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Do Mergers and Acquisitions Increase Shareholder value? – An Event Study of companies within the renewable energy/cleantech industry

Master's Thesis in Finance and Accounting

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Abstract

This thesis research whether mergers and acquisitions in the renewable energy industry create value for the acquiring firms' shareholders. To research this, an event study methodology has been employed where three different event windows are studied in the short term, and one event window is studied in the long term. All acquirers are listed in either Europe or the US, and the short-term samples consists of 150 deals, whereas the long-term sample consists of 133 deals between 2000 and 2018. To measure the acquiring firms' added shareholder value, the study focuses on abnormal returns following an acquisition. A robustness test was conducted by performing the regression on the US and Europe sample separately, yielding similar results. The short-term study uses the cumulative abnormal returns, whereas the long-term study uses buy-and-hold abnormal return. The results of the short-term study indicate that mergers and acquisitions in renewable energy are value-adding for the shareholders of the acquirer, lending support to previous research in the field. However, the findings in the long-term study imply that mergers and acquisitions are value-destroying for the shareholders. Finally, the findings in general lack statistical significance with several results conflicting with previous empirical findings.

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1. Introduction

1.1. Background

As the world population grows at an exponential rate, the need and demand for energy in general and electricity in particular, grows in parallel. Coupled with an increasing demand for clean, carbon-neutral energy, the renewable energy sector will be the focus going forward. One of humanity's biggest worries currently is the ever-increasing global temperature levels. Global warming is of particular interest due to the idea of climate tipping points, defined as thresholds that when crossed cause irreversible change to the climate system, and associated risks with crossing these tipping points increase with higher temperature levels (IPCC, 2014). Addressing this problem, finding solutions to limit global warming to below 2°C above pre-industrial levels, and mitigating the effects of climate change was the goal of the Paris Agreement in 2015 (UN, 2015).

The global investment in renewable energy has been trending upwards during most of the 21st century. According to the United Nations Environment Programme (UNEP), global investments in renewable energy experienced rapid growth during the 2000's, increasing from $46 billion in 2004 to $162 billion in 2009 (UNEP, 2010). In the US, investments in renewable energy amounted to $11.4 billion in 2005 compared to $46.5 billion in 2018. In comparison, investments in renewable energy in Europe amounted to $32.5 billion in 2005 and $62.2 billion in 2018 (UNEP, 2019). To put this into perspective, investments in renewable energy would have to increase from the current level of 2% of GDP to a level of 2.8% of GDP (representing €520-575 billion) annually in order to achieve a net-zero greenhouse gas economy (European Commission, 2018). According to IEA (2019), global government research and development (R&D) spending witnessed a 5% year-on-year increase, amounting to $26 billion. Furthermore, the European Commission (EC) approved €3.2 billion in funding from seven member states in a pan-European R&D project in battery technology (EC, 2019).

As technology continues to advance, many smaller actors spawn in the increasingly fragmented renewable energy market (Patel, Seitz and Yanosek, 2017). This fragmentation in the business environment leads to a sub-optimal usage of resources, which can be helped by a consolidation of the market. This would result in cost reductions and economies of scale, consequently leading to better resource allocation. Deloitte (2020) cite cost reductions, increased

competitiveness of battery storage, and rising capacity factors of renewable energy as the primary drivers of growth in the renewable energy sector in the US in 2019, and these drivers are believed to facilitate further growth in 2020. Wüstenhagen, R. and Menichetti, E. (2012) underline the strategic choices for investments in renewable energy and how they are influenced by energy policies. Furthermore, that the cleantech market is dependent on government support to an extent above normal. It is concluded that idiosyncrasies distinguish the renewable energy industry from traditional industries, resulting in positive deal premiums. Additionally, investments in renewable energy are described as a function of the traditional risk-reward framework. It is discussed how energy policies are being set to increase the risk-reward for investments in renewable energy. Weight is also put on diversification and how renewable energy assets might provide a positive diversification effect to a portfolio of conventional energy. Furthermore, the diversification within the renewable energy sector itself is also of importance, investing in both solar and wind energy is likely more favourable than just investing in one of them.

Furthermore, in a survey by KPMG (2018), 98% of respondents consider battery storage to be an important factor when deciding whether to invest in renewable energy or not. Additionally, 41% of respondents consider subsidies, whether it be direct investments or tax incentives, to be an important factor in renewable energy investment decisions. Nonetheless, investments as in acquisitions of renewable energy sources are often discussed as costly. In an article by Ambec and Lanoie (2008), it is discussed whether improved environmental performance could lead to better financial performance or if it is just cost increasing. However, the results conclude that the additional expenses from engaging in environmental activities and investments often are offset by the benefits that can be reaped.

Acquisitions in the renewable energy industry have seen a steady growth, where deal volumes increase annually and are expected to increase further in the coming years. The main driver of this growth is the diversification efforts of traditional energy companies trying to appease public demand, according to KPMG (2018). The UNEP reported a record-high deal value of $149.1 billion in renewable energy in 2018, a year-on-year increase of $6 billion, and the sixth consecutive year of growth. This was mainly driven by asset acquisitions, corporate mergers and acquisitions (M&As), and private equity (PE) buyouts, where the majority of these deals have been concentrated in solar and wind. Tailwinds that have driven M&A activity include regulations, easy access to capital and financing resulting from low interest rates, and a positive

outlook on economic growth (UNEP, 2019). These can be expected to continue to drive growth during the foreseeable future.

1.2. Purpose of Study

The purpose of this study is to research whether M&As in the renewable energy sector add value for the acquiring firms' shareholders. Furthermore, this study will examine whether there are any differences in effects between the US and Europe, and what the drivers for these potential effects are. The chosen drivers are based on previous empirical literature that have been proven to have a direct impact on the announcement returns. Previous research, to the best of our knowledge, has been focused on value creation in renewable relative traditional energy, and not the direct differences between different markets. This study will therefore attempt to close this gap.

This study will employ different event windows of varying lengths when analysing stock price reactions following an M&A announcement. The motivation for this is to capture the true value that the announcement creates, regardless of information leakages in the days leading up to the event. The effect will be analysed in a short-term and a long-term perspective in order to assess whether M&A is in the interest of the acquiring firms' shareholders. Naturally, this leads to the following research question: Do mergers and acquisitions in the renewable energy industry create shareholder value?

The thesis will continue as follows: the following section will provide an empirical foundation for the short- and long-term value creation of M&As. Section three will provide a theoretical foundation for the phenomenon of abnormal returns. Section four describes the methodology and data collection. Section five presents the findings. And lastly, section six presents the conclusions.

2. Literature Review

2.1. Short-term event study

Travlos (1987) study how the method of payment impacts shareholder value surrounding an acquisition. The findings show that equity as a means of payment is associated with negative returns, whereas cash deals are neutral or at best slightly positive. The sample consisted of 167

acquiring firms during the period 1972 to 1981. Using a three-day event window around the day of the announcement, the acquiring firms' shareholders get a -0.09% CAR following a successful cash-bid, whereas a successful stock-bid yielded -1.25% CAR. Finally, the research conclude that the findings are consistent with the signalling hypothesis.

Bradley, Desai and Kim (1988) study how successful tender offers affect the stock price of both the target firm and the acquiring firm. Furthermore, it is examined how the synergistic gains are divided between the shareholders of the target firm and the acquiring firm. The sample consisted of 236 tender offers, in which the target and acquirer were listed on NYSE or AMEX between 1963 and 1984. The findings show a total gain of 7.4% on average, representing a dollar value of 117 million. Additionally, the shareholders of the target firm capture most of the total gains, and since the passing of the Williams Act in 1968, which entailed disclosure requirements for the bidding firm with the aim of increasing transparency in the M&A environment, their share of realized gains have only increased. Consequently, the gains that shareholders of the acquiring firm realize are decreasing. Bradley, Desai and Kim (1988) argue that regulation and legislation is a zero-sum game as far as synergistic gains are concerned.

