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Are green M&As of oil and gas companies recognized by the stock market?

Bachelor's thesis in Financial Economics

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Abstract

This research is focusses on the question if sustainable mergers and acquisitions of major oil and gas companies is recognized by capital markets, with the renewable energy and e-mobility industry as specific industries. By focussing on major oil and gas companies and the e-mobility industry. This research contributes to scientific knowledge by looking at major oil and gas companies and the e-mobility industry specific. The results showed that sustainable M&A deals of acquiring major oil and gas companies are not recognized by capital markets in general. The short-term study showed a negative relationship between M&A deals and abnormal returns for both industries, while only the long-term study within the renewable energy industry showed a positive relationship.

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1 Introduction

Because of the Paris Agreement, in which politicians around the world committed to 2°C global warming with the aim to limit it to 1.5°C. Certain assets in the fossil fuel industries are at risk and may become useless in the transition to a low-carbon economy. The agreement contains a global carbon budget of a couple of hundred gigatons of carbon (GtC), meaning that a substantial amount of fossil fuel reserves must stay in the earth permanently. This could create an enormous amount of stranded assets for major oil and gas companies such as Shell, BP, and ExxonMobil. If these companies want to survive in a low-carbon economy, they may have to make a switch to renewable energy sources and commercialise e-mobility, in some point in time. However, the major oil and gas companies expect that demand of fossil fuels will grow and stay high in the foreseeable future. On the other hand, one could argue that with every investment these companies make in renewable energy, they slowly break down their own (trusted) profitable fossil business-case. This paper focusses on the research question "Do mergers and acquisitions in renewable energy or e-mobility change major oil and gas company's stock valuations?". The focus will be on M&A deals where major oil and gas companies acted as acquirers. Different hypotheses that are relevant to the research question will be tested by an event study approach (ESA).

The results conclude that short-term effects of M&A deals on abnormal returns are negative for both the renewable energy and e-mobility industry. This was expected for the renewable energy but not for the e-mobility industry. The long-term study showed more surprising results. It showed a positive abnormal return, statistically significant under 5%, for M&A deals within the renewable energy industry. The long-term study within the e-mobility industry showed a negative relationship between M&A and abnormal returns, without statistical significance. Additionally, the results showed a negative relationship with abnormal returns and M&A deals where the target was European. At last, the results showed that there was a positive relationship between cash M&A and non-cash transactions within the renewable energy and e-mobility industry, but it lacked statistical significance.

First, the background and corresponding literature of the research question will be set out. After this, there is an accurate description on how the event study will be performed. In chapter 5 the classification of a major oil and gas company and the deal criteria are stated. Conclusions are drawn after presenting the results and discussing them.

2 Literature Review

In the following paragraph we will discuss different economic concepts that are relevant to and could clarify the underlying thought of the research question.

2.1 Efficient Market Hypothesis

The efficient market hypothesis (EMH) comprises that any new information that comes into the market, is immediately reflected in stock prices, which implies that a security is being traded at its fair value on the market (Fama, 1970). This makes it impossible for investors to purchase undervalued stocks, sell overvalued stocks, or have a consistent alpha generation. Fama (1970) describes three conditions under which the EMH holds: (1) absence of transactions costs, (2) availability of all information without costs, and (3) the agreement of all agents upon the implications of information. In practice, these assumptions are never achieved, but they are an indicator on how efficient the market is operating. The hypothesis can be broken down by market efficiency into three different variations: (1) weak form, (2) semi-strong form, and (3) strong form. The weak form of the EMH entails that the future price of securities are predictions based on all publicly available information. The semi-strong form assumes that prices adjust quickly to any newly available public information. In this form it is not possible to beat the market with technical or fundamental analysis. The strong holds that stock prices always reflect all publicly available information and private information.

2.2 Agency theory

Agency theory is centered around the relationship between stakeholders and managers. It attempts to explain and resolve disputes of the difference in interests between principals and their agents, where the principals delegated decision-making authority to the agent. The difference in interest is formed by the assumption that everyone maximizes their own utility. Under the agency theory, managers, acting as agents, may take investment decisions against the interest of shareholders, the principals. The principals can change the incentives of an agent to achieve combined interests. Jensen (1986) discussed the importance of free cash flow as an agency cost relating to M&A. High levels of free cash flow could move managers to engage in investments with the risk of having a negative Net Present Value (NPV). Jensen (1986) proposed that high levels of free cash flow should be reduced by distributing it to shareholders or by share repurchasing, in this way a managers cannot easily engage in risky investments. In addition, firms should be using debt to finance new projects, because it helps prevent such firms from wasting resources on low-return projects. Issuing debt often requires approvals of multiple people within the company and approval of the lender.

2.3 Mergers and Acquisitions

M&A activity takes place due to the search of synergy, or the concept that two companies together have a greater value than the companies individually. Economies of scale, cost reduction or the elimination of duplicate activities are different forms of synergies. Bruner (2005) argues that the similarities between acquirers' assets and the target's assets could enable economic benefits, and a deal that is seen as diversification could limit synergies. Next to that, there are two other value drivers in mergers and acquisitions: the importance of value investing and the key role of management involvement (Campo & Hernando, 2004).

Relatedness of an acquired firm to its acquirer is often assumed to impact the post-acquisition performance of the acquiring firm (King et al., 2004; Finkelstein & Haleblian, 2002). Industry familiarity can eliminate or significantly diminish the need for acquiring firm managers to learn the business of the acquired firm (Hitt et al., 2001). Other factors such as method of payment or whether the acquiring firm had prior experience in M&A, could impact the performances as well (Finkelstein & Haleblian, 2002; Sudarsanam & Mahate, 2003).

2.4 Stranded Assets

'Stranded assets' are assets at risk of becoming obsolete because of unanticipated or premature write-offs, downward revaluation or the conversion to liabilities due to regulatory or environmental changes (Atanasova & Schwartz, 2019). At some time prior to the end of their economic life, as a result of the transition to a low-carbon economy, assets will no longer add positive value to the company.

A lot of oil and gas companies are segment-specific, they can operate upstream, midstream, or downstream. While some companies, such as Shell or BP, are integrated into multiple or all streams, upstream companies are focused on identification, exploration, and production of raw materials. Possible stranded assets in that case are oil or gas fields, production facilities, or pipelines. Midstream companies take care of the transportation and storage of fossil fuels. Pipelines, storages, distribution facilities, or ships could become stranded. At last, the downstream companies, are positioned closer to the consumer and handle the refining and marketing of oil and gas. Assets such as refining facilities, concessions, or gas stations could get stranded. The scale of the cost of writing off stranded assets can differ between up-, mid-, and downstream companies. Notice, that it is not sure that these assets will get stranded. An alternative use could be found for some of these assets. A gas station, for instance, can be transformed into a charging station for electric vehicles.

