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FOSSIL FUEL DIVESTMENT MOVEMENT EFFECTS ON CARBON HEAVY INDICES AND STOCKS

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ABSTRACT

In order to stop the climate change, socially responsible investing (SRI) has become largely popular in the United States of America, almost doubling in assets from 2012 to 2014. In addition to traditional SRI, the sustainable investing scene has found a new way of impacting: the Fossil Fuel Divestment Movement (FFDM). Since 2011, the FFDM has managed to gather pledges to divest assets out of fossil fuel industries worth over $3.4 trillion. The main purpose of this thesis is to examine whether the FFDM divestment announcements, endorsements and climate change news have an effect on four different indices and two US-based stocks, which represent the four main features that could be affected by the FFDM: oil, gas, coal, sustainability indices and stocks. Excluding one global sustainability index, all examined US-based indices' and stocks' returns are statistically significantly negatively affected by the FFDM outputs.

KEYWORDS: Socially responsible investing, Climate change, Fossil Fuel Divestment Movement

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1. INTRODUCTION

As the earth's average temperature has risen almost 1°C in the past century and Greenland ice sheet is melting at an alarming rate due to a manmade climate change, people and nations worldwide have expressed their concerns. Scientist forecast the average temperature of earth to keep rising this century from 3° to 10° Fahrenheit, which has forced mankind to take action in efforts to save the planet. The temperature rise is harmful to the planet and to mankind for many reasons, mostly due to the sea-level rise and thus to the threat of major cities being submerged in the near future. The single human activity most affecting the temperature rise and climate change is the combustion of fossil fuels such as coal, natural gas and oil for energy and transportation purposes. Especially stopping the burning of coal is essential in the fight against the climate change. (EPA 2016; NASA 2014.)

In order to stop the climate change, socially responsible investing (SRI) has become largely popular in the United Stated of America, almost doubling in assets from 2012 to 2014. The rise from $3.74 trillion to $6.57 trillion in assets in just two years is a sign of the popularity of trying to make a difference through markets and investing. These socially responsibly managed assets strive to fight the climate change and other social issues through investing in sustainable options that value high corporate ethics and/or will endorse the communal and environmental well-being. (USSIF 2014.)

In addition to the existing SRI, the sustainable investing scene has found a new way of impacting: the Fossil Fuel Divestment Movement (FFDM). Since 2011, FFDM has managed to gather pledges worth over $3.4 trillion in assets. The pledge for this movement is a promise to withdraw one's investments from a fossil fuel heavy companies in the near future. These pledgers have mainly been religious establishments, universities, public institutions and pension funds as well as private companies. FFDM's goal is to get the fossil fuel industry to leave the remaining fossil fuel reserves in the ground and change their operations so that carbon emissions decrease immensely. Furthermore, FFDM strives to affect legislation decision-making so that governments restrict fossil fuel drilling and issue laws that contribute in the fight against climate change. (Arabella Advisors 2015; Bloomberg 2015; SSEE 2013.)

Many of the firms that are being divested from are US-based, thus this thesis will evaluate US-based oil, gas, coal and sustainable indices as well as stocks and use the S&P500-index

as a benchmark. Furthermore, one global fossil fuel free index is examined. SRI and its lucrativeness as well as the effects of ethics based divesting campaigns has been investigated by many[1], but as the FFDM is a rather new phenomenon, few studies have focused on how have the oil, gas and coal industries suffered due to these divestment announcements, which by every measure seem significant both for the finances and the reputation of these industries.

1.1. Purpose of the study

The main purpose of this thesis is to examine whether the FFDM divestment announcements, endorsements and climate change news have an effect on three different US indices, one global fossil fuel index and two stocks, which represent the four main features that could be affected by the FFDM: oil, gas, coal and sustainable options. To be more exact, an event study is made to investigate whether fossil fuel indices or stocks suffer any negative abnormal returns after a divestment announcement, an endorsement or climate change news, or conversely, whether a SRI and a fossil fuel free indices gain any abnormal returns during the aforementioned event. Ball & Brown (1968) were among the first to use the event study method to examine a single event's effect on market prices. This method is still widely used.[2] The events studied in this thesis are the announcements of new participants in the FFDM, endorsements of individuals/groups and news regarding climate change and its research.