Berger and Ofek (1995) examine how diversification affect firm value. The findings show that diversified firms are valued between 13% and 15% below the stand-alone values of the individual business segments. The sample consisted of 3,659 firms during the period 1986 to 1991. The sum-of-the-parts valuation was performed using median industry-peer ratios and estimates firm value as if these individual segments operated as stand-alone entities. Using the average debt ratio of 30%, the loss that equity holders experienced from diversification ranged from 18.1% to 21.7%. Furthermore, the average dollar loss per firm during the sample period was $235.1 million. However, this contrasts with the conclusions of Wüstenhagen and Menichetti (2012). They discuss the positive effects of diversifying a conventional energy portfolio with renewable energy is discussed, especially if several types of renewables are used. Eisenbach, Ettenhuber, Schiereck and von Flotow (2011) also provide support for positive abnormal returns as a consequence of diversification.

Cogman (2014) found that acquiring firms' shareholders have experienced negative short-term abnormal returns of 4.4% on average during the period 1999 to 2013. However, the findings also suggest that these returns are trending upwards, and in 2013, shareholders enjoyed positive announcement returns. This could be explained by a more selective approach to acquisitions,

improved in-house M&A departments and corporate development groups, or simply a reward to the company for reducing agency costs of free cash flow (Cogman, 2014).

2.2. Long-term event study

Franks, Harris and Titman (1991) have studied the post-takeover stock performance of 399 US firms during the period 1975 to 1984. The findings indicate that poor ex post stock performance is likely a result of benchmarking errors rather than mispricing. The authors test for abnormal returns using four different benchmarks, yielding four various results. Measured over a 36-month period using an equally weighted index, monthly abnormal returns amount to -0.2%. Using a value-weighted index, monthly abnormal returns amount to 0.29%. They also find that all-cash bids outperform all-equity bids, smaller firms outperform larger firms, and that contested bids yield greater returns than uncontested bids.

Using a sample on 947 US acquisitions between 1970 and 1989, Loughran and Vijh (1997) find significant negative long-term abnormal returns for the acquirers. Control firms based on book-to-market ratio and market value of equities are used as benchmark when measuring the five-year buy-and-hold abnormal returns (BHAR). Furthermore, the study controls for the method of payment, stock or cash, and also the type of acquisition. While the acquirers in hostile takeovers outperform their control firms, the firms engaging in friendly mergers significantly underperform with average abnormal returns of -15.9%. Lastly, their study finds that cash outperforms stocks as a method of payment. While the BHAR for cash deals were 18.5%, the BHAR for stock deals were -24.2%.

Observing share repurchases, seasoned equity offerings, and mergers between 1958 to 1993, Mitchell and Stafford (2000) conduct a long-term event study on 2,193 acquisitions. They discuss previously used methodology in long-term event studies and use both the calendar-time approach and BHAR to perform their own study. Neither of the methods yield any statistically significant results, however, the long-term abnormal returns using the BHAR approach are negative. They advise the use of the Calendar-time method to measure abnormal returns, nonetheless, they introduce “corrected” t-statistics to control for statistical significance when measuring abnormal returns with BHAR that does not overstate the significance.

Measuring 1300 M&A events between 1993 and 2002, Dutta and Jog (2009) study the long-term performance of Canadian acquirers. In order to be unbiased by the choice of a specific methodology, the study uses both the BHAR approach and the Calendar-time three-factor approach by Fama-French. The results indicate that the Canadian market reacts positively to any announcements of M&As on short-term and that there are no signs of overpayment or value-destruction. A summary of several similar studies shows that negative abnormal returns are common in the long-term, mostly from studies in the US, which contrasts with the positive results found in Canada.

2.3. Renewable energy

The research within the effects of M&As in renewable energy and cleantech is limited. However, there are some previous studies, Eisenbach et al. (2011), Basse-Mama, Koch, Bassen and Bank (2013) and Palmquist and Bask (2016), where all have examined the subject and find that renewable energy and cleantech display positive abnormal returns. It is further investigated by Yoo, Lee and Heo (2013), finding differing returns that are dependent on if the deals are homogenous or heterogenous.

Eisenbach et al. (2011) conduct a study which provides support for positive abnormal returns as a result of M&A announcements on completed deals within the renewable energy industry when acquirers diversify their activities towards renewable energy. The sample consisted of 337 deals between 2000 and 2009, and the market model was employed. As a result of the renewable energy sector being fragmented, they discuss whether the deals are used by companies outside the industry to diversify and gain positive signals, thus, a “green premium” for engaging in renewables.

Another event study investigating the effects of announcements within M&A, asset disposals and joint ventures in cleantech is done by Basse-Mama et al. (2013). The study is providing evidence that deals within cleantech are yielding high abnormal returns on short-term, likely a result of government interventions. The sample used consists of 328 M&A announcements from countries all over the world. The event study is done using the market model with a single index to estimate normal performance, calculate abnormal returns and lastly analyse the CAARs. The results show that cleantech yields higher abnormal returns than non-cleantech, thus showing that it pays to be green.

Yoo, Lee and Heo (2013) conduct a study focusing on the inter-relationship between the target and the acquirer. Measured on 47 deals from 2008 to 2010 the study is using the Generalized Autoregressive Conditional Heteroskedasticity (GARCH) model which allows for time varying volatility. The study focuses on how M&As affect enterprise value cross-sectionally, where focused deals, i.e. a solar energy company acquiring another solar energy company, are proven to have the biggest effect on enterprise value. The heterogenous energy deals are proven to have a negative impact on enterprise value, which is argued to be due to the execution of policies. The findings also suggest that the renewable energy industry seems to have potential as an investment product for companies outside the industry.

Palmquist and Bask (2016) examine the market dynamics in the renewable energy and cleantech sectors. The study is based on 273 announced and 54 completed deals from 1997 to 2014 and it displays the abnormal returns in these sectors in comparison to the returns of traditional energy deals. To conduct the event study, they are using the market model with an index for each country of the acquirers in order to finally analyse the CAARs. They are analysing deals within solar, waste management, water treatment, wind and traditional energy and mining, and investigate whether there is a difference between a horizontal or vertical integration. The conclusion is that even if the deals in renewable energy sector yield positive abnormal returns, the deals in traditional energy and mining outperform them.

3. Theoretical Background and Hypothesis Development

3.1. Theory

3.1.1. Efficient Market Hypothesis

The efficient market hypothesis (EMH) states that stock prices fully reflect all available information, positing that shares trade at their respective fair value (Fama, 1970). In the hypothetical, frictionless world described by Fama (1970) where (i) there are no transaction costs, (ii) all information is costlessly available to agents in the market, and (iii) all agents in the market agree upon the implications of information on security prices, the EMH holds. These prerequisites do not hold in the real world, however, they are not necessarily sources of market

inefficiency. Thus, an investor's efforts in seeking undervalued stocks to outperform the market would prove fruitless, as according to the EMH, arbitrage opportunities and consistent alpha returns are inherently impossible.

The EMH can essentially be broken down into three different versions of the same theory: (1) weak form, (2) semi-strong form, and (3) strong form. This categorization can be used to see where the hypothesis breaks down. The weak form posits that current stock prices reflect all past available information. The weak form efficiency is closely linked to the random walk theory, which posits that price changes represent random outcomes from previous prices. The logic behind the random walk idea is that stock prices immediately reflect all information on any given day, and subsequent price changes reflect only that day's set of information, independent of previous price changes (Malkiel, 2003). This level of efficiency has been supported through extensive empirical testing (Fama, 1970). Fama (1998) concludes that the hypothesis of market efficiency holds with evidence of both over- and under reactions. The semi-strong efficiency posits that the stock price is a function of both past information, but also newly released public information like earnings or acquisition announcements. Finally, the strong form efficiency posits that the stock price is a function of all publicly available information and private information, i.e. insider information, which would make fundamental and technical analysis useless (Fama, 1998).

3.1.2. Agency theory and Financing theory

Agency theory has been the focus of copious amounts of research and is concerned about the relationship between stakeholders and managers. Jensen & Meckling (1976) define the term *agent* as someone who have been given decision-making authority to perform a service on behalf of the *principal*. The bread and butter assumption of agency theory is that the interests of the agent diverge from those of the principal. This is due to the assumption of homo economicus, meaning that the agent seeks to maximize their own utility. According to agency theory, the principal can introduce different incentives for the agent to align their interests, as well as introduce monitoring mechanisms to hinder opportunistic actions by the agent (Hill & Jones, 1992).

In terms of agency costs relating to M&A, the attention is now brought to free cash flow. Jensen (1986) discussed the implications of cash payouts to shareholders, and what the resulting conflicts were. On the one hand, payouts to shareholders in the form of dividends or share

repurchases reduce the amount of cash under the manager's discretion, limiting the risk of negative net present value (NPV) investments or managerial entrenchment. On the other hand, it also increases the likelihood that the firm must enter the capital markets to raise external capital to fund future investments and thus incurring external monitoring. By financing investments or projects with internally generated funds, the firm would avoid this monitoring and the raise of external funds at a high cost of capital.

Free cash flow is cash in excess of what is required to fund operations. When a firm generates high levels of free cash flow, the principal-agent problems are especially severe. To limit a manager's ability to waste free cash flow on value-destroying projects, Jensen (1986) proposes that the firm should use debt. Debt is not free from agency costs however, due to potential conflicts of interest stemming from the separation of management from ownership (Kim & Sorensen, 1986). The benefit of issuing debt, from an agency theory perspective, is that the firm assumes an obligation of continuous interest payments, thus reducing the agency costs of free cash flow. However, as leverage increases, so does the costs of financial distress. This implies that there is a need for the manager to find the optimum debt-equity ratio which is found where the marginal cost of debt equals the marginal benefit of debt (Jensen, 1986; van Binsbergen, Graham & Yang, 2010).

In a world where there is information asymmetry, where the manager will finance an acquisition in the most profitable way possible, the method of payment may be signalling valuable information to the market. According to the adverse selection effect of Myers and Majluf (1984), managers will opt for cash financing if they believe that the stock is undervalued and opt for equity financing if they believe that the stock is overvalued. Thus, according to the signalling hypothesis, a cash-offer is a positive signal to the market in terms of undervalued equity, whereas an equity-offer is a negative signal about the firm's intrinsic value. Harford (1999), found that cash-rich firms tend to pursue acquisitions more often, and in support of the free cash flow hypothesis, these acquisitions tend to be value decreasing. In contrast, Pinkowitz, Sturgess and Williamson (2013) find evidence that cash-rich firms favor to finance acquisitions with stock to a larger extent than non-cash-rich firms and suggest that these findings act as a counterweight to traditional theory.

3.1.3. M&A theory

In theory, M&A provides attractive opportunities for firms to pursue growth and enter new markets. The three primary motives for an acquisition according to previous literature are synergy, agency, and hubris (Berkovitch & Narayanan, 1993). These motives will be discussed below. Furthermore, the hubris motive proposes that management overestimate its own ability, misvaluing the target firm, and pursuing the acquisition without any synergies.

The synergy motive proposes that firms engage in acquisitions because of the resulting economical gains (Berkovitch & Narayanan, 1993). From an M&A perspective, according to Gaughan (2017) the term synergy refers to a situation where 1 + 1 = 3, meaning that the combined value of the two firms is greater than the sum of their parts. The expected synergies resulting from an acquisition allow the acquiring firm to incur the associated costs, while also paying a premium for the target shares. This translates into the following formula for calculating the net acquisition value (NAV):

$$NAV = [V_{AB} - (V_A + V_B)] - (P + E)$$

where: V_{AB} = the combined value of firm A and B; V_A = the value of firm A; V_B = the value of firm B; P = the premium paid for firm B; and E = acquisition expenses.

Synergies resulting from an acquisition can materialize in different ways, but the main types are operating synergies and financial synergies. Operating synergies include cost reductions and revenue growth, and financial synergies include reduced cost of capital (Gaughan, 2017). Bruner (2005) argue that opportunities to realise synergies are greater when the motive of the acquisition is focus rather than diversification, due to the greater overlap between assets of the acquirer and the target, enabling cost reductions and economies of scale.

The agency motive proposes that firms engage in acquisitions for management entrenchment or empire-building purposes, at the expense of the shareholders of the acquiror. Previous literature suggest that some firms engage in acquisitions fuelled by the self-interest of the acquiring firm's management (Berkovitch & Narayanan, 1993). Jensen (1986) presents the idea that some managers use free cash flow to pursue acquisitions to increase the size of the firm, i.e. empire-building. Shleifer and Vishny (1989) presents the idea that some managers make acquisitions to increase their power over the firm, and make the firm more dependent on the manager, i.e. managerial entrenchment. Cools, Gell, Kengelbach and Roos (2007) find that

deals exceeding $1 billion in value, are twice as value-destroying as deals below $1 billion. Furthermore, the larger the target relative the acquirer, the more value is destroyed in the deal (Cools et al., 2007). Loderer and Martin (1990) also find that deal values in the 95th percentile, i.e. deal sizes exceeding $500 million in their sample, are value-destroying with announcement returns of -1.5%. These findings imply that the larger the dollar value of a deal, the more likely it is that the manager overpays. This could possibly be explained by Roll's (1986) hubris hypothesis, where managers overestimate their own ability to integrate the target and realize synergies, and thus overpay. This hypothesis is strengthened by Malmendier and Tate (2007) who find that overconfident managers are likely to overpay for a target company and undertake value-destroying acquisitions. The effects are most severe when the acquisition is financed internally, thus lending support to Jensen's (1986) free cash flow hypothesis.

3.2. Hypothesis Development

In an empirical study by Travlos (1989), the stock performance post-acquisition is examined and a short-term negative CAR is the result of both cash and stock bids. This is in accordance with Koller, Goedhart and Wessels (2015) stating that most empirical research show that the shareholders of an acquiring firm will have the benefits of the acquisition fall to the selling companies' shareholders. The findings of Cogman (2014) show an adverse relationship between M&A announcements and acquiring shareholders' returns. However, this relationship may be at a turning point, where M&As are starting to add shareholder value. Coupled with the research of KPMG (2018) and UNEP (2019), the empirical findings of Yoo, Lee and Hoe (2013), Eisenbach et al. (2011), Basse-Mama et al. (2011) and Palmquist and Bask (2016), we expect to see a positive relationship between M&As and abnormal returns for the acquiring firms' shareholders.

H_1: The short-term effects from the announcement of M&A deals within the renewable energy industry are value-adding for the acquirer's shareholders.

Several studies are made to determine the long-term performance of M&As. Dutta and Jog (2009) summarize numerous key studies on post-merger performance from 1980 and forwards. The majority of these studies conclude negative abnormal returns as a result of mergers in the long term, one of which being a study by Loughran and Vijh (1997). Their study on the US market in the 70s and 80s finds significant results that the long-term average abnormal return

following an acquisition is negative for acquirers. Another study by Mitchell and Stafford (2000) confirms the results of negative long-term performance, however, the results lack statistical significance which limit the reliability. Based on these studies and the efficient market hypothesis, it is expected that the long-term abnormal returns of acquisitions in renewable energy are negative.

H_2: The long-term effects from the completion of M&A deals within the renewable energy industry is value destroying for the acquirer's shareholders.

Previous empirical evidence provide results that increasing deal values in M&As tend to be value-destroying (Cools et al., 2007; Loderer & Martin, 1990). Larger deals have long been associated with overconfident managers, overestimating their ability to integrate the target correctly and thus realize expected synergies. This phenomenon is closely linked to Roll's (1986) hubris hypothesis, positing that managers often overpay for the target, resulting in a value-destroying acquisition. Therefore, it is anticipated that an increase in deal size implies relatively worse returns than a smaller deal size.

H_3: There will be an adverse relationship with returns and increased M&A deal sizes in the renewable energy industry

An increased activity of investments in the renewable energy industry could be seen in both the US and in Europe. However, the two regions differ both in legislation and policy, hence a comparison of the two regions is of interest. In a survey by KPMG (2018) it is concluded that the policies regarding renewables in the US are the least favourable among the advanced economies. Meanwhile, in the EU there are several goals of reduced CO_2 emissions to reach the temperature target set by the Paris Agreement, simultaneously with targets of increased usage of renewable energy sources. Considering this "renewable-friendly" regulatory environment, in contrast to the US. leaving the Paris Agreement, it is expected that M&As in Europe are associated with relatively higher abnormal returns than the US.

H_4: The effects from M&A deals within the renewable energy industry are greater in Europe than in the US.

Whether the method of payment consists of cash or not tend to be of importance for the return of the acquiring firms shareholders. The method of payment in acquisitions and its effects on shareholder value has been widely documented in previous research. On the one hand, cash financed acquisitions can be value-adding (Travlos, 1987; Franks, Harris & Titman, 1991), and on the other hand they can be value-destroying (Harford, 1999). Consistent with the signalling hypothesis and the findings of Travlos (1987) and Franks et al. (1991), we expect to see a positive relationship between abnormal returns and cash payment.

H_5: The effects from M&A deals within the renewable energy industry are greater from cash bids than non-cash bids.

In the study by Yoo, Lee and Heo (2013), it is concluded that deals that are within the same sector within renewables are the ones that show the most positive effect on enterprise value. What they refer to as heterogeneous deals, i.e. diversification deals where non-renewable energy companies acquire renewable energy, are considered to have a negative effect on enterprise value due to incurring costs. This is consistent with Bruner's (2005) line of thought, that focused acquisitions provide greater opportunities to realise synergies than diversified acquisitions. These findings support earlier research on the focus hypothesis, positing that strategic focus is consistent with shareholder wealth maximization (Comment and Jarrell, 1995; Berger and Ofek, 1995; Denis et al., 2002), implying a negative relationship between diversification and post-acquisition stock performance. Thus, we expect to see a negative association between diversification and shareholder value.

H_6: The effects of diversification on firm value from M&A deals within the renewable energy industry are relatively lower than focused deals

Cross-border acquisitions can seem like an attractive way of pursuing growth and expansion. Benefits of these acquisitions include entry into a new market, making use of the target's country-specific expertise and distribution network. Despite these benefits, firms that engage in cross-border acquisitions seem to destroy value. According to Denis, Denis and Yost (2002) who examine the valuation effects of global diversification, globally diversified firms are associated with a discount similar in magnitude to that of industrially diversified firms. This discount increases in magnitude if the firm is both globally and industrially diversified. Similarly, Moeller and Schlingemann (2005) find that US acquirers engaging in cross-border

acquisitions rather than domestic acquisitions, experienced lower announcement returns, where the difference is defined as the cross-border effect. They find that the announcement returns that cross-border acquirers experience are approximately one percentage point less than domestic acquirers. Bruner (2005) suggest that this difference in returns is the premium that foreign acquirers pay to gain access to new markets and local know-how. Considering the literature above, we expect to see an adverse relationship between cross-border acquisitions and abnormal returns.

H_7: The effects from the M&A deals within the renewable energy industry are lower from cross-border transactions than from domestic transactions.

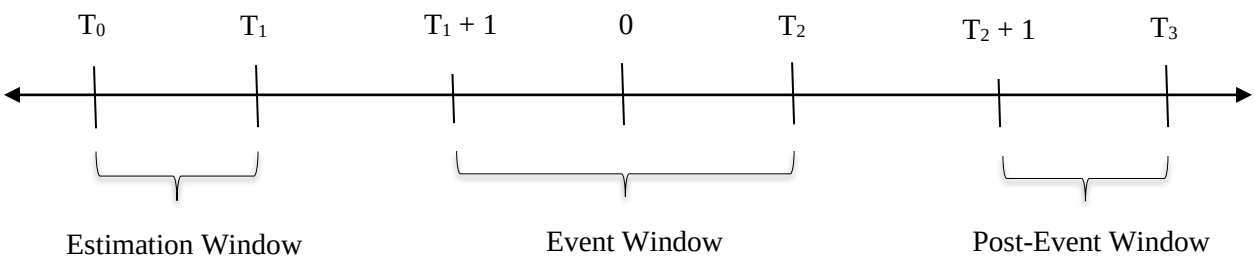
4. Data and Methodology

The first step to perform the event study was to collect all the necessary data. This study will focus on the period between 2000-01-01 to 2018-12-31 in order to capture as many deals as possible, while still remaining within a relevant time period. All data regarding the M&A deals have been collected from Zephyr's database and all stock and index prices have been obtained from Datastream. An event study does not have a unique structure, but according to MacKinlay (1997) the study can be broken down into several steps that have been followed throughout the study. Conducting an event study is a popular way of measuring the impact of an economic event on firm value, used to determine whether said event is value creating for shareholders. Most commonly, event studies are used to measure the effect on common equity, which is also the case in this study.

4.1. Defining the Event

The first step would be to define an event of interest and the event window. The event study could be presented as a timeline, as pictured below in Figure 1. The length of the estimation window is represented by T0 to T1. Then the event occurs at T=0 and the event window is represented as T1+1 to T2. After the event window there could be a post-event window presented as T2+1 to T3.

Figure 1: The Event Study Timeline



This Figure present the timeline of an event study

The event of interest for our short-term study and our long-term study respectively, is the point in time when the M&A announcement is made and when the deal is completed. The event window is centred on the event date and for our short-term study there are three event windows: [-1, 1], [-3, 3], and [-5, 5], the first and the last are chosen based on what is commonly used according to a study by Bruner (2002). The [-3, 3] is added to improve robustness of the study and displays whether the results are dependent on the time period chosen or not. For the long-term study, the event window is set to [0, 252] in accordance with prior research. All days are calculated as trading days to achieve the same amount of days over the entire sample. The days prior to the event are included to capture any leaked information that could have affected the stock price. The estimation window is used to predict the normal behaviour of stock returns. Recommendations per MacKinlay (1997) have been followed, using 120 trading days as the estimation window, where care is taken that there is no overlap between the event window and the estimation window. This is recommended by Mitchell and Stafford (2000), arguing that overlapping events can cause cross-sectional dependence, which in turn would bias the test statistics upwards. To achieve this, a 30-day buffer is left between the end of the estimation window and the start of the event window.

4.2. Selection criteria

The next step would be the selection criteria, where the deals that are used in the study are selected. The data for the M&As have been collected using Zephyr's database and the deals have all been selected using the following criteria, presented in Table 1 below.

Table 1: Selection Criteria

Category	Criteria
Announcement date	2000-01-01 to 2018-12-31
Target Industry	Renewable energy
Acquirer Nation	Europe and United States
Acquirer Public Status	Listed
Deal definition	M&A
Deal status	Completed
Deal Size	> €5 000 000
Acquirer's share of target	100%

This table provides the requirements that have been set for the M&A deals used in the study.

The first sample selection consisted of deals that were classified as M&A by the Zephyr database. This study is restricted to deals with an announcement date between 2000-01-01 to 2018-12-31 in order to reach a sufficient sample. This further allows the study to cover the sixth M&A-wave between 2004 and 2007 (Gaughan, 2017). The second criteria is, naturally, that the target of the acquisition is in the renewable energy industry. Thirdly, the acquirer must be located in the US or Europe. The fourth criteria is that the acquirer is publicly listed. The targets can be private or publicly listed, as it makes no difference to the study. The fifth criteria is that the study is restricted to completed deals only, to avoid possible effects from withdrawn bids misleading the results of the study. The sixth criteria is that the deal value must exceed €5 million to reduce the risk of external noise, as argued by Gregory (1997). Larger deal values also increase the chance that the acquisitions have a significant economic impact on the acquirer. Lastly, it is required that the acquirer's share of the target is 100%, meaning that the acquirer has full control over the company and all the deals are comparable and fully affect the target company.

4.3. Estimating Expected Normal Returns

After determining the final sample, the expected normal returns must be calculated. This is the stock performance to be expected if the event would not have happened (Campbell, Lo & MacKinlay, 1997). The estimation of normal returns is done using the returns in the estimation

window and are used to assess the abnormal returns. Expected normal returns can be estimated using different models, some of which will be described below.

4.3.1. Constant-Mean-Return Model

Often referred to as the simplest model to estimate normal performance. Brown and Warner (1985) still argue that the constant-mean-return model often yields similar results as the more complicated models. The constant-mean returns are the addition of the mean return of a stock and a residual following a normal distribution with constant variance and an expected value of zero. However, it ignores all effects that the market has on the securities performance. The formula is as follows:

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

where $R_{i,t}$ is the individual stock return at time t, and $E(R_{i,t})$ for the expected $R_{i,t}$. As mentioned, the model assumes the following:

$$E[\epsilon_{i,t}] = 0$$
$$Var[\epsilon_{i,t}] = \sigma_{\epsilon_i}^2$$

4.3.2. Market Model

The market model is the most used method to determine expected performance. It is a statistical model that uses simple time series regression to relate any given return of a security to the return of a market portfolio (Campbell, Lo & MacKinlay, 1997). The market model defines expected normal returns as:

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

with the following assumptions:

$$E[\epsilon_{i,t}] = 0$$
$$Var[\epsilon_{i,t}] = \sigma_{\epsilon}^2$$

where $R_{i,t}$ is the returns for the stock at time t and $R_{m,t}$ is the return for the market portfolio at time t. The expected value of the residual, $E(\varepsilon i,t)$ equals zero, $\alpha_i$is the intercept and $\beta_i$is the beta of stock i which reflects the stocks sensitivity to changes in the market.

The model considers the factor of market risk by reflecting the relationship between the individual stock and the market portfolio.

4.3.3. Capital Asset Pricing Model

The Capital Asset Pricing Model (CAPM) was presented as an extension of the market model by Sharpe (1964) and Lintner (1965). The CAPM describes the linear relationship between the return of a security and the systematic risk. However, Fama and Macbeth (1973) questions the correlation between unsystematic risk and the beta. The stock's performance is a function of the risk-free rate of return, the volatility of the stock in comparison to the market and the market risk premium.

$$E[R_{i,t}] = R_{f,t} + \beta_i \left(R_{m,t} - R_{f,t}\right) + \epsilon_{i,t}$$

Beta is the systematic risk of the stock and $R_{f,t}$ is the risk-free rate.

4.3.4. Fama French Three-Factor

Fama and French (1993) adds two additional factors that influence the stock price, book-to-market premium and size-premium:

$$R_{i,t} - R_{f,t} = \propto_1 + \beta_1\left(R_{m,t} - R_{f,t}\right) + S_i(SMB_t) + H_i(HML_t) + \epsilon_{i,t}$$

SMB_t is the difference between the returns of small market value firms over big market value firms, and HML_t is the difference between the returns of high- and low book-to-market securities. $R_{m,t}$-$R_{f,t}$ is the market's excess return and $R_{i,t}$-$R_{f,t}$ is the stock's excess return.

However, the model is being criticized by Barber, Lyon and Tsai (1999), arguing that the three factors does not change over time and that they do not interact with each other.

4.4. Methods for abnormal returns

To assess how the stock performs in the defined event window, the abnormal return is calculated. The abnormal return is the actual return minus the expected return:

$$AR_{i,t} = R_{i,t} - E(R_{i,t})$$

In previous studies, the two most common return metrics are the cumulative abnormal return (CAR) or the buy-and-hold return (BHAR). The formula for CAR is as follows:

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

CAR is obtained by simply summing up all the abnormal returns over the event window. However, this is criticised since it assumes that the investors buy the stock and then instantly sell it off, which normally would not be the case. This problem is countered by the BHAR approach which assumes that the investors are holding their stocks over the period, and the formula is as follows:

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

Fama (1998) argues that the BHAR approach is better at capturing the long-term performance and confirms that it is commonly used in previous studies for long-term event studies, this approach is also favoured by Loughran and Vijh (1997) and Barber and Lyon (1997) since it captures the investors' true experience. Barber and Lyon (1997) further analyse the test statistics in event studies and their empirical power in the long term. Their study shows that BHARs yield negatively biased test statistics while CARs are positively biased and conclude that for long-term performance, BHAR is the most appropriate method. The use of BHAR to control for long-term performance is also supported by Rosen (2006) and Dutta and Jog (2009).

Kothari and Warner (2005) and Mitchell and Stafford (2000) argue that using BHAR might lead to drops in statistical power and produce biased results, and Fama (1998) highlights the statistical difficulties with the method. Mitchell and Stafford (2000) also counter the argument of using BHAR to mimic the experience of the investors, with the fact that several other

methods can capture this as well. According to Rosen (2006) there is a tradeoff between using BHAR and the Calendar-time approach when conducting the hypothesis tests. The use of BHAR increases the power of the test, but might also lead to an over rejection of null hypothesis, commonly known as Type I errors. Contrarily, creating calendar-time portfolios through aggregating individual events will throw away relevant information, hence this will reduce the power of a hypothesis test, also known as Type II errors.

Furthermore, if one wants to find out the impact over a pool of firms, the average effect must be computed. This could be done using the following formula:

$$CAAR(t_1, t_2) = \frac{1}{N}\sum_{i=1}^{N} CAR_i\,(t_1, t_2)$$

Finally, to determine the statistical inference to see whether the CAR and the BHAR are statistically significant, a t-test could be performed. If the parametric test results in a t-value that exceeds the value determined by a significance level, the result is considered statistically significant. This is done using the following formulas:

$$t_{CAR} = \frac{\overline{CAR_{i,t}}}{(\frac{\sigma(CAR_{i,t})}{\sqrt{n}})}$$

$$t_{BHAR} = \frac{\overline{BHAR_{i,t}}}{(\frac{\sigma(BHAR_{i,t})}{\sqrt{n}})}$$

where σ is the standard deviation of the abnormal returns.

4.5. Choice of Methods

In a study be Campbell, Lo and MacKinlay (1997) it is highlighted that the use of complicated economic models like CAPM or the three-factor model adds little benefit over a simpler statistical model like the market model. Barber and Lyon (1997) argue for the use of an adjusted market model, which in turn is a simplified version of the market model since it assumes perfect correlation with a reference portfolio or a control firm, it also assumes no idiosyncratic risk. However, by reviewing previous research, Fama (1998) is looking into long-run returns and

the efficiency of the market. He argues that the market model is suited to estimate the effects of specific events for companies, such as an announcement of an M&A. This is due to the abnormal returns not hindering the cross-sectional expected returns since they are given by the market return. Taking this into account, as well as the fact that the market model is the most used model in event studies, this method will be applied to calculate normal returns.

To calculate the normal returns for our short-term study, all stock and index price data have been downloaded from DataStream. To convert these stock prices to actual returns, the natural logarithm has been used to get the daily returns. The use of logarithmic values improves the normality of the distribution in comparison to the distribution when using simple returns (Fama, Fisher, Jensen & Roll, 1969). The natural logarithmic returns were calculated in for each individual stock and benchmark index using the following formula:

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

$R_{i,t}$ represents the actual return on the 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*.

To do this we have followed the approach by Palmquist and Bask (2016) and used the main index from each country as the reference portfolio instead of using control firms. The list is presented below in Table 2.

Table 2: Equity Indices

Country	Index
Austria	Austrian Traded Index
Czech Republic	Prague SE PX
Denmark	OMX Copenhagen 20
Finland	OMX Helsinki
France	CAC 40
Germany	DAX 30
Great Britain	FTSE All Share
Hungary	BUX
Italy	FTSE Milano Italia Borsa
Netherlands	AEX
Norway	OBX Index
Poland	Warsaw General Index
Portugal	PSI All Share
Romania	Romania BET
Russia	MOEX Russia Index
Spain	IBEX 35
Turkey	BIST 100
US	S&P 500

The table reports the equity indices used to represent the market portfolio for each country.

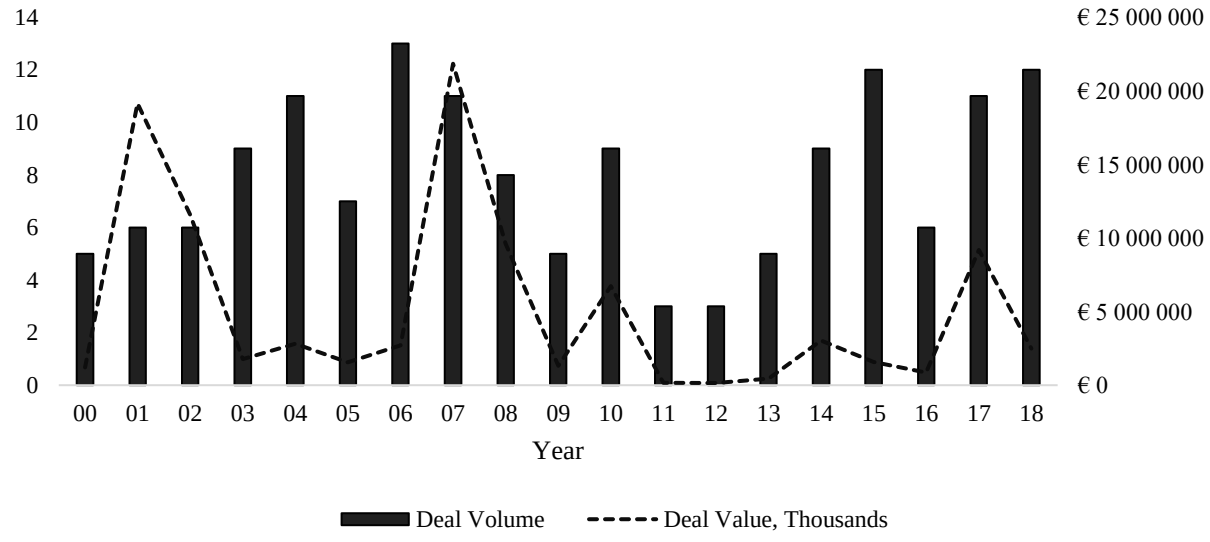
4.6. Data Collection

To collect all relevant data for our study, we have used the Zephyr database. The criteria for the selection of data is described in section 4.2. The categorisation of the target industry has been done using the NAICS 2017 classification in Zephyr and the sectors that are considered renewable are: Hydroelectric Power Generation, Wind Electric Power Generation, Solar Electric Power Generation, Biomass Electric Power generation, Electric Power Generation, Other Electric Power Generation, Materials recovery Facilities and Hazardous Waste Treatment and Disposal. In the last four sectors, the downloaded deals are both renewable and non-renewable, thus, all these deals have been manually checked and non-renewable deals have been excluded. Some of the deals have been announced or completed on a weekend. This has been handled by using the next trading day as the event date.

The data has then been manually sorted in where all events with missing stock price data have been excluded from the sample resulting in three deals being excluded from both short-term and long-term in the US, and eight deals being excluded from both short-term and long-term in Europe. There is also the problem of overlapping events due to many M&As taking place. All overlapping events have been excluded since this would affect the normal return resulting in the removal of three short-term and five long-term deals in the US. In Europe 28 short-term and 42 long-term deals have been removed due to overlapping events. Finally, one European company has been excluded since it was an Indian company, cross-listed in both India and the UK.

The final sample for the short-term study consists of 150 deals, where 97 of them are deals in Europe and the remaining 53 are completed in the US. For the long-term study, there are 133 deals, 82 in Europe and 51 in the US. These deals are distributed as shown in Figure 2 where the number of deals each year and the total deal values of those years are presented. Moreover, the data of all M&A deals used for the study can be provided upon request.

Figure 2: Deal Statistics



The Figure presents the deal volume and the deal value of the sample used in the study.

4.7. Regression models

To be able to test our hypotheses, several Ordinary Least Squares (OLS) regressions have been conducted. The dependent variable used in the regression for our short-term study is the *CAR* for each deal. Deal Size has been used as our main explanatory variable where the deal value

has been logarithmized. Moreover, four different control variables are used to control for different characteristics and how they affect the performance. These are chosen based on their explanatory power on share performance and what is common practice in previous research. All four control variables are set up as dummy variables.

The first dummy variable is *Cash*. If the transaction is made with cash, the dummy takes a value of 1, if not it takes a value of 0. The second dummy is *US*. If the transaction is made by a US acquirer, the dummy takes a value of 1, if it is made by a European acquirer, the dummy takes a value of 0. The third dummy is *Cross-border*, where the dummy takes a value of 1 if the acquirer purchases a foreign target, if not the dummy takes a value of 0. The last dummy variable *Diversification* takes a value of 1 if the acquirer is from another industry than renewable energy, if not the dummy takes a value of 0.

Table 3 is an exhibit of the distribution among the different deal characteristics that the dummies are meant to control for. Among all deals, about a third are completed using cash as the method of payment while the remaining deals are financed with other means. The same distribution goes for the regions where 52 out of 150 events are in the US and the rest are in Europe. Additionally, two thirds of the deals are made domestically, leaving one third cross-border. Lastly, only 28 out of 150 deals are made when both acquirer and the target is within renewable energy, and 122 deals are therefore classified as diversifications.

Table 3: Deal Characteristics

	Short-term	Long-term
Deal Characteristics	Observations	
Cash	53	44
Non-Cash	97	89
US	52	51
Europe	98	82
Cross-border	52	48
Domestic	98	85
Diversification	122	108
Focus	28	25

The table provides statistics over the deal characteristics observed in the sample.

Furthermore, the 150 deals across Europe and the US vary in deal size. The transaction with the largest deal value totals €1.72 billion while the smallest deal in the sample is €7.2 million. Additionally, the average deal value is close to €650 million while the median is only just above €100 million, an effect of a skewed distribution.

Finally, the first step on the regressions was to perform several univariate regressions using the variables described above with the event window [-5,5]. However, by adding several explanatory variables to a regression, creating a multiple regression, the models explanatory power will increase. This is done by eliminating these variables from the error term, thus, the residual decreases. Therefore, a multivariable analysis is regressed on all the different event windows to see the effect of the announcements. All our regressions are performed using robust standard errors to counter any unwanted unbiasedness with heteroskedasticity.
The final model for our short-term study is as follows:

$$CAR_i = \beta_0 + \beta_1 Deal\ Size + \beta_2 Cash + \beta_3 US + \beta_4 Cross\text{-}border + \beta_5 Diversification + u_i$$

The model for our long-term study is as follows, using BHAR instead of CAR:

$$BHAR_i = \beta_0 + \beta_1 Deal\ Size + \beta_2 Cash + \beta_3 US + \beta_4 Cross\text{-}border + \beta_5 Diversification + u_i$$

5. Empirical Analysis and Discussion

5.1. Empirical findings

The first results from the short-term event study is presented in Table 4. It provides information of the stock returns from the announcement of M&A deals in the renewable energy industry. The data presented is derived from using the market model and calculating the CARs and regressed as univariate regressions.

Table 4: Cumulative Abnormal Returns

Model	(1)	(2)	(3)	(4)	(5)
Event Window	(-5, 5)	(-5, 5)	(-5, 5)	(-5, 5)	(-5, 5)
Variable	CAR	CAR	CAR	CAR	CAR
Deal size	-0.018				
	(0.643)				
US dummy		-1.449			
		(2.282)			
Cash dummy			0.748		
			(1.508)		
Cross-border dummy				-2.687	
				(2.272)	
Diversification dummy					-1.551
					(1.410)
Constant	0.389	0.679	-0.088	1.108*	1.438
	(8.212)	(0.631)	(1.261)	(0.624)	(0.950)

The table reports five univariate regressions on CAR for our different explanatory variables. Robust standard errors in parentheses,*** p<0.01, ** p<0.05, * p<0.1. All CARs winsorized at 1 & 99 percentile

However, the regression is taken a step further into a multivariable, and regressed in accordance with the formula presented above. This is displayed below in Table 5. However, due to some extreme outliers in the sample a new regression was performed using CARs that have been winsorized at the 1% and 99% levels. As a result of the winsorization the distribution of the CARs is normalized.

Table 5: Cumulative Abnormal Returns

Model	(1)
Event Window	(-5, 5)
Variable	CAR
Deal size	0.163
	(0.832)
US dummy	-2.188
	(3.235)
Cash dummy	0.097
	(1.160)
Cross-border dummy	-3.123
	(2.868)
Diversification dummy	-1.406
	(1.419)
Constant	1.228
	(8.272)

The tables reports the CAR in the event window [-5, 5] prior to winsorizing. Robust standard errors in parentheses,*** p<0.01, ** p<0.05, * p<0.1.

The results from using the winsorized CARs are presented in Table 6 where the three event windows are displayed in column 1, 2 and 3. Viewing the results, there is a lack of statistical significance with only *Deal Size* and the *Constant* being statistically significant at 5%. Common among all event windows is that the total short-term effect is positive, suggesting that deal announcements in the renewable energy sector are indeed value adding in the short term.

Table 6: Cumulative Abnormal Returns

Model	(1)	(2)	(3)
Event Window	(-1, 1)	(-3, 3)	(-5, 5)
Variable	CAR	CAR	CAR
Deal Size	-0.348**	-0.217	-0.325
	(0.175)	(0.275)	(0.340)
US dummy	-0.542	-0.704	0.236
	(0.588)	(1.020)	(1.261)
Cash dummy	-0.342	-0.022	-0.139
	(0.527)	(0.833)	(0.990)
Cross-border dummy	0.731	-0.127	-0.915
	(0.567)	(0.867)	(1.138)
Diversification dummy	-0.534	-0.040	-0.541
	(0.595)	(1.321)	(1.151)
Constant	4.869**	3.325	5.075
	(2.084)	(3.675)	(4.097)

The table reports the CARs in three different event windows for determining short-term performance after the announcement of an M&A deal. Robust standard errors in parentheses,*** p<0.01, ** p<0.05, * p<0.1. All CARs winsorized at 1 & 99 percentile

As illustrated in Table 6, the variable *Deal Size* indicates that the larger the deal, the worse the CAR as all the event windows have negative signs. On the event window [-1, 1] which has largest negative magnitude, the results are statistically significant at 5%.

On the third row presenting the regional differences between Europe and the US, two out of three event windows present negative signs on the dummy variable *US*, of which the two are larger in magnitude than the positive coefficient. Therefore, the regional effects are presented in the third row which indicate that European acquirers are outperforming US acquirers.

The third dummy, *Cash*, displays a negative coefficient on all three event windows. Neither of them being statistically significant, but the results suggest that deals where the method of payment is cash, performs worse in the short term than a deal that is made using any other method of payment. These results are in contrast to previous empirical research as well as commonly cited corporate finance theory.

The *Cross-border* coefficients are displayed on the fourth row. The results differ on all event windows, in the shortest event window the coefficient is positive, suggesting that cross-border deals would perform better in the short term than a domestic deal. However, the negative

coefficients on the other two event windows indicate that a cross-border deal would perform worse than a domestic deal. Therefore, the results are inconclusive.

Finally, the *Diversification* dummy is presented on the fifth row. The negative coefficients on all event windows suggest that when a non-renewable company acquires a renewable company, i.e. diversification, the stock performance in the short term is worse than it would be after a focused deal.

In Table 7 the same regression is conducted over all three short-term event windows using Europe and the US as two individual samples. Despite the absence of statistical significance, it is clear that deals in the US and the deals in Europe differ. The use of cash in the US outperforms the European deals which exhibit a negative CAR over all event windows. The opposite can be observed on *Cross-Border*, where the coefficient on the US event windows are all negative, suggesting that cross-border transactions in the US are value-destroying while the European deals are value-adding for the acquirers.

Table 7: Cumulative Abnormal Returns

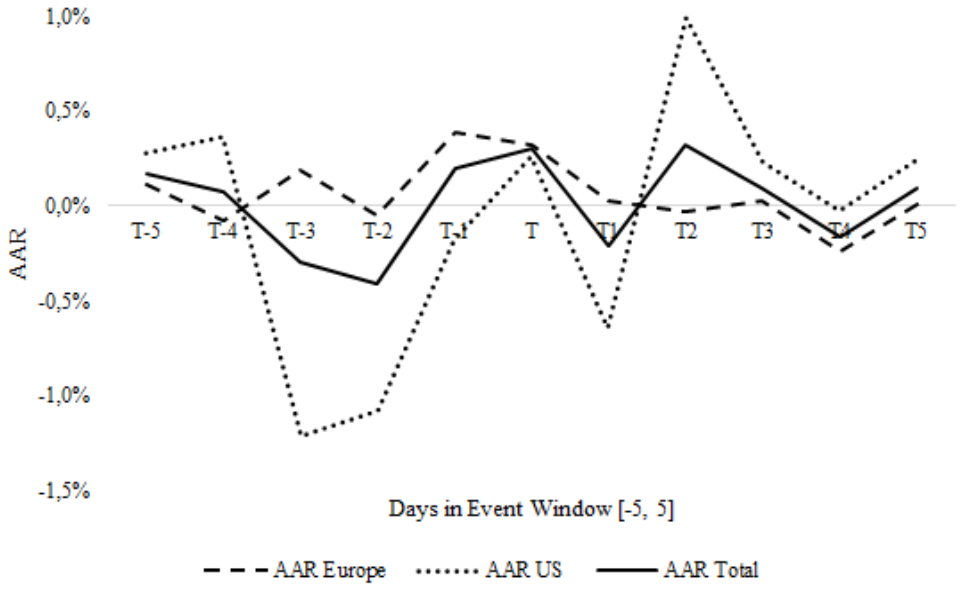
Model	(1)	(2)	(3)	(4)	(5)	(6)
Region	US	Europe	US	Europe	US	Europe
Event Window	(-1, 1)	(-1, 1)	(-3, 3)	(-3, 3)	(-5, 5)	(-5, 5)
Variables	CAR	CAR	CAR	CAR	CAR	CAR
Deal size	-0.566	-0.345	-0.346	-0.329	-0.232	-0.577
	(0.402)	(0.212)	(0.622)	(0.324)	(0.694)	(0.399)
Cash dummy	0.542	-0.797	1.140	-0.723	1.397	-0.887
	(1.306)	(0.523)	(1.668)	(0.918)	(2.246)	(1.081)
Cross-border dummy	-0.580	1.134	-2.750	0.851	-3.908	0.580
	(1.307)	(0.750)	(1.892)	(1.085)	(2.672)	(1.268)
Diversification dummy	-0.193	-0.652	0.425	-0.073	-1.852	0.319
	(1.333)	(0.711)	(3.385)	(1.235)	(2.596)	(1.281)
Constant	6.703	4.938**	3.995	4.478	5.427	6.906
	(4.773)	(2.485)	(9.580)	(3.832)	(9.213)	(4.675)

The table reports the CARs in the short-term event windows with the sample divided into the two regions, Europe and the US. Robust standard errors in parentheses,*** p<0.01, ** p<0.05, * p<0.1. All CARs winsorized at 1 & 99 percentile

Figure 3 displays the average abnormal returns for each day in the event window. In the European and the total sample, the average abnormal return (AAR) do not show a trend or any

signs of overreactions. However, the AAR from the US sample display value destroying performance prior to the event, but the return on the event day is slightly positive.

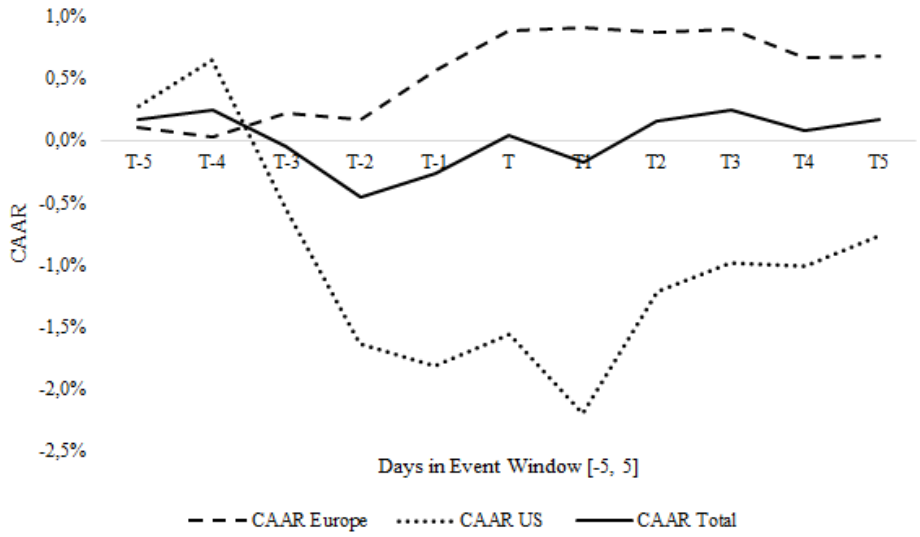
Figure 3: Average Abnormal Returns



The Figure describes the Average Abnormal Returns over the event window [-5, 5].

Looking at Figure 4, the cumulative average abnormal returns for our short-term study with the event window of [-5, 5] is presented. The stock market reactions for the European deals are outperforming the US deals by a great margin. The share price performance display positive returns for the European deals and negative returns from the US deals. However, if the market is assumed to be efficient the graph indicates sign of information leakage prior to the event. According to Fama (1970) the market can be assumed to have a semi-strong efficiency. This would imply that the stock prices assimilate all publicly available information. However, as presented in Figure 4 we cannot conclude that the market is efficient since there does not seem to be any trend in the abnormal return of the announcement and most of the effect comes prior to the event. This suggests that there could be a trend of information leakage, however, the result is not statistically significant, hence, no conclusion can be drawn.

Figure 4: Cumulative Average Abnormal Returns



The Figure describes the Cumulative Average Abnormal Returns over the event window [-5, 5].

The long-term results that are presented in Table 8 where the BHAR is used instead of CAR. The results differ slightly from the short-term results and are displayed in Table 8, where the long-term abnormal returns are negative. However, except for *Deal Size,* the long-term results lack statistical significance as well, meaning that the results are unreliable. In comparison to the short-term study, the long-term performance is positively affected by an increase in *Deal Size,* with weak significance and a low magnitude. Looking at the dummy variable *Region,* it indicates that the long-term deals completed by US acquirers perform worse than the ones in Europe. The results on *Method of Payment,* indicates that cash deals would outperform non-cash deals. The next dummy that was controlled for is *Geography* where the positive coefficient indicates that cross-border deals slightly outperform domestic deals. Lastly, we controlled for *Deal Type,* yielding worse long-term stock performance than if it were a focused deal.

Table 8: Buy-and-Hold Abnormal Returns

Model	(1)
Variable	BHAR
Deal Size	0.029*
	(0.015)
US dummy	-0.108
	(0.070)
Cash dummy	0.055
	(0.060)
Cross-border dummy	0.011
	(0.061)
Diversification dummy	-0.073
	(0.089)
Constant	-0.307
	(0.198)

The table reports the long-term performance one year after the deals have been completed. Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1. All BHARs are winsorized at 1 & 99 percentile

5.2. Discussion

Our empirical findings are not consistent with previous findings of ex post stock performance. Due to the glaring absence of statistical significance, these findings should be considered with caution, however, the economic significance is still worth discussing. Despite the lack of statistical significance, the positive abnormal return in the short term suggest that M&As in the renewable energy industry create shareholder value, as presented in Table 6. This is in contrast to previous research, finding that M&As are value-destroying (Koller, Goedhart & Wessels, 2015; Travlos, 1989; Bradley, Desai and Kim, 1988), but also consistent with previous research within the renewable energy sector, finding that M&As are value-adding (Basse-Mama et al., 2013; Eisenbach et al., 2011; Palmquist & Bask, 2016; Yoo, Lee and Heo, 2013). With a positive effect on shareholder value, it can be assumed that the acquirers on average do not pay any large "green premiums" that would offset the benefits of the deal. Another explanation could be that the market's perceived value of the deal exceeds this premium, thus yielding positive returns. Due to the scope of this study, we cannot say for certain why this is. However, one possibility could be the positive investor sentiment within, and increased public demand

for renewable energy. But since the study lacks statistical significance, we fail to reject our hypothesis.

Our long-term negative BHARs are consistent with previous empirical research (Loughran and Vijh, 1997; Mitchell and Stafford, 2000; Franks, Harris, and Titman, 1991), and with the efficient market hypothesis, positing that stock prices reflect new information immediately. One explanation for these findings could be that the event window is too short for the potential benefits to materialize. We find some different results when running our long-term regression, where it seems that larger deals are associated with positive returns, albeit with weak significance. We also find evidence that cash and cross-border deals are associated with positive abnormal returns, conflicting with our short-term findings as well as previous research on the subject. With only weak significance in one variable, we fail to reject the hypothesis that acquisitions are value-destroying in the long-term.

To test our hypothesis that cash-bids generate higher abnormal returns than non-cash-bids, we ran the regressions on the dummy representing the method of payment. Our findings indicate that there is an adverse relationship between the abnormal returns and internally financed acquisitions relative externally financed acquisitions. This is consistent with the findings of Harford (1999) and Malmendier and Tate (2007), and can possibly be attributed to Roll's (1988) hubris hypothesis and Jensen's (1986) free cash flow hypothesis, as opposed to the signaling hypothesis. However, in the absence of statistical significance, we fail to reject the hypothesis that cash-bids generate greater returns than non-cash-bids. The magnitude of the coefficient implies that manager would be better off financing the deal externally. Coupled with the results of our *Deal Size* dummy, which is statistically significant at the 5% level, the findings are similar to those of Loderer and Martin (1990). Relating these results to Roll's (1986) hubris hypothesis, we posit that the value of an acquisition could be a proxy for the manager's hubris and the likelihood of overpayment.

Additionally, the test of the fourth hypothesis suggest that European acquirers outperform the US in both the short and long term. This is supported by a survey by KPMG (2018), concluding that investor sentiment has dampened due to legislative problems within the renewable energy industry in the US and that they left the Paris Agreement. These problems contrast with several goals set by the EU to work towards the use of renewable energy sources and a sustainable society. However, the lack of statistical significance of these results leads to failing to reject

the hypothesis. Subsequently, the study cannot conclude that M&A deals perform better in Europe than the US.

The idea of corporate diversification as a value-adding activity has been extensively researched. In theory it is perfectly sound, but it does not hold in reality, as shown by previous empirical findings (Berger and Ofek, 1995; Comment and Jarrell, 1995; Denis et al., 2002; Bruner, 2005). Our findings, albeit not statistically significant, support this body of literature, arguing in favour of the focus hypothesis. This could be explained by the fact that diversification is something that the shareholders themselves can engage in. Another possible explanation could be agency problems, i.e. that managers pursue diversification as a means of empire-building. However, we fail to reject our hypothesis that deals motivated by diversification would perform relatively worse than deals motivated by focus. Similarly, cross-border transactions are controlled for and tested to see whether they are outperforming domestic deals or not. Our findings in the shortest event window imply that cross-border deals in fact are value-adding, conflicting with the findings of Denis, Denis and Yost (2002). With no statistical significance and varying magnitude signs, no conclusions can be drawn. Therefore, we fail to reject the hypothesis that cross-border deals add less shareholder value than domestic deals.

6. Conclusion

The study is performed to examine whether M&As increase the shareholder value in the renewable energy industry. This is tested in the short term using cumulative abnormal returns on 150 deals in Europe and the US from 2000 to 2018. A similar study is conducted in the long term where the performance is measured using buy-and-hold abnormal returns on a sample of 133 deals in the same regions. The final results conclude that the short-term effect of announcements of M&As within the renewable energy industry are positive for the acquiring firm's shareholders. The long-term effect shows that M&As are value-destroying, but with a small magnitude. Most of our results are consistent with previous research and theory, though there are some surprising results. The most surprising finding was the negative coefficient of the cash-deals, which we expected to have a positive association with abnormal returns. However, with the lack of statistical significance, no definitive conclusions can be drawn.

There are several restrictions with the study, the first would be the relatively small sample of only 150 deals in the short-term study and 133 in the long-term study. However, the sample is limited to the set criteria, and the lack of stock price data lead to the exclusion of several deals. In previous M&A literature there are several other deal characteristics that are commonly controlled for, e.g. whether the merger is horizontal or vertical, the market value of acquirer, relative size of the target, cash ratios, and profitability measures. These could have been added to the regression in order to get an increased explanatory power. The question could also have been researched using another methodology to perform the event study. One approach that is frequently used is the GARCH model that arguably could have improved the reliability of the study. Another restriction is our choice of market portfolios, the use of control firms or another reference index to examine the abnormal returns could have worked as a complement to the local indices used. This part is central to the approach using the market model to estimate the normal returns for improved robustness. Finally, due to a general lack of statistically significant results, further studies would have to be made to verify the results.

Further research could be conducted focusing not only on the shareholder value of the acquiring firm, but on the effects on the targets in the deals. The study is also restricted to acquisitions made by European and US companies, this could have been extended to other parts of the world. With China being one of the biggest economies and the country with largest CO_2 emissions, the Chinese market would have been of interest in this research. Moreover, Europe consist of many countries that differ to a great amount and it might not be optimal to consider them as one. Renewable energy will keep growing, and considering the limited research within M&As in renewable energy industry, there is much potential for future research.

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