The transition to a low-carbon economy leads to two types of asset stranding. First, economic stranding, which could also exist under business-as-usual conditions. This risk could arise due to a change in relative costs: with renewable energy becoming more affordable, high conventional energy prices will encourage the shift away from these sources towards renewables. The second type of asset stranding is regulatory stranding. Given new emission regulations, such as a carbon tax, carbon pricing, or caps on carbon emissions can limit the extraction and consumption of fossil fuels.

3 Background and Hypothesis Development

In 2011, the Carbon Tracker Initiative (CTI) developed the idea of unburnable carbon. This topic has put the question of stranded-asset risk at the centre of debate for energy investors. The main concern is the enormous reserves of fossil fuels, which are currently on the balance sheets of fossil fuel companies, that would need to remain in the earth to limit global warming to 1.5 or 2°C relative to preindustrial temperatures considering the Paris commitments (Atanasova & Schwartz, 2019; Van der Ploeg & Rezai, 2020). Assets in the conventional energy industry could become worthless due to continuing inventions and improvements in renewable energy technology and incorporated climate policies by governments.

Investors should be pricing climate change risk into stock prices and considering the effects of global warming on their portfolios (Byrd & Cooperman, 2016). Fossil fuel companies generally state that the risk of asset stranding is not a real threat, since the shift to alternative energy sources and implementation of regulations will be far out in the future (Byrd & Cooperman, 2016). However, with the Paris Agreement as turning point, we can already see governments implementing a price on carbon, which could change the business model of major oil and gas companies. In a decarbonizing world, investments are at risk of not achieving the expected returns. Investors may find it difficult to confidently embed carbon risk into share prices of fossil fuel companies. Thus, for investors the risk of stranded assets remains a critical risk management issue for portfolios. Investors need to know whether share prices reflect stranded asset risk to make an informed investment decision, and if so, to what extent.

Some (groups of) shareholders of major oil and gas companies, like “Follow this”, try to move the board to a lower carbon balance sheet. By setting up voting rounds on the annual general meeting or by using the media this group tries to make these companies turn their policy in such a way that the Paris agreements can be accomplished. Next to that, there are also funds or individuals who do not want to invest in ‘dirty companies’ because of ethical reasons. The stock price could therefore increase if these companies become greener.

Firms believe that sustainable investments have a lower return on investment than the more conventional investment opportunities (McKinsey&Company, 2017). However, Wüstenhagen and Menichetti (2012) found a positive relationship between shareholder value and diversifying towards renewable energy. Oil producers with higher extraction costs or with undeveloped oil reserves located in countries with strict climate policies, have a strong negative effect on their valuation (Atanasova & Schwartz, 2019). It should be noted that the study of Atanasova & Schwartz (2019) is limited to only North American oil producers. The market seems to recognize that some reserves might never be utilized due to the high development costs.

The energy transition is undoubtedly the primary driver for M&A in the energy sector and it is likely to remain so (CMS, 2022). For large firms it is hard to change business and transform into a new (greener) company. Especially not for major oil and gas companies, for whom investments may pay off after multiple decades. In addition, there is a lack of large-scale 'green' investments generating the same ROI compared to what they are used to in the oil and gas industry (Deloitte, 2022). Nevertheless, with more investment in renewable energy, major oil and gas companies automatically accelerate the slow destruction of their trusted fossil fuel business model. To major oil and gas companies, mergers and acquisitions in renewable energy could therefore be considered a secondary importance. While it is not easy for major oil and gas companies to change, the Danish energy firm Ørsted has shown that it is possible. In 2016 Ørsted decided to divest all of its oil and gas activities and to focus entirely on renewable energy sources. This transformation has improved net results while significantly reducing carbon emissions per sold energy quantity (Deloitte, 2022). Atanasova & Schwartz (2019) found that transition to renewable energy is recognized by capital markets in general and therefore increases shareholder value. However, with the factors by which major oil and gas companies are dealing, it is interesting to find whether these findings also hold for these companies.

There already exists some research on the effect of M&A deals within the renewable energy. However, for the last few years there has been an increasing focus on a lower carbon economy, with the Paris Agreement as turning point. Therefore, it is interesting to conduct a study that focusses on the last decade. This study will therefore focus on a more recent timeframe to test whether these results still hold.

Generating renewable energy is an upstream segment of the market, whereas e-mobility is linked to the downstream segment of the market. U.S Environmental Protection Agency stated that 27% of the greenhouse gas emissions in the United States came from transportation in 2020. E-mobilty can be sustainable, relative to conventional ways of transport, if the electricity that is used is renewable and batteries are produced in a sustainable way. Investments in the e-mobility sector are needed to boost the transition to cleaner ways of mobility. Next to that, major oil and gas companies could be left with no one to sell their fuels to when every form of transport has been electrified. In December 2021 a tipping point was reached in Europe, for the first time more electric cars were registered than diesel-powered cars (Hampleton, 2022). The major oil and gas companies are most interested in the EV charging segment of e-mobility, because it is relatively close to the current business operations, thus reducing the risk of stranded assets. Governments of countries such as China, Japan, the US, and Germany are subsidizing the EV charging infrastructure along with R&D for quicker and more efficient charging techniques, this boosts the EV charging stations market growth (Bloomberg 2022). It is important to note that e-mobility is not new, but due to the improving battery capacity, charging speed, and political attention it is a growing popularity more used in transport. In 2021 the EV charging market size reached

USD 6.72 billion, but this is expected to grow to USD 123.12 billion in 2030 (Emergen Research, 2022). Therefore, it is interesting to observe the market reaction on deals in the e-mobility sector. There has not been performed any research on shareholder value due to M&A within the e-mobility industry to best of our knowledge. This paper will therefore attempt to close this gap in the literature.

This study focuses on the period between 2012-01-01 to 2021-12-31 to collect as many deals as possible while keeping the focus on the time period in which there has been an increased attention to climate change. This method shows if M&As in renewable energy or e-mobility increase shareholder value for major oil and gas companies. This paper examines whether, and if so, to what extent, capital markets account for an increase in firm value due to mergers and acquisition in the e-mobility sector by major oil and gas companies. There are eight hypothesis that will be tested.

Eisenbach et al. (2011) concluded that there were positive short-term returns when mergers and acquisitions diversify the company to renewable energy. Later in time, Yoo et al. (2013) found that M&A in renewable energy have negative effects on enterprise value in the short-term for existing energy industries. Johansson and Lüning (2020) also found a negative relationship between diversification and shareholder value on the short-term, however, the results lack statistical significance which limits the reliability. The effects of M&A within the e-mobility industry have not been studied before, but Teti and Tului (2020) found short-term positive and statistically significant abnormal returns of M&A deals within the infrastructure and utility industry. Therefore, the expectation is to see a negative relationship between stock returns and M&A announcements of major oil and gas companies within the renewable energy industry, and a positive relationship within the e-mobility industry.

H1: There is a negative relationship between M&A deals within the renewable energy industry and an acquiring oil and gas company's short-term stock return.

H2: There is a positive relationship between M&A deals within the e-mobility industry and an acquiring oil and gas company's short-term stock return.

The short-term effects reflect the expected synergy between the acquiring firm and a target firm, rather than the realized effects of the merger or acquisition. Therefore, it is also interesting to look at the long-term effects of M&A deals. Existing evidence on long-term acquirer performance suggests negative post-merger performance. Agrawal et al. (1992) find significant negative abnormal returns over five years after a merger. Dutta and Jog (2009) analysed different studies to determine the long-term performance of M&A. They concluded that in general there is a negative relationship between long term abnormal returns and M&A deals. Mirvis (2006) showed that bidders can gain benefits targeting sustainable firms if there is a strategic and cultural fit between the merged firms in the long-term.

Johansson and Lüning (2020) found that in the long-term diversification mergers and acquisitions within the renewable energy industry are value-destroying for shareholders of the acquiring company. Datta et al. (2013) found negative long-term returns within the European utility industry, which could give an indication of the effects within the e-mobility industry. Therefore, the expectation is to see a negative relationship between abnormal returns and M&A announcements of major oil and gas companies within the renewable energy and e-mobility industry.

H3: There is a negative relationship between M&A deals within the renewable energy industry and an acquiring oil and gas company's long-term stock return.

H4: There is a negative relationship between M&A deal announcements within the renewable energy industry and an acquiring oil and gas company's long-term stock return.

Eight of the top ten countries with the most renewable energy installing per person over the past decade are from Europe, only Canada (5th) and Australia (10th) are from outside the region (WEF, 2019). In addition, eight of the top ten countries with the highest plug-in vehicle share of new car sales also were from Europe in 2018 (WEF, 2019). The push towards renewable energy and e-mobility is a wider trend in Europe with stable climate policy of the EU and other European countries aiming at decarbonisation. Which contrasts with the United States, who were not part of the Paris Agreement between 2017 and 2021. Therefore, the expectation is to see a greater effect where a European company is involved as a target than a non-European target within the renewable energy and e-mobility industry.

H5: M&A deals with a European target have greater effects than a non-European target within the renewable energy industry.

H6: M&A deals with a European target have greater effects than a non-European target within the e-mobility industry.

Cash financed acquisitions are both found to be value-adding (Wansley et al., 1983; Travlos, 1987) and value-destroying (Harford, 1999; Johansson and Lüning, 2020). It is therefore interesting whether the method of payment is of importance for shareholder value within the renewable energy and e-mobility industry. The expectation is to see a positive relationship between cash transactions and an acquiring oil and gas company's stock return in both the renewable energy and e-mobility industry.

H7: Cash M&A deals have greater effects than non-cash deals within the renewable energy industry.

H8: Cash M&A deals have greater effects than non-cash deals within the e-mobility industry.

4 Methodology

The idea of event studies is to track the market prices of firms that are involved in the studied event, in order to detect the market reaction (Kliger & Gurevich, 2014). Analysing multiple events of the same type, can help to understand how stock prices react on such events. In this paper an event study is used to measure the impact of a merger or acquisition on a firm's value. By looking at the statistical data a hypothesis can be rejected or accepted. To draw any conclusions from these tests it is necessary to have a sufficient number of available events.

Stock prices are tracked over a period that is potentially relevant for evaluating the effect of the event on the prices of the traded securities, a so called 'event window'. Two different event windows will be formed, a short term and long-term window. The short-term event-window reflects the expected synergy between the acquiring firms and target firm, rather than the realized synergy and new value creation. Therefore, a different methodology is adopted to measure the long-term stock performance. In this way the market reaction on a deal and the long-term value creating of a deal can be measured.

4.1 Event Window

The event of interest for our study is the point in time when the M&A completion announcement is made, this will be referred as T = 0. For the short-term study a three-day event window is used [-1, 1], because it is most common in event studies and to exclude any other events that happened near the announcement. The day prior to the event is included to capture any insider trading or leaked information, which could impact the return on the announcement day itself. For the long-term study the average number of trading days in a year is taken, this leads to an event window of [0, 252].

Next to that, an event study uses an estimation window. This is a period prior to the event and is used to predict the normal return of a security, without the effect of the event. MacKinlay (1997) states that a 120 trading days event window is proper. Mitchell & Stafford (2000) argued that the estimation window and event window should not overlap each other. For this reason, the estimation window ends ten days before the event so possible leaked information is left out [-130, -10].

4.2 Normal Return

To determine the abnormal return, firstly, an expected normal return must be calculated. The expected normal return reflects the stock performance if the event would not have happened. Normal return function as a benchmark against which actual returns can be measured. Practically, there are various ways of assessing normal returns, each of which relies on a predefined model of stock returns and could lead to different results. A few methods are described below.

4.2.1 Market-adjusted return benchmark

The first and most basic model to calculate the normal return is also known as the naïve benchmark. This model assumes that the normal return for all companies is the market return of a broad stock market index, such as the S&P500 or Euro Stoxx 50. This model includes systematic risk but neglects firm specific risk. This model is described by the following equation:

$$R_{i,t} = R_{m,t} + \epsilon_{i,t}$$

where $R_{i,t}$ is the individual stock return at time *t*, and $R_{m,t}$ is the index return at time *t*. The expected value of the residual equals 0.

4.2.2 Constant mean return benchmark

Another basic model to calculate the normal return is the constant mean return model. By averaging past returns the predicted return for a security is estimated. Brown and Warner (1980, 1985) argued that the constant mean return model often predicts similar results to those of more sophisticated models, because a more sophisticated model does not reduce the variance of the residuals much. The constant mean return model does not account for market factors or risks. The model is described by the following equation:

$$R_{i,t} = E(R_{i,t}) + \epsilon_{i,t}$$

where $R_{i,t}$ is the individual stock return at time *t*, and $E(R_{m,t})$ is the expected return at time *t* based on the average past returns. The expected value of the residual equals 0.

4.2.3 The Single-Factor model (Market model)

The single-factor model, also known as the market model, was invented by Sharpe (1963) and is a more advanced model. It is a statistical model that looks at linear relations between stock returns and market returns (Campbell et al., 1997). This model includes a stocks' beta, which reflects the sensitivity between stock prices and changes of the market (Kliger & Gurevich, 2014). This model is described by the following equation:

$$R_{i,t} = a_i + \beta_i R_{m,t} + \epsilon_{i,t}$$

where $R_{i,t}$ is the individual stock return at time *t*, a_i is the intercept, β_i is the beta of a security, and $R_{m,t}$ is the index return at time *t*. The expected value of the residual equals 0.

4.2.4 Capital Asset Pricing Model

The Capital Asset Pricing Model, also known as CAPM-model, describes the linear relationship between the expected return and the risk that comes along with the security. The model was independently developed by Sharpe (1964), Lintner (1965), and Mossin (1966). The performance of a security is expected to be equal to the risk-free rate return plus a risk premium. This premium is based on the beta of the security. This model is described by the following equation:

$$R_{i,t} = R_{f,t} + \beta_i(R_{m,t} - R_{f,t}) + \epsilon_{i,t}$$

where $R_{i,t}$ is the individual stock return at time *t*, $R_{f,t}$ is the risk-free rate, β_i is the stocks' beta, and $R_{m,t}$ is the index return at time *t*. The expected value of the residual equals 0.

4.2.5 The Three-Factor benchmark

Multifactor benchmarks include additional sources of systematic stocks returns. The different factors are included to increase the explanatory power of return models. Fama and French (1993) added two additional factors to the CAPM-model, the first is a size-premium and the second is a book-to-market premium. SMB_t is the difference between the average returns of small-stock portfolios and the average returns of big-stock portfolios. HML_t account for the difference between the returns of high book-to-market firms over low book-to-market firms. This model is described by the following equation:

$$R_{i,t} = R_{f,t} + a_i + \beta_i(R_{m,t} - R_{f,t}) + S_i(SMB_t) + H_i(HML_t) + \epsilon_{i,t}$$

where $R_{i,t}$ is the individual stock return at time *t*, $R_{f,t}$ is the risk-free rate, β_i is the stocks' beta, and $R_{m,t}$ is the index return at time *t*. S_i and H_i represent the factors of respectively SMB_t and HML_t are the factors described above. The expected value of the residual equals 0.

In the literature there is still an ongoing discussion on which methodology is the best performing in most cases and all the different methodologies are widely used. Brown and Warner (1980) state that there is no evidence that more complicated methodologies to calculate the normal return provide any benefit to a simple, one-factor model. In addition, the market model is the most frequently used model to calculate the expected normal return. For these reasons, the market model is used to calculate normal returns.

4.3 Abnormal Return

The abnormal return is the first and foremost indicator of the market reaction to an M&A-announcement (Kliger & Gurevich, 2014). The abnormal return is the actual return minus the expected normal return, as shown below:

$$AR_{i,t}\ (Abnormal\ Return) = Actual\ Return_{i,t} - Expected\ Normal\ Return_{i,t}$$

There are different ways to calculate the abnormal return within an event-window, which will be described below.

4.3.1 Cumulative Abnormal Return (CAR)

By adding up individual abnormal returns the impact of an event within a certain event window can be measured, this constitutes the Cumulative Abnormal Return (CAR). CAR is described by the following equation:

$$CAR_{i,t} = \sum_{t=1}^{\tau} AR_{i,t}$$

4.3.2 Buy-and-Hold Abnormal Return (BHAR)

The CAR-method assumes that investors buy the security at the beginning and sell it at the end of the event window, which is very unlikely in practice (Johansson & Lüning, 2020). The Buy-and-Hold Abnormal Return methodology (BHAR) is based on investing for a long time period, which is more likely in practice. The security that underwent the event is compared to the return of a portfolio consisting of similar, event-unrelated securities over the same time period (Kliger & Gurevich, 2014). BHAR is described by the following equation:

$$BHAR_{i,\tau} = \prod_{t=1}^{\tau}(1 + R_{i,t}) - \prod_{t=1}^{\tau}(1 + E[R_{i,t}])$$

Where $BHAR_{i,t}$ is the abnormal return of the security *i* over the period τ, $R_{i,t}$ is the return of the security at *t*, $R_{m,t}$ is the index return at *t*.

In this paper the CAR is used for the short-term study. Barber and Lyon (1997) and Kothari and Warner (1997) show that CARs are positively biased estimators, while BHARs were negatively biased. This initiated that the BHAR methodology is a more appropriate estimator for the long-term event study because it "precisely measures investor experience". Fama (1998) stated that the BHAR methodology ideal, because imperfect expected returns lead to compounding systematic errors in the long-term. Fama encouraged to use the monthly calendar-time portfolio approach instead to measure long-term abnormal performance. Other researchers pointed out that the calendar-time portfolio approach is less suitable to detect abnormal performance, because it averages over months of ‘hot’ and ‘cold’ event activity, they still prefer to use the BHAR methodology to measure long-term abnormal returns. (Mitchell & Stafford, 2000).

In a sample event study that holds multiple observations of individual event types, such as this one, a Cumulative Average Abnormal Return (CAAR) can be calculated. In this way the impact of a typical event can be measured over a pool of firms. CAAR is described by the following equation:

$$CAAR_{\tau} = \frac{1}{N}\sum_{i=1}^{N} CAR_{i,\tau}$$

The natural logarithm of the stock or index prices has been used to transform it into daily returns. It enables adding up or subtracting different returns, which is not possible with simple returns. The daily return is described by the following equation:

$$R_{i,t} = \ln[\frac{P_{i,t}}{P_{i,t-1}}]$$

$R_{i,t}$ represents the return on day t, $P_{i,t}$ is the adjusted closing price on the day *t*, and $P_{i,t-1}$is the adjusted closing price on day *t*-1.

The S&P 500 Integrated Oil & Gas Sub Industry Index has been used as reference portfolio, in this way some systematic risks of the oil and gas industry, such as soaring market prices, have been minimalized.

4.4 Regression Models

4.4.1 Short-term Hypotheses

The Ordinary Least Squares (OLS)-method is used to test H1 and H2, the short-term hypotheses. H1 states there is a negative relationship between M&A deals within the renewable energy industry and an acquiring oil and gas company’s short-term stock return. H2 states that there is a positive relationship between M&A deals within the e-mobility industry and an acquiring oil and gas company’s short-term stock return. OLS is a common technique to estimate coefficients of linear regressions which describe the relationship between a dependent variable and one or more independent variables. For these short-term hypotheses, the CAR has been used as dependent variable, which is calculated by the market model. The first independent variable that is used, is the dummy variable *Cash*. The variable takes a value of 1 if it is known that the deal has been paid with cash and 0 otherwise. The second independent variable is the dummy *European target*, which takes the value of 1 if the target is established in Europe and 0 otherwise. For the renewable energy industry, the dummy variables *Wind*, *Solar* and *Diversified* are added to see whether the type of target tent to be of importance for the acquiring firms' return. If the target is operational in the wind turbine market or an operator of a wind farm the variable *Wind* takes the value of 1 and 0 otherwise. If the target is operational in the solar market or a solar farm operator, the variable *Solar* takes a value of 1 and 0 otherwise. The variable *Diversified* takes a value of 1 if the firm combines different renewable energy sources or energy saving techniques, and 0 otherwise. Several regressions have been performed, both univariate as multivariable, with the event window [-1, 1]. By adding the extra control variables to a regression, the explanatory power of the models is increased. To counter any biasedness due to heteroskedasticity, all the regressions are performed using robust standard errors.

The model that is used to test H1 is described by the following equation, we call this model A:

$$Model\ A: CAR_i = \beta_0 + \ \beta_1 Cash + \beta_2 European\ target + \beta_3 Wind + \beta_4 Solar + \beta_5 Diversified + u_i$$

The model that is used to test H2 is described by the following equation, we call this model B:

$$Model\ B: CAR_i = \beta_0 + \ \beta_1 Cash + \ \beta_2 European\ target + u_i$$

If β_0 > 0 with enough significance under the one-tailed test, we can reject a hypothesis.

4.4.2 Long-term Hypotheses

The OLS-method is also used to test H3 and H4, which state that announcements of M&A deals for major oil and gas companies within the renewable energy and e-mobility industry respectively, are value destroying in the long-term. For the long-term study, the BHAR has been used as dependent variable. The first independent variable that is used, is the dummy variable *Cash*. The variable takes a value of 1 if it is known that the deal has been paid with cash and 0 otherwise. The second independent variable is the dummy *European target*, which takes the value of 1 if the target is located in Europe and 0 otherwise. For the renewable energy industry, the dummy variables *Wind*, *Solar* and *Diversified* are added to see whether the type of target tent to be of importance for the acquiring firms' return. If the target is operational in the wind turbine market or an operator of a wind farm the variable *Wind* takes the value of 1 and 0 otherwise. If the target is operational in the solar market or a solar farm operator, the variable *Solar* takes a value of 1 and 0 otherwise. The variable *Diversified* takes a value of 1 if the firm combines different renewable energy sources or energy saving techniques, and 0 otherwise. Several regressions have been performed, both univariate as multivariable, with the event window [0, 252]. By adding the extra control variables to a regression, the explanatory power of the models is increased. To counter any biasedness due to heteroskedasticity, all the regressions are performed using robust standard errors. It turned out that it was impossible to add the variable *European target dummy* in the long-term regression for the e-mobility sector due to the fact that every deal used had a European target.

The model that is used to test H3 is described by the following equation, we call this model C:

$$Model\ C: BHAR_i = \beta_0 + \beta_1 Cash + \beta_2 European\ target + \beta_3 Wind + \beta_4 Solar + \beta_5 Diversified\ + u_i$$

The model that is used to test H4 is described by the following equation, we call this model D:

$$Model\ D: BHAR_i = \beta_0 + \ \beta_1 Cash + \ \beta_2 European\ target + u_i$$

If $\beta_0 > 0$ with enough significance under the one-tailed test, we can reject a hypothesis.

H5 and H6 state that announcements of M&A deals where there was a European target are value-adding for the shareholders of an acquiring major oil and gas company within the renewable energy and e-mobility industry, respectively. H7 and H8 state that cash M&A deals have greater effects than non-cash deals within the renewable energy and e-mobility industry, respectively. To test the H5, H6, H7, and H8, we will look at both the short- and long-term models.

5 Data

Data about past mergers and acquisitions is needed to perform an accurate event-study. Bloomberg is used as the main dataset to collect these deals and has provided financial data such as stock prices and market capitalizations. Other financial datasets such as ThomsonOne, Zephyr's, and Yahoo Finance have been used to complement the data. In this study daily stock returns have been used, as these have a better distribution than monthly stock returns. In addition, daily stock returns are preferably when there is no uncertainty over the precise announcement date (Morse, 1984).

5.1 Selection criteria acquirer

The next step is to define the acquiring companies, the major oil and gas companies. As stated before, the scale of the cost of writing off stranded assets can differ between up-, mid-, and downstream companies. Additionally, a lot of upstream oil and gas companies are state-owned, which limit the availability of daily stock prices and transparency. Due to these reasons, this study will only focus on companies that are integrated into the whole oil and gas production process. In this way, an investor could account for a weighted average of stranded capital within the oil and gas sector. The second criterium for selecting the data is that the acquiring companies must be listed on a stock exchange. This is necessary to measure the abnormal return. This study focusses only on North American and European companies, because in these regions the market for mergers and acquisition is the most mature (Institute for Mergers, Acquisitions and Alliances, 2022). At last, the acquirer needs a market capitalization of over \$25b, so it has significant buying power. A comprehensive overview of the selection criteria for the acquirer is shown below in Table 1. The selection criteria resulted in a list of companies that will be studied, which is set out in Table 2.

Table 1: Selection criteria acquirer

Category	Criteria
Sector	Integrated Oils
Public status	Listed
Region	North America and West Europe
Market capitalization	> $25,000,000,000

The table provides the requirements to select the sample acquiring companies.

Table 2: List of companies

Exxon Mobil	BP PLC
Chevron	Suncor Energy
Shell PLC	Eni SpA
TotalEnergies SE	Cenovus Energy
Equinor ASA	Imperial Oil

The table provides an overview of the sample companies.

5.2 Selection criteria deals

A comprehensive overview of the selection criteria for the deal is shown below in Table 3.

Table 3: Deal criteria

Category	Criteria
Deal status	Completed
Completion date	2012-01-01 to 2021-12-31
Target industry 1	Renewable energy
Target industry 2	E-mobility

The table provides the requirements to select the sample deals.

First, the deal needs to be completed, this is necessary to avoid possible effects from failed acquisitions or mergers. Second, this study focuses on the period between 2012-01-01 to 2021-12-31 to collect as many deals as possible while keeping the focus on the time period in which there has been an increased attention to climate change. At last, only deals within the renewable energy or e-mobility sector are selected.

5.2.1 Renewable Energy and E-mobility criteria

To collect all deals within the scope of 'renewable energy' this study used the Bloomberg database. With all the criteria filled in, a list was produced of all M&A deals of major oil and gas companies. The deals that are within the scope of renewable energy were manually picked from this list. This resulted in total of 31 deals. From the same list of all M&A deals, the deals that fall within the scope of e-mobility were manually picked. This resulted in a total of 8 deals.

5.3 Deal characteristics

The selection criteria for the acquirer and deals resulted in a list for the short-term study of 31 observations within the renewable energy industry and 8 observations within the e-mobility industry. For the long-term study a few of the observations had to be removed from the list since the event window lies in the future. This makes it impossible to measure the long-term abnormal return. A comprehensive overview of the deal characteristics is shown in Table 4 below. Here, the quantity of cash deals per study is stated and the number of deals per company is shown. It is remarkable that not all of the major oil and gas companies were active in M&A market within the timeframe.

Table 4: Sample observations

Industry	Renewable Energy	E-mobility	Renewable Energy	E-mobility
Event window	[-1, 1]	[-1, 1]	[0, 252]	[0, 252]
N	31	8	20	5
Variables				
Cash	18	5	11	2
Non-Cash	13	3	9	3
European target	21	7	13	5
Non-European target	10	1	7	0
Wind	8	-	6	-
Solar	7	-	4	-
Diversified	8	-	6	-
Acquirers				
Exxon Mobil	0	0	0	0
Chevron	0	0	0	0
Shell PLC	8	3	5	2
TotalEnergies SE	9	2	9	2
Equinor ASA	3	0	1	0
BP PLC	4	2	2	1
Suncor Energy	0	0	0	0
Eni SpA	7	1	3	0
Cenovus Energy	0	0	0	0

Imperial Oil	0	0	0	0

The table provides the number of observations of both the short-term and long-term study per industry, renewable energy or e-mobility. N gives the total observations per event window and industry. The variables *Cash* and *European target* show the distribution of the total observations on these dummy variables. Under '*Acquirers'* the distribution of total observations is shown per company.

Table 5 below shows statistics of the abnormal returns from the M&A announcements within the different industries. Since there are outliers in the CARs and BHARs for the renewable energy deals, these have been winsorized at 5 and 95 percentile. In this way all observations can be used as dependent variables in the regressions. The appendix holds tables with statistics of the abnormal returns per variable.

Table 5: Descriptives on all CARs and BHARs for the M&A deal announcements

	Cumulative abnormal returns (CARs)		Buy-and-Hold Abnormal Returns (BHARs)	
Industry	Renewable energy	E-mobility	Renewable energy	E-mobility
Event window	[-1, 1]	[-1, 1]	[0, 252]	[0, 252]
N	31	8	20	5
Mean	-0.0100	0.0023	0.0953	0.0080
Median	-0.0014	-0,0014	0,0446	0,0294
Minimum	-0.1571	-0.0074	-0.1351	-0.2049
Maximum	0.0275	0.0334	0.3593	0.1258
Standard deviation	0.0333	0.0133	0.1279	0.1269
Skewness	-3.0249	1.8427	0.3616	-1.0603
Kurtosis	13.6343	5.0149	2.3831	2.7239

The table provides statistics of the abnormal returns from the M&A announcements within the renewable energy and e-mobility industry. CARs are calculated by the market model over the event window [-1, 1], BHARs are calculated over a long-term event window [0, 252].

6 Results

In Table 6 below, the results of the first short-term study are presented. It provides information of the regressions on the Cumulative Abnormal Returns (CARs) of major oil and gas companies at M&A announcements within the renewable energy industry. The CARs over the event window [-1, 1] are calculated using the market model. The first five regressions are univariate regressions of model A with the dummy variables *Cash*, *European target*, *Wind*, *Solar*, and *Diversified*. The sixth regression is the multivariate analysis of model A.

Table 6: Regressions on Cumulative Abnormal Returns of Renewable Energy Deals

Model	(1)	(2)	(3)	(4)	(5)	(6)
Event Window	[-1, 1]	[-1, 1]	[-1, 1]	[-1, 1]	[-1, 1]	[-1, 1]
Dependent variable	CAR	CAR	CAR	CAR	CAR	CAR
N	31	31	31	31	31	31
$\mathbf{R^2}$	0.015	0.075	0.004	0.000	0.001	0.100
Adjusted $\mathbf{R^2}$	-0.019	0.043	-0.031	-0.034	-0.034	-0.080
Cash	0.005					0.004
	(0.009)					(0.010)
European target		-0.013*				-0.014*
		(0.007)				(0.008)
Wind			0.003			0.005
			(0.011)			(0.012)
Solar				0.000		-0.003
				(0.009)		(0.014)
Diversified					0.001	0.000
					(0.008)	(0.012)
Constant	-0.010	0.001	-0.008*	-0.007	-0.007	-0.002
	(0.007)	(0.005)	(0.004)	(0.005)	(0.005)	(0.007)

The table reports six regressions of model A within the renewable energy industry. The dependent variable CAR is calculated using the market model over an event window of [-1, 1], *Cash*, *European target*, *Wind*, *Solar*, and *Diversified* are explanatory variables. Robust standard errors in parentheses, all tests are one-tailed: *p < 0.10, **p < 0.05, ***p < 0.01. All CARs are winsorized at 5 & 95 percentile.

Looking at the results in Table 6, the *Constant* is statistically significant under 10% in the univariate regression with *Wind* as explanatory variable. There is a lack of statistical significance for the dummy variables *Cash*, *Wind*, *Solar*, and *Diversified* in the univariate and multivariate model. The measured effects are too small to significantly differ from zero, to draw any conclusions. The relatively small size and insignificancy of the coefficient of the *Constant* in the multivariate model means that it cannot be concluded that deal announcements in the renewable energy industry are in the short-term neither value-adding nor value destroying. The dummy variable *European target* shows a negative effect being statistically significant at 10%.

In Table 7 below, the results of the second short-term study are presented. It provides information of the regressions on the Cumulative Abnormal Returns of stock returns of major oil and gas companies at M&A announcements within the e-mobility industry. The CARs are calculated using the market model, and over the event window [-1, 1]. The first two regressions are univariate regressions of model B with the dummy variables *Cash* and *European target*. The third regression is the multivariate analysis of model B.

Table 7: Regressions on Cumulative Abnormal Returns of E-mobility Deals

Model	(1)	(2)	(3)
Event Window	[-1, 1]	[-1, 1]	[-1, 1]
Dependent variable	CAR	CAR	CAR
N	8	8	8
$\mathbf{R^2}$	0.104	0.062	0.232
Adjusted $\mathbf{R^2}$	-0.045	-0.0947	-0.075
Cash	0.008		0.011
	(0.008)		(0.010)
European target		-0.009	0.014
		(0.006)	(0.010)
Constant	-0.003	-0.006	-0.017
	(0.002)	(0.011)	(0.010)

The table reports three regressions of model B within the renewable energy industry. The dependent variable CAR is calculated by the market model, *Cash* and *European target* are explanatory variables. Robust standard errors in parentheses, all tests are one-tailed: *p < 0.10, **p < 0.05, ***p < 0.01. All CARs are not winsorized.

Looking at the results of Table 7, there is a lack of statistical significance for both variables and the *Constant* in all the three models. The measured effects are too small to significantly differ from zero, to draw any conclusions. Although it is still interesting to see the sign and size of the coefficient. The slightly negative coefficient of the *Constant* in the multivariate model suggests that deal announcements in the e-mobility industry are in the short-term value destroying for shareholders of the acquiring major oil and gas company. The insignificancy also indicates that the small number of observations weights on the efficiency of the tests.

In Table 8 below, the results of the first long-term study are presented. It provides information of the regressions on the Buy-and-Hold Abnormal Returns (BHAR) of major oil and gas companies after M&A announcements within the renewable energy industry. The BHAR is calculated over the event window [0, 252]. The first five regressions are univariate regressions of model C with the dummy variables *Cash*, *European target*, *Wind*, *Solar*, and *Diversified*. The sixth regression is a multivariate analysis of model C with the five variables included.

Table 8: Regressions on Buy-and-Hold Abnormal Returns of Renewable Energy Deals

Model	(1)	(2)	(3)	(4)	(5)	(6)
Event Window	[0, 252]	[0, 252]	[0, 252]	[0, 252]	[0, 252]	[0, 252]
Dependent variable	BHAR	BHAR	BHAR	BHAR	BHAR	BHAR
N	20	20	20	20	20	20
$\mathbf{R^2}$	0.000	0.049	0.167	0.001	0.027	0.249
Adjusted $\mathbf{R^2}$	-0.056	-0.004	0.121	-0.055	-0.027	-0.020
Cash	0.000					0.028
	(0.051)					(0.047)
European target		-0.051				-0.034
		(0.058)				(0.058)
Wind			-0.098*			-0.136*
			(0.056)			(0.073)
Solar				-0.007		-0.075
				(0.064)		(0.072)
Diversified					0.039	-0.033
					(0.049)	(0.058)
Constant	0.094***	0.128**	0.124***	0.096***	0.083**	0.167**
	(0.032)	(0.052)	(0.026)	(0.029)	(0.033)	(0.071)

The table reports six regressions of model C within the renewable energy industry. BHAR as dependent variable and *Cash*, *European target*, *Wind*, *Solar*, and *Diversified* as explanatory variables. Robust standard errors in parentheses, all tests are one-tailed: *p < 0.10, **p < 0.05, ***p < 0.01. All BHARs are winsorized at 5 & 95 percentile.

Viewing the results of Table 8, the first, third, and fourth univariate model show that the effect of *Constant* is statistically significant under 1%, and for the second, fifth, and sixth model there is significance under 5%. The positive coefficient on all the six models suggests that deal announcements in the renewable energy industry are in the long-term value-adding for shareholders of the acquiring major oil and gas company. The explanatory variable *Wind* shows a significant effect under 10%, targets that operate in the market of wind energy production are therefore value-destroying for acquirers' shareholders.

In Table 8 below, the results of the second long-term study are presented. It provides information of the regression on the Buy-and-Hold Abnormal Return (BHAR) of stock returns of major oil and gas companies at M&A announcements within the e-mobility industry. The BHAR is calculated over the event window [0, 252]. The dummy variable *Cash* is added as explanatory variable.

Table 9: Regression on Buy-and-Hold Abnormal Returns of E-mobility Deals

Model	(1)
Event Window	[0, 252]
Dependent variable	BHAR
N	5
$\mathbf{R^2}$	0.134
Adjusted $\mathbf{R^2}$	-0.155
Cash	0.085
	(0.102)
Constant	-0.023
	(0.102)

The table reports the regression of model D on BHAR within the e-mobility industry. Robust standard errors in parentheses, all tests are one-tailed: *p < 0.10, **p < 0.05, ***p < 0.01. All BHARs are not winsorized.

Looking at the results of Table 9, there is a lack of statistical significance for the *Constant* and the dummy variable *Cash*. The measured effects are too small to significantly differ from zero. The relatively small size and insignificancy of the coefficient of the *Constant* in the model means that it cannot be concluded that deal announcements in the e-mobility industry are in the long-term neither value-adding nor value-destroying. The insignificancy also indicates that the small number of observations weights on the efficiency of the tests.

7 Discussion

The results of both the short-term studies, within renewable energy and e-mobility, lack statistical significance which limit the reliability. However, it is impossible to draw any hard conclusions of these results, the findings could still give an indication of the effects. For the renewable energy industry, the results show a relatively small negative *Constant* in all the models. This is in line with H1, which stated that there is a negative relationship between M&A deals within the renewable energy industry and an acquiring oil and gas company's short-term stock return. In addition, it is in line with prior research from Yoo et al. (2013) and Johannson & Lüning (2020) but is not in line with the research of Eisenbach et al. (2011). For the e-mobility industry study the results show a negative short-term abnormal return in the multivariable model. This is not in line with H2, which stated that there is a positive relationship between M&A deals within the e-mobility industry and an acquiring oil and gas company's short-term stock return, but we cannot reject this hypothesis due to a lack of significance. Although the statistical significance is missing, it can be seen as in line with the research of Eisenbach et al. (2011). Diversifying towards e-mobility is somewhat recognized by the shareholders as a good move or at least not a bad move. These findings are not in line with Teti and Tului (2020) who found positive short-term abnormal returns of M&A deals within the infrastructure and utility industry.

The long-term study results show something different. The *Constant* of the BHAR regression within the renewable energy industry is positive and statistically significant. This is not in line with H3 and prior research (Johansson and Lüning, 2020) which indicated a negative relation between abnormal returns and M&A deals within the renewable energy industry. We can therefore reject H3 under a significance level of 5%. These results suggest that this M&A activity is valued more in the last few years. the *Constant* in Table 8 shows a negative relationship between abnormal returns and M&A deals within the e-mobility industry. This is in line with H4, which stated that announcements of M&A deals for major oil and gas companies within e-mobility industry are value destroying in the long-term, and prior research (Datta et al., 2013). However, the long-term study results within the e-mobility industry are not statistically significant and should therefore be considered with caution. We fail to reject the fourth hypothesis which stated that announcements of M&A deals for major oil and gas companies within e-mobility industry are value-destroying in the long-term.

The coefficients of the variable *European target* within the renewable energy industry are negative in both the short- and long-term (Table 6 and 8), with statistical significance under 10% for the short-term model. We can reject H5, which stated that the effects from M&A deals within the renewable energy industry where there was a European target are greater than a non-European target, under a significance level of 10%. To test H6, which stated that the effects from M&A deals within the e-mobility industry where there was a European target are greater than a non-European target, we could only look at the short-term study. This is due to a lack of non-European targets in the long-term study. The coefficient of the variable *European target* indicates a negative relationship in the univariate model and a positive relationship in the multivariable model, both insignificant (Table 7). Therefore, it is not possible to ascertain clear effects and we fail to reject H6.

The coefficients of the variable *Cash* within the renewable energy and e-mobility industry are positive in both the short- and long-term (Table 6, 7, 8, and 9). Although the results are insignificant, the sign is in line with prior research of Wansley et al. (1983) and Travlos (1987) and in line with H7 and H8, which stated that cash M&A deals have greater effects than non-cash deals within the renewable energy and e-mobility industry, relatively.

8 Conclusion

In this paper different hypotheses were tested by an event study approach. The hypotheses were relevant to the research question: “Do mergers and acquisitions in renewable energy or e-mobility change major oil and gas company’s stock valuations?”. This study focussed on M&A deals where major oil and gas companies acted as acquirers over a time period of 01/01/2012 till 31/12/2021. To measure short-term effects the Cumulative Abnormal Return was calculated by the market model over the event window [-1, 1]. The BHAR-method was used to measure long-term effects over a larger event window [0, 252]. The results conclude that short-term effects of M&A deals on abnormal returns are negative for both the renewable energy and e-mobility industry. This was expected for the renewable energy but not for the e-mobility industry. However, no hard conclusions could have been drawn from these results due to a lack of statistical significance. In the long-term study the results were more surprising. The results showed a positive abnormal return, statistically significant under 5%, for M&A deals within the renewable energy industry, which is not in line with prior research. The long-term study within the e-mobility industry showed a negative relationship between M&A deals and stock performance. In this case there was a lack of statistical insignificance, which limits the reliability. The overall negative relationships indicate that the factors by which major oil and gas companies are dealing influence the effect of market reactions to green M&A deals.

Surprisingly the results showed a negative relationship with abnormal returns and M&A deals where the target was European. However, only the results of the short-term study within the renewable energy industry were statistically significant enough to reject the hypothesis that there is a positive relationship between European targets and abnormal returns. At last, the results showed that the effects from M&A cash M&A deals have greater effects than non-cash deals within the renewable energy and e-mobility industry, but it lacked statistical significance.

A major restriction of this study is the relatively small size of the sample of deals in both short-term as long-term, which makes it difficult to measure an actual trend. This is caused by the selection criteria for acquirers and deals. This study has focused on major oil and gas companies so that it was not possible for them to change their business in a year. Because of the magnitude of the companies, it is more difficult to achieve abnormal returns from a single deal, this may have caused the insignificant results of the study. With more M&A deals coming up within the renewable energy and e-mobility industry in the future, this can be studied with more data, which increases the reliability. This study focused on the North American and West European oil and gas companies, however the M&A industry in Asia is becoming more mature in time. This market can be the focus for next research. Next to that, further research could focus on a better trade-off between the magnitude of the companies and the impossibility to change the business in a short period.

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Appendix I – Descriptives of different variables

Table A: Descriptives on CARs and BHARs for the M&A deal announcements for the variable *Cash*

	Cumulative Abnormal Returns (CARs)		Buy-and-Hold Abnormal Returns (BHARs)	
Industry	Renewable energy	E-mobility	Renewable energy	E-mobility
Event window	[-1, 1]	[-1, 1]	[0, 252]	[0, 252]
Cash				
N	18	5	11	2
Mean	-0.0098	0.0054	0.0960	0.0588
Median	-0.0014	-0.0014	0.0569	-
Minimum	-0.1571	-0.0058	-0.0135	0.0573
Maximum	0.0267	0.0334	0.3593	0.0603
Standard deviation	0.0384	0.0164	0.1535	0.0021
Skewness	-3.3398	1.2123	0.3286	-
Kurtosis	13.5889	2.8012	2.0342	-
Non-Cash				
N	13	3	9	3
Mean	-0.0102	-0.0028	0.0945	-0.0259
Median	0.0001	-0.0006	0.0693	0.0015
Minimum	-0.0675	-0.0074	-0.0201	-0.2049
Maximum	0.0275	-0.0004	0.2618	0.1258
Standard deviation	0.0262	0.0040	0.0969	0.1670
Skewness	-0.9079	-0.7053	0.3451	-0.2927
Kurtosis	3.0895	1.5000	1.9385	1.5000

The table provides statistics of the abnormal returns from the M&A announcements within the renewable energy and e-mobility industry of the variable *Cash*. CARs are calculated by the market model over the event window [-1, 1], BHARs are calculated over a long-term event window [0, 252].

Table B: Descriptives on CARs and BHARs for the M&A deal announcements for the variable *European target*

	Cumulative Abnormal Returns (CARs)		Buy-and-Hold Abnormal Returns (BHARs)	
Industry	Renewable energy	E-mobility	Renewable energy	E-mobility
Event window	[-1, 1]	[-1, 1]	[0, 252]	[0, 252]
European target				
N	21	7	13	5
Mean	-0.0155	0.0035	0.0710	0.0080
Median	-0.0014	-0.0006	0.0569	0.0294
Minimum	-0.1571	-0.0074	-0.1351	-0.2049
Maximum	0.0119	0.0334	0.2709	0.1258
Standard deviation	0.0383	0.0139	0.1077	0.1269
Skewness	-2.6734	1.6601	0.0826	-1.0603
Kurtosis	10.1343	4.3093	2.6215	2.7239
Non-European target				
N	10	1	7	0
Mean	0.0015	-0.0058	0.1405	-
Median	-0.0021	-0.0058	0.0693	-
Minimum	-0.0125	-0.0058	-0.0636	-
Maximum	0.0275	-0.0058	0.3593	-
Standard deviation	0.0150	-	0.1579	-
Skewness	0.8390	-	0.1021	-
Kurtosis	2.3372	-	1.5493	-

The table provides statistics of the abnormal returns from the M&A announcements within the renewable energy and e-mobility industry of the variable *European target*. CARs are calculated by the market model over the event window [-1, 1], BHARs are calculated over a long-term event window [0, 252].

Table C Descriptives on CARs and BHARs for the M&A deal announcements for the variables *Wind*, *Solar*, and *Diversified*

	Cumulative Abnormal Returns (CARs)	Buy-and-Hold Abnormal Returns (BHARs)
Industry	Renewable energy	Renewable energy
Event window	[-1, 1]	[0, 252]
Wind		
N	8	6
Mean	-0.0161	0.0137
Median	0.0016	0.0130
Minimum	-0.1571	-0.1351
Maximum	0.0267	0.2709
Standard deviation	0.0586	0.1381
Skewness	-2.0301	1.0992
Kurtosis	5.5526	3.2320
Solar		
N	7	4
Mean	-0.0071	0.1107
Median	-0.0002	0.0446
Minimum	-0.0507	-0.0042
Maximum	0.0119	0.3593
Standard deviation	0.0208	0.1673
Skewness	-1.4562	1.0898
Kurtosis	3.9206	2.2900
Diversified		
N	8	6
Mean	-0.0060	0.1220
Median	0.0001	0.1042
Minimum	-0.0326	0.0024
Maximum	0.0275	0.2618

Standard deviation	0.0175	0.0901
Skewness	0.5244	0.3230
Kurtosis	3.1289	2.2119

The table provides statistics of the abnormal returns from the M&A announcements within the renewable energy and e-mobility industry of the variables *Wind*, *Solar*, and *Diversified*. CARs are calculated by the market model over the event window [-1, 1], BHARs are calculated over a long-term event window [0, 252].