Many researchers have recently studied the correlations between investor mood and stock market returns. For example, Kamstra, Kramer & Levi (2000) show sleeping disorders, caused by the daylight savings time change are affecting stock returns. Furthermore, Hirshleifer & Shumway (2003) link the weather to stock returns. Moreover, Liston Perez (2016) finds that both individual and institutional investor sentiment are major drivers for *sin stock* returns, which by definition fossil fuel stocks are. The contribution of this thesis is to shed light on whether the FFDM is so influential that news surrounding the phenomenon affects the fossil fuel industries' returns. As the FFDM has grown exponentially in the recent years, the media coverage from large newspapers[3] has been increasing as well. This could lead to a major sentiment change among investors against the fossil fuel companies and thus affect the industry indirectly. Furthermore, the direct fundamental financial impact of FFDM

[1] Such as Huimin, Cheung & Roca (2010) and Meznar, Nigh & Kwok (1994)
[2] For example Scholtens & Peenstran (2009).
[3] For example The Guardian (2014).

and arguments of incorrect valuation models in valuating fossil fuel industry are considerable due to the fact that energy companies are often valued by all of their existing natural resources which either way cannot be drilled out of the ground to the last drop, are considerable, thus making this thesis topical. (SSEE 2013.)

1.2. Hypothesis development

The four hypotheses are constructed by dividing the information in to different type of categories and testing the different type of categories individually against the S&P500-index. As Beal, Goyen, and Phillips (2005) argue, there are three main reasons why investors want to invest in a responsible way: to earn greater returns in the future, to push for a social change and personal non-financial goals. Similar to other SRI strategies, the FFDM is a result of all of these, thus these potential reasons for SRI are the backbone of the hypotheses proposed in this thesis. The obvious assumption is that the coal index and the coal stock will experience the greatest reaction to the examined events, due to the fact that the coal industry is rather small and illiquid compared to the oil & gas industry. Moreover, the SRI and fossil fuel free indices returns should not be affected as much, because although the money is divested from fossil fuel industries, it does not follow that the funds will be directed to a SRI or a fossil fuel free index approved alternative.

H1: Fossil Fuel Divestment announcements cause negative (positive) abnormal returns in the oil & gas, coal indices and stocks (SRI and fossil fuel free indices).

The first hypothesis is expected to be the most plausible in terms of affecting the examined indices and stocks. Amihud, Mendelson & Pedersen (2005) state that a decrease in the stock liquidity decreases the stock price, thus the fundamental effect of lost future investors affecting the future liquidity and therefore the future stock prices of oil, gas and coal companies. Furthermore, financing for the *dirty* firms become more expensive, as lenders will refuse to finance the industry[4]. The abnormal returns effect of a divestment campaign has been found to be positive for the divesting initiator[5], but not many studies have examined the effect on the divested firms. Edmans, Carcia & Norli (2006) state that a low investor sentiment can lead to a *hangover effect* in the market, decreasing the liquidity significantly.

[4] Bloomberg (2016)
[5] For example Grossman and Sharpe (1986).

Therefore, as an indirect effect, the stigmatization of the industry is hypothesized to affect the sentiment of investors towards the *dirty* companies, thus making the negative abnormal effect on the indices and stocks even greater through both direct and indirect factors. (SSEE 2013.)

The divestment announcements are divided by the type of the divesting party: public authorities, private companies and social organizations. This allocation is also roughly based on the asset size: public authorities such as pension funds often have the most assets to divest from the fossil fuel industry, private firms have the second highest and social organizations such as universities and religious establishments have the least to divest. Therefore, different entities' divestment announcements are examined individually.

H2: Fossil Fuel Divestment endorsements cause negative (positive) abnormal returns in the oil & gas, coal indices and stocks (SRI and fossil fuel free indices).

Although lacking the direct effect on fossil fuel industries' funds, the indirect stigmatization factor is worthy of consideration when examining the effects of the FFDM endorsements made by individuals as well as groups or governments. In January 2016, famous celebrity Oprah Winfrey endorsed Weight Watchers International and their products. During the same day, the firm's stock price rose nearly 20 %.[6] As many of the endorsements are given by public officials, the effect can be estimated to be much stronger due to the possibility of a legislation change. If some concern can get enough political will behind it, efforts will be made to solve the problem via legislative procedures. Regarding the fossil fuel industry controversy, the legislative actions could be for example high carbon taxing and air pollution regulation which would hurt the cash-flows of the fossil fuel firms and thus decrease the stock prices. (Fortune 2016; SSEE 2013)

H3: All Fossil Fuel Divestment announcements cause negative (positive) abnormal returns in the oil & gas, coal indices and stocks (SRI and fossil fuel free indices).

The third hypothesis sums up all the divestment announcements made in order to examine whether any and all kind of divestment announcements linked to the FFDM have an effect on the researched indices and stocks regardless of the entity. This hypothesis is important in order to decide how large the effect of FFDM as a whole is.

[6] Fortune (2016).

H4: Climate change news cause negative (positive) abnormal returns in the oil & gas, coal indices and stocks (SRI and fossil fuel free indices).

Firm specific research has found out that information revealing bad corporate rating for sustainability, for example environmental values, hurts the firm economically.[7] Conversely, there are not many studies done on how general climate change news affect stock market or firm returns. The presumption is that a rational investor will change his/her behavior when faced with unsettling facts concerning the global warming and climate change research results. In addition to changing for example consumer behavior, one should change investing behavior as well, resulting in a divestment from carbon heavy firms due to their unsustainable operations. In other words, there should be an investor sentiment change towards these *sin stocks* that are the main cause of global warming.

1.3. Structure of the thesis

This study consists of seven chapters, including the first introduction chapter. The second chapter explains more in-depth the socially responsible investing phenomenon. First, the definition and history of SRI is described. Then, different SRI-strategies are examined and the rest of the chapter is focused on explaining the Fossil Fuel Divestment Movement and its' possible effects on carbon heavy industries. Also, background, reasons and other specifics of the FFDM are explained.

The third chapter focuses on clarifying the theoretical background of this thesis, which include market efficiency and the introduction of different risk and return models. The fourth chapter discloses several previous studies made in the field of socially responsible investing and divestments. The fifth chapter establishes the data related to the thesis. The data consists of two US-based indices related to oil, gas and coal industry, stocks of two of the top carbon heavy US-firms, one US-based sustainability index, one global fossil fuel free index and the S&P500 which is used as a benchmark. Moreover, the data also consists of divestment announcements, endorsements and climate change news from various sources. Furthermore, the event study method used in this thesis is explained. Chapter summarizes the results and the seventh chapter concludes the findings and proposes some further research topics.

[7] For example Beatty & Shimshack (2010).

Finally, list of the announcements, endorsements, climate change news and the list of top-200 carbon heavy firms are attached in the appendix of this thesis.

2. SOCIALLY RESPONSIBLE INVESTING

Socially responsible investing has many different aliases[8] due to the fact that it can be approached from many different angles. The term used is often dependent on the SRI strategy used. For example, if one of the end-goals of the investment is to impact nature and environment, the term used would be *green investing*. Basically, SRI is investing in a manner in which one considers social, environmental and ethical issues in addition to the return on investment.[9] In other words, investors seek financial gains together with a positive impact on different social matters. Schueth (2003) describes SRI as *"the process of integrating personal values and societal concerns into investment decision-making".* Thus, three probable reasons for socially responsible investing by Beal et al. (2005) are: financial gains, non-financial gains and social change. Although these proposed causes of SRI together interpret the motivations of an ethical investor satisfyingly, individually, they cannot explain actions of one single investor. (Beal et al. 2005; USSIF 2015.)

One argument for investing in socially responsible firms is that the returns one can get from them are greater when compared to socially non-responsible firms. El Ghoul, Guedhami, Kwok and Mishra (2011) find that firms which have a better corporate social responsibilities (CSR) have also a lower cost of capital. From an accounting based data sample of 12 915 US firms from 1992 to 2007, firms that scored a high CSR also had a mean of 0.56 % lower cost of capital than the firms that scored a low CSR. This statistically significant finding implies that those firms face lower risk and thus should be invested in. The lower risk of high CSR firms suggests that these firms also do better in an uncertain and volatile market. Furthermore, Orlitzky, Schmidt and Rynes (2004) conclude that socially responsible firms outperform financially in their empirical meta-analysis study of relationship between corporate social performance and corporate financial performance.

Beal et al. (2005) propose a three way approach to the utility of ethical investment:

1. *Emotional returns of ethical investing are largely comparable to the fun of participation that gamblers enjoy.*

[8] Such as community investing, green investing, ethical investing, impact investing and shareholder advocacy.
[9] Horst, Renneboog & Zhang (2008).

2. *Measuring the perceived level of ethicality in their investment decisions by adding the variable in the investor's utility function.*
3. *Comparing the ethical investments emotional returns to other emotional returns gained from different activities, such as sports or playing video games.*

Researchers have found that the fun of participation in gambling, is independent of the outcome of the gamble, if the size of wealth gambled is small compared to the total wealth of the participant. This implies that whether people gambling win or not, they get some mental gains from it. When this theory is incorporated into ethical investing, the potential total utility gained is the investment returns plus the emotional returns gained from participating. This outcome can be illustrated when the levels of utility of different investing methods are compared against each other, see Figure 1 below. (Beal et al. 2005.)

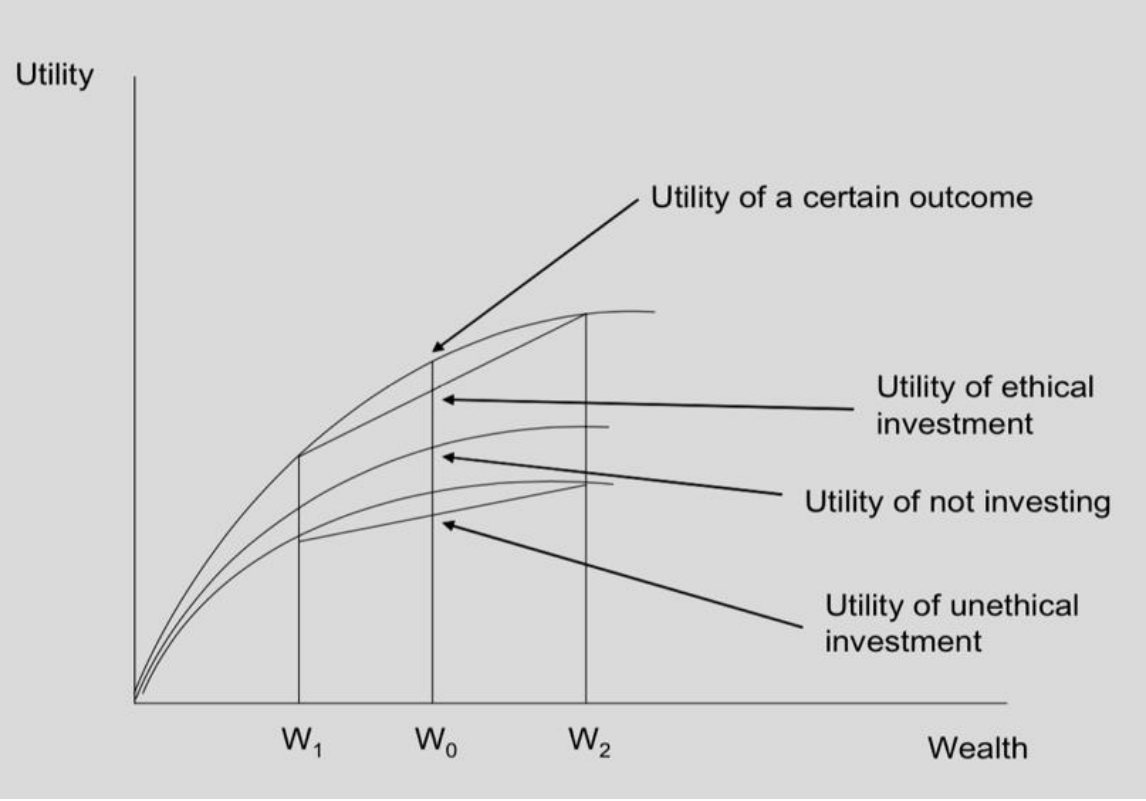

Figure 1. Ethical Investor's Utility Function (Beal et al. 2005).

Whether the investor loses (*W1*) or wins (*W2*) the utility of an ethical investment is positive compared to not investing at all. Conversely, if the investment is unethical, the utility is negative regardless of the outcome. (Beal et al. 2005).

Harper & Leight (1993) define social change in three different ways: a significant social event which causes a change, social trends changes and a change in the social institutions or population. While one individual shareholder cannot cause a change in a firm, a group of investors can. However, the social change aspect and reasoning of SRI is caused largely by the same feeling as the fun of participating: The investors feel they are participating in making a social change and abstracting from supporting any undesirable activities, hence getting emotional returns even though no real, concrete social change has yet happened. (Beal et al. 2005).

2.1. History of SRI

The early origins of SRI come from hundreds of years ago when Jewish laws forbade investing in many unethical options. Furthermore, the birth of SRI happened through religions as different churches had morals and codes on how to act and spend money, which is partly the reason why SRI was referred to as *ethical investing*. The religious background can also be seen in the avoidance of *sin stocks,* which generally consist of alcohol, tobacco and gaming companies. Generation after another, religious people have tried to avoid investing in some unwanted cause. (Schueth 2003.)

The current SRI movement originates largely from the middle of the 20th century, when many social problems were existent, from the Vietnam War to gender inequality, which were followed by the 1970s labor issues and anti-nuclear protests. Socially responsible investing came to mainstream when a large amount of investors put social pressure on the South African government by divesting out of the country in order for the local government to stop the racist apartheid. Nowadays, SRI has become more about the environment as people have awoken to the climate change and its' effect on the globe. Nevertheless, social issues are still a topical part of the SRI movement, largely due to the recent school shootings and human rights issues. (Schueth 2003.)

As stated in the introduction part of this thesis, in recent years socially responsible investing has doubled its size if measured by amount of assets. The size of the SRI phenomenon has

grown so large that academics are interested in studying the effects of SRI on the economy and companies financials. Moreover, with SRI being the fastest growing trend in the financial markets even legislative power has caught up with it: from July 2000 onwards, UK private pension funds have been legally obliged to consider the socially responsible point of view in their investments. (Bauer, Koedjiik & Otten 2005; Sparkes 2001; USSIF 2014.)

Organizations such as the United Nations (UN) have also taken part in the SRI movement: Principles for Responsible Investment (PRI) was founded by UN in the early 2000's. PRI is an international group which helps investors to understand the basis of socially responsible investing and the implementations of it. PRI has already $59 trillion in assets by 1 382 investors who have signed the principles. PRI has launched six core principles for SRI[10]:

1. *Incorporate environmental, social and corporate governance (ESG) issues into investment analysis and decision-making processes.*
2. *Be active owners and incorporate ESG issues into our ownership policies and practices.*
3. *Seek appropriate disclosure on ESG issues by the entities in which we invest.*
4. *Promote acceptance and implementation of the Principles within the investment industry.*
5. *Work together to enhance our effectiveness in implementing the Principles.*
6. *Report on our activities and progress towards implementing the Principles.*

2.2. SRI strategies

Broadly, socially responsible investing can be divided into three different strategies: *community investing, shareholder advocacy* and *screening. Community investing* refers to a strategy which targets people living in low-income communities. Investors put their money in community development projects that strive to help society members that have a hard time making ends meet in life through conservative ways. This kind of investing can help for example low-income community members to get business loans for their endeavors in case they are rejected by the traditional financing entities such as banks and credit unions. *Shareholder advocacy* means that socially aware investors try to affect in the decision-making of the firm from within. As owners of the company, social shareholder advocates vote at company meetings in a way that benefits all stakeholders of the company, from employees to the environment. For these shareholders it is important to establish a

[10] Principles for Responsible Investment (2015).

communication with the management in order to affect their opinions in social matters and thus usher the company to act in a more sustainable way. (Schueth 2003.)

Screening is generally divided into two different categories: positive and negative screening. As SRI has become more mainstream, different corporate governance ratings of firms have become a large factor in deciding where to invest responsibly. Positive screening is a process where the investor finds the investment options with the best corporate governance and sustainability ratings. Negative screening is the oldest style of socially responsible investing. In negative screening, investors choose an industry in which they do not want to take part and abstain from investing in companies doing business in that specific industry. Usually, such industries include tobacco, gambling, alcohol etc. This thesis examines the effects of the Fossil Fuel Divestment Movement, which in a way is a type of a negative screening: investors refuse to invest in fossil fuel companies, but go a step further and even pledge to take their existing capital out of the industry. (Schueth 2003.)

When talking about negative screening and SRI, usually the term *sin stocks* comes up. This term describes firms that have operations in socially reprehensible industries. Hong and Kacperczyk (2009) state that "sin stock industries" usually refers to the *triumvirate of sin*, namely tobacco, alcohol and gaming companies. These companies are described as *sinful* due to their addictive products or negative effects on and consequences to the society. Sin stocks usