Yes	Yes
R-squared	0.4438	0.5444	0.5764	0.7628
N	19	19	19	19

Table 9. This table shows the OLS regression results of sell-offs (A) and spin-offs (B). The four columns evaluate the abnormal returns of the different event windows: [-1,+1], [-3,+3], [-5,+5] and [-10,+10]. These CAARs are used as dependent variables and variables: *Size, R&D, Deal value, Risk* and *Performance* as the independent variables. Heteroskedasticity is tested and is present in the windows: [-1,+1], [-3,+3], [-5,+5] and [-10,+10], therefore robust standard errors are used. ***,**,* indicates the significance level of 1%, 5% and 10% respectively.

In this second part of the regression results the focus will be on the different effects of independent variables on the abnormal returns of the announcement of sell-offs and spin-offs. Table 9.A provides the results of the regressions for the sell-offs and table 9.B the results for spin-offs. As we are interested in the differences in impact of sell-offs and spin-offs, this section will focus on these different effects and attempt to explain them. The independent variables deal value, risk and performance appear to have similar effects on both sell-offs and spin-offs based on the results. However, for the variables size and research and development, we do see solid differences in impact between the two.

For spin-offs the results shows that size is found to be negative in the last 3 event windows, indicating that the abnormal returns are higher for smaller firms. These results are in contradiction with those of sell-offs where for each interval a positive impact of size on the abnormal returns is observed. It is notable that the impact of size for spin-offs increases negatively from +1.1% in the 3-day interval to -3.85% in the 21-day interval. Also, the negative impact of size in the last interval is found to be significant at a 5% level. As a result, slight assumptions can be made that smaller companies in many cases generate more positive abnormal returns around the announcement of a spin-off compared to a sell-off. These negative effects of size on spin-offs are in line with the stated hypothesis but cannot be fully accepted due to the conflicting result from the 3-day interval and lack of significance. However, it does seem that the wider the interval becomes the more negative and significant the effect of size gets.

In addition to the difference in size effect, the results reported in A and B also indicate a marked difference in effect of research and development expenses. For sell-offs, a positive impact of R&D is found in the 3, 7 and 21-day intervals that vary from +4.56, +2.41% to +6.32% respectively. This implies that the abnormal returns increase with these percentages for every 1% increase in R&D. These results are not found to be significant and therefore cannot be assumed. Regarding the market reaction to a divestiture announcement, the results for spin-offs state the opposite effect. A negative effect is found for each interval where in the 21-day interval an effect of -4.58% is obtained and found to be significant at a 5% level. This difference in the impact of R&D in sell-offs and spin-offs can possibly be explained by the nature of the divestment form. For instance, parent companies with higher R&D intensity may prefer a sell-off to divest an entire polluting division in order to pursue a new more sustainable path.

5.2.1 Correlations

To examine the interrelationships of the independent variables, a pairwise correlation was performed as shown in table 10. The Cumulative Average Abnormal Returns were also added to capture the trends of the variables across the windows. Using this pairwise correlation, we can test hypothesis 4 and determine whether smaller firms will generally have higher R&D intensity.

Table 10. Pairwise correlation matrix

	CAAR(-1,+1)	CAAR(-3,+3)	CAAR(-5,+5)	CAAR(-10,+10)	Size	R&D	Deal value	Risk	Performance
CAAR(-1,+1)	1.000								
CAAR(-3,+3)	0.7552	1.000							
CAAR(-5,+5)	0.6078	0.8307	1.000						
CAAR(-10,+10)	0.4920	0.5856	0.6101	1.000					
Size	-0.1659	-0.0659	-0.0597	0.0363	1.000				
R&D	0.3627	0.2231	0.0877	0.2525	-0.4211	1.000			
Deal value	0.0785	-0.0516	0.0279	-0.0821	-0.6054	0.0639	1.000		
Risk	-0.0069	-0.0899	-0.0694	0.0173	-0.1452	0.0263	0.3598	1.000	
Performance	-0.3854	-0.4210	-0.3936	-0.2956	0.5264	-0.5379	-0.2116	-0.1113	1.000

Table 10. This table shows the pairwise correlations matrix of the independent variables: Size, R&D, Deal value, risk and Performance and the dependent variables CAAR(-1, +10, CAAR(-3, +3), CAAR(-5, +5), CAAR(-10, +10). Heteroskedasticity is tested and is present in the windows: [-1,+1], [-3,+3], [-5,+5] and [-10,+10], therefore robust standard errors are used. A negative correlation is indicated by "-" and implies that the variables in question move in the opposite directions.

Accordingly, for size, risk, and performance we observe negative relationships with the cumulative average abnormal returns, which holds that an increase in the independent variable is paired with a decrease in the cumulative average abnormal returns. For R&D and partly deal value positive relationships were found, meaning that an increase in the independent variable is followed by an increase in the cumulative average abnormal returns. These findings are in line with the stated hypotheses. To test hypothesis 4, we look at the inter-individual correlation of two specific variable, shown in table 10.1.

Table 10.1. Correlation between Size and R&D

	Size	R&D
Size	1.000	
R&D	-0.4211	1.000

Table 10.1. This table shows the correlation between independent variable size and R&D.

From the correlation between firm size and research and development intensity, a negative relationship is obtained. This refers to the fact that smaller firms generally have higher R&D intensity and due to this negative relation, hypothesis 5 can be accepted.

The correlation shows that none of the variables appear to be highly correlated with each other, which would imply that there is no multicollinearity problem. To get more clarity on this multicollinearity problem, a Variance Inflation Factor (VIF) test was performed shown in the table below.

Table 11. Variance Inflation Factor Test

Variable	VIF	1/VIF
Size	3.18	0.31
R&D	2.01	0.49
Deal Value	2.09	0.48
Risk	1.47	0.68
Performance	2.60	0.38
Mean VIF	2.27	

Table 11. This table shows the results of a Variance Inflation Factor (VIF) Test to check for multicollinearity. Meyers (1990) suggests in his study that VIF-scores lower than 10 combined with 1/VIF-scores higher than 0.1 indicate that there are no multicollinearity problems.

The Variance Inflation Factor (VIF) test was performed to check for multicollinearity. According to Meyers (1990) VIF-scores lower than 10 combined with 1/VIF-scores higher than 0.1 indicate that there are no multicollinearity problems. It can be concluded from the table that the VIF scores are well below 10 and the 1/VIF scores are all above 0.1, indicating that there is no multicollinearity problem.

5.3 Robustness

A number of actions were conducted to improve and test the robustness of the results. First, as an additional robustness test based on Corrado and Zivney (1992), a sign test was performed to check for consistent differences between positive and negative observations. In addition, another robustness check was performed in this paper by implementing oil prices as an independent variable in the regression. By adding the oil price, a check can be made to ensure that the results do not change drastically which will makes the results robust against a key omitted variable. For the oil price, the West Texas Intermediate (WTI) was considered, which is a specific grade of crude oil that is widely used in U.S. refineries and is considered to be one of the top benchmarks for oil prices. As a result of the inclusion of WTI as an independent variable, no major changes were observed in the results leading us to conclude that the results are robust against a major omitted variable.

An important aspect in analyzing corporate finance is the problem of endogeneity among explanatory variables used in the regression model. This problem can occur when an observed or unobserved variable that is not included in the model is correlated with a variable that is included in the model. Endogeneity problems can stem from several sources including simultaneity, omitted variables, measurement error and selection bias. To account for these endogeneity problems, omitted variables were included and controlled for in the model. To address a simultaneity problem, this paper used lagged values to define the explanatory variables used in the regression model. In compiling the sample, only divestitures from companies operating in the oil and gas industry were selected, resulting in a highly industry-focused selection of primarily divestitures from larger companies, in part due to the minimum transaction size criteria.

6 Conclusion

In response to the rising awareness surrounding climate issues, the increasing pressure on corporate responsibility and the polluting nature of the oil and gas industry, this study examines the impact on parent companies as they move away from polluting corporate activities. Although the climate issues are a major problem and the impact of the oil and gas industry is enormous, only a limited amount of research has been done on this topic. Therefore, this research will attempt to complement and contribute by providing new insights using new databases and exploring new drivers. Accordingly, this paper will ultimately revolve around answering and explaining the research question below.

What are the effects of divestments in the oil and gas industry on the performance of the parent company?

To analyze this impact, the cumulative average abnormal returns of 118 different divestments were examined within the US. All are publicly listed and active in the oil and gas industry. This is a relatively small sample due in part to the inclusion of research and development expenses. Other similar studies, covered in the meta-literature overview, used similar samples making the observation size acceptable. The abnormal returns were calculated using the market model and based on different event windows around the announcement dates. To check for significance both a t-test and a sign-test were performed. For all event windows, significant positive abnormal returns were found ranging between 1.18% and 2.47%. These results indicate that an announcement of a divestment in the US oil and gas industry, has a positive impact on the stock price of the parent company. Sabet, Agha and Heaney (2018) and Dordi and Weber (2019) found similar results in their studies of divestments in the oil and gas industry. Based on these outcomes, Hypothesis 1, the announcement of a divestment in the U.S. oil and gas industry has a positive impact on the parent company's stock price, was accepted. This assumption is in line with the results, in terms of the positive impact of divestments on the parent company, of Huson and MacKinnon (2003), Veld and Veld-Merkoulova (2004), Dasilas et al. (2011), and Zakaria and Arnold (2018). Examining the differences in abnormal returns between sell-offs and spin-offs, it appears that spin-offs generate slightly higher abnormal returns, but these differences lack significance. Therefore, hypothesis 2 must be rejected and it cannot be stated that sell-offs generally yield higher abnormal returns than spin-offs in this industry. Table 12 summarizes the hypotheses formulated and the results regarding their acceptance or rejection.

Table 12. Hypothesis overview and results

	Hypothesis	Result
H1	The announcement of a divestment in the US oil and gas industry, has a positive impact on the stock price of the parent company.	Accepted
H2	Sell-offs generally yield more positive abnormal returns relative to spin-offs within the oil and gas industry.	Rejected
H3	Smaller parent companies show higher abnormal returns surrounding the divestment announcement.	Rejected
H4	Parent companies with relatively higher R&D expenditures will generate higher cumulative abnormal returns	Rejected
H5	Smaller firms will generally have higher R&D intensity.	Accepted
H6	The deal size of the divestment has a positive effect on the shareholders' value of the parent company.	Rejected
H7	There is a negative relation between the prior financial performance of the parent company and market reaction to a divestment announcement.	Partially accepted

Table 12. This table provides an overview of the hypotheses. The result column indicates whether the hypotheses were accepted, rejected, or partially accepted.

Regarding the size of the parent companies, its impact on the abnormal returns of the divestment announcement was examined. Smaller but contradictory results were found which led to the rejection of hypothesis 3 which states that smaller parent companies have higher abnormal returns surrounding the divestment announcements. This contradicts the findings of Bauguess et al. (2009) who argued that larger firms tend to accept smaller premium more quickly and thus miss out on shareholder value. This contradiction can possibly be explained by the higher pressure on larger firms to be corporate socially responsible (Wu, 2006). By divesting polluting divisions, they respond to the external pressure on corporate responsibility by reducing their emissions. This response may be of greater importance in this particular industry in terms of how the market responds to such a divestment, which may result in a positive market reaction.

From the results of the regression analysis, no significant results were found for R&D expenses across the sample. Therefore, assertions by Longwell (2002) and Mitchell et al. (2012) indicating that R&D of new technology will play a pivotal role in the success or failure of the future of the oil and gas industry cannot be supported from the perspective of divestments in this industry based on this research. Sheppard (2021) pointed out to the recent gas crisis as a reason not to completely abandon oil and gas sector. Currently, the economic dependence on the oil and gas sector hinders the research and development of more sustainable energy sources within companies. Renewable energy sources cannot yet be deployed on a large scale, which means that the deployment and investment in these sources by companies on a large scale is still outstanding. The negative oil price effect on renewable energy use is an important factor in the development of the sustainable transition and rising oil prices may accelerate this transition (Karacan et al., 2021). For now, we must reject hypothesis 4, which states that parent companies with relatively larger R&D expenses generate higher cumulative abnormal returns, yet future research should show whether this will still be the case in a few years' time. In addition, the relationships of R&D expenses with other variables were examined which showed that firm size and R&D were significantly negatively correlated with one another. Therefore, Hypothesis 5 can be accepted, which states that smaller firms generally have higher R&D intensity.

Hypothesis 6 addresses whether the deal size of the divestments has a positive effect on the shareholders' value of the parent company. Regarding the deal size, the relative size compared to the market value of the parent company has been considered. The results are in line with the findings of Klein (1986) who identified a positive relation between the deal size of divestments and shareholders value. The results of this study show that there are positive effects, but there is a lack of significance and therefore hypothesis 6 must be rejected. To test the final hypothesis, the impact of prior performance on abnormal returns was investigated. Hillier, McColgan and Werema (2009) found negative relationships in their study between operating performance before the divestment and abnormal returns. The results of this study support these findings by identifying negative effects across all intervals, with significant results found over the 7-day and 11-day intervals. Since the effects were not significant in all windows, hypothesis 7 which states that there is a positive relationship between the prior financial performance of the parent company and the market reaction to a divestment can only be partially accepted.

6.1 Limitations and recommendations

Regarding this research, there are some limitations and recommendations for future research on this topic. While the results are largely consistent with the hypotheses and a positive market response to the announcement of divestments is observed, there are a variety of factors that hamper the data and contributed to the lack of significant results, which may call into question the plausibility of this study.

First of all, a conceivable limitation lies in the data set that was used for this research. The requirements that the events had to meet led to a relatively small sample of divestments, partly due to the focus on the research and development expenses. Although this has provided new insights, it has also limited the number of observations and therefore affected the potential of significant results and the reliability of the research. In the oil and gas industry, sell-offs are a lot more common since they allow companies to completely withdraw from a polluting division. The largest part of the sample therefore consists of sell-offs, which affects the results of the small sample of spin-offs and makes them less reliable. Also, due to the small sample size it was not possible to distinguish between the different standard industrial classifications. As a result, in this study no conclusion could be drawn about the different impact of divestments of various specific departments or lines of business within the oil and gas industry. The proceeds of the divestments and particularly the extent to which they depend in size on the type of divestment, a profit-making division or loss-making division, can be seen as a limitation. Divestments and in particular sell-offs are very heterogenous and including their various characteristics could further explain the impact of divestments on their parent companies. Additionally, this study does not focus on the allocation of the divestment proceeds, such as whether they are invested in research and development or used to pay down debt. This information could provide an important perspective on the longer-term vision and performance of parent company and therefore limits this study. However, the ability to ascertain the use of the proceeds was somewhat limited by not attempting to further shrink the sample. Furthermore, it can be argued that divestments of smaller size have less impact on the performance of the parent company. Although divestments under half a million are excluded, this says little about the relative size of the divestment. However, the relative size of the divestment is included as a variable in the regression and does not appear to have a significant impact on the abnormal returns.

In addition, the influence of government and politics on the impact of divestments can be seen as a limitation of this research. For instance, this study does not consider political uncertainty which can affect the impact of divestments. Also, it is evident that Trump's exit from the Paris Agreement has had its effects and benefits on the oil and gas industry and Bidon's entry vice versa. However, this effect is somewhat corrected by controlling for year fixed effects. Also, the Russian invasion of Ukraine will lead to much disruption and changes in the oil and gas industry worldwide, with many forced divestments out of Russia due to sanctions imposed by NATO and others. These disruptions and changes will potentially lead to an increase in divestments in the oil and gas industry and possibly accelerate the development of the renewable energy sector. In addition to the influence of governments and politics, the influence of managerial motives to divest is also understated. Management of the various parent companies may have different motivations for initiating a divestment of a particular division. This study investigated divestments in the oil and gas industry with a friendly deal attitude, but not the specific incentives of the management to divest. However, the literature does indicate that the current climate conditions and growing climate regulations are forcing the oil and gas industry with the managements towards a sustainable transition from a strategic and financial point of view.

As discussed earlier, the endogeneity issue is a common problem which has led to limitations in this research. While attempts were made to eliminate the simultaneity problem by using lagged explanatory variables, the use of a 2SLS methods could have further eliminated this problem. In addition, the endogeneity problem cannot be completely ruled out even though some omitted variables have been controlled for unknown explanatory variables may still play a part in the model.

This research managed to identify significant cumulative abnormal returns within the oil and gas industry for the entire sample as well as for sell-offs and spin-offs separately. Hence, for performance there are strong assumptions of a negative impact on the abnormal returns but for most explanatory variables flawed results are found that do indicate a trend of impact but lack significance. When the focus of future research excludes research and development or manages to measure it in alternative ways where a large sample remains, the drivers behind abnormal returns can be further investigated in a more accurate and reliable manner. This may lead to finding stronger results and greater significance.

Furthermore, when a larger divestment sample is used in future research, it may also be possible and interesting to distinguish between different standard industrial classifications within the oil and gas industry and to compare their respective impacts. In this way, abnormal returns can be observed based on a divestment of a specific business activity in the industry.

Since this paper only focuses on sell-offs and spin-offs by US companies, it might be interesting to analyze and compare similar research for the industry in Europe since the climate issue is a global problem and concerns every company worldwide. In addition, it is also interesting since the international policies and regulations of these different countries regarding emission will possibly be an important factor in the differences on top of to the corporate explanatory variables. Another interesting area for further research concerns the incentives for oil and gas companies to divest. For instance, it is currently not yet possible to run an entire energy system on renewable energy due to the lack of storage capacity and fluctuations in its generation. This limits the ability of companies to fully divest from polluting divisions. The prices of oil and gas play an important role in the extent to which the technology of renewable energy sources is further developed and widely adopted. It may therefore be relevant for future research to consider the developments of the renewable energy sector that should serve as an alternative for these oil and gas companies.

In conclusion, this research aimed to make three things clear. First, to identify the impact of divestments in the oil and gas industry. Second, to identify and explain the difference in impact between sell-offs and spin-offs. And finally, it attempts to shed light on the drivers behind the impact of these types of divestments. All in all, it was found that investors reward companies in the oil and gas industry when they divest from polluting divisions, regardless of the type of divestment, and thereby reduce their emissions. In the future, more thorough research will be required to better account for these driving factors. Nevertheless, these insights will contribute to a movement towards a less polluting industry and push for a sustainable energy system.

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Appendix

Appendix A

Table 13. Sub-industries with their corresponding SIC codes

Industry	**SIC**
Crude petroleum and natural gas	1311
Natural gas liquids	1321
Drilling oil and gas wells	1381
Oil and gas field exploration services	1382
Oil and gas field services	1389
Industry organic chemicals	2869
Chemical preparations	2899
Petroleum refining	2911
Asphalt paving mixtures and blocks	2951
Asphalt felts and coatings	2952
Lubricating oils and greases	2992
Products of petroleum and coal	2999
Oil and gas field machinery and equipment	3533
Air and gas compression	3563
Crude petroleum pipelines	4612
Pipelines	4619
Natural gas transmission	4922
Natural gas transmission and distribution	4923
Natural gas distribution	4924
Petroleum bulk stations and terminals	5171
Liquefied petroleum gas dealers	5984

Table 13. This table shows the various sub-industries from the oil and gas industry that were included in the sample. These various sub-industries within the US oil and gas industry are denoted by the 4-digit standard industrial classification (SIC).

Table 14. Sample size of divestment types

Divestment form	N
Sell-off	97
Spin-off	19
Equity-carve out	2

Table 14. This table shows how many divestments of each divestment form are included in de sample. The divestment forms are on the left of the table and the amounts on the right under "N".

Table 15. Overview of explanatory variables

Variable Name	Description	Transformation
Size	The total assets of the parent company	Log- transformed
R&D	The average R&D expenses of the parent company over the last 2 years before the divestment	Measured by the average R&D expenses dived by the total revenue
Deal value	The transaction value of the divestment	Deal value as a percentage of the market equity value of the parent company
Risk	Debt level of the parent company	Total debt of the parent company as a percentage of capital of the parent
Performance	The returns of the parent company	Measured by the Return on Assets (ROA)

Table 15. This table provides an overview of the multiple independent variables that are used in the regression.

Appendix B

Figure 5. The development of abnormal returns sell-offs

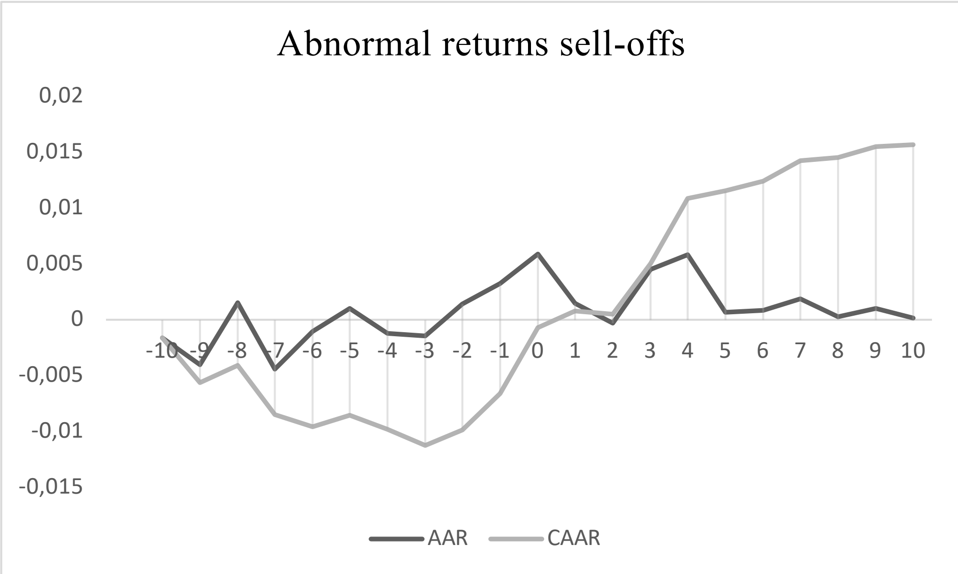

Figure 5. The development of the average abnormal returns (AAR) and the cumulative average abnormal returns (CAAR) of the sample consisting of only sell-offs. The x-axis displays the relevant days related to the event windows and on the y-axis the abnormal returns are shown. The abnormal returns on the y-axis must be multiplied by 100 to get percentages.

Figure 6. The development of abnormal returns spin-offs

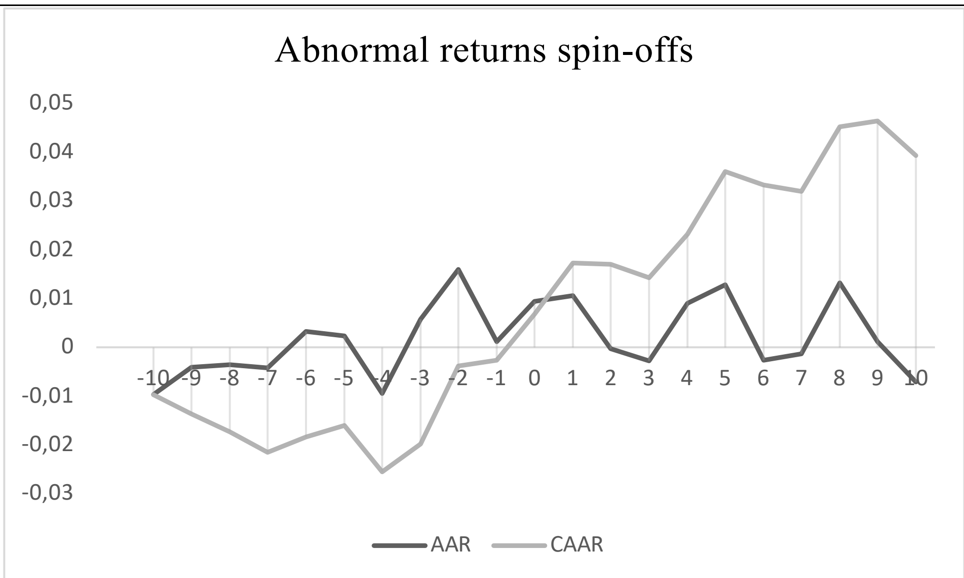

Figure 6. The development of the average abnormal returns (AAR) and the cumulative average abnormal returns (CAAR) of the sample consisting of only spin-offs. The x-axis displays the relevant days related to the event windows and on the y-axis the abnormal returns are shown. The abnormal returns on the y-axis must be multiplied by 100 to get percentages.

Appendix C

Table 16. Breusch-Pagan Test

	CAAR(-1,+1)	CAAR(-3,+3)	CAAR(-5,+5)	CAAR(-10,+10)
Chi2	2.57	9.31	1.84	3.12
Prob > Chi2	0.109	0.023	0.175	0.077

Table 16. This table shows the outcomes of the Breusch-Pagan Test to test heteroskedasticity. When the test statistic has a p-value of "p < 0.05", the null hypothesis of homoskedasticity must be rejected and we must assume heteroskedasticity.

Table 17. Regression results including WTI

All Divestments				
	CAAR(-1,+1)	CAAR(-3,+3)	CAAR(-5,+5)	CAAR(-10,+10)
Size	0.0022 (0.573)	0.0022 (0.573)	0.0025 (0.615)	0.0026 (0.651)
R&D	0.0309 (0.548)	0.0014 (0.971)	-0.0313 (0.508)	0.0307 (0.186)
Deal value	0.0028 (0.428)	0.0018 (0.957)	0.0047 (0.261)	-0.0002 (0.961)
Risk	-0.0002 (0.511)	-0.0004 (0.158)	-0.0007 (0.211)	0.0001 (0.837)
Performance	-0.0014* (0.064)	-0.0022*** (0.002)	-0.0030*** (0.002)	-0.0019** (0.041)
WTI	0.0001 (0.693)	-0.0002 (0.431)	-0.0003 (0.432)	0.0002 (0.485)
Constant	0.0189 (0.811)	0.01631 (0.823)	-0.0761 (0.293)	0.0352 (0.698)
Year effects	Yes	Yes	Yes	Yes
Firm effects	Yes	Yes	Yes	Yes
R-squared	0.1897	0.1769	0.1788	0.1040
N	118	118	118	118

Table 17. This table shows the OLS regression results of the total sample of divestments. West Texas Intermediate (WTI) is a type of petroleum that is widely used in U.S. refineries and is considered a benchmark for oil prices. The four columns evaluate the abnormal returns of the different event windows: [-1,+1], [-3,+3], [-5,+5] and [-10,+10]. These CAARs are used as dependent variables and the variables: *Size, R&D, Deal value, Risk* and *Performance* as the independent variables. Controlled

for year and firm effects when represented by *Yes*. Heteroskedasticity is tested and is present in the windows: [-1,+1], [-3,+3], [-5,+5] and [-10,+10], therefore robust standard errors are used. ***,**,* indicates the significance level of 1%, 5% and 10% respectively. The number of divestments is expressed per column by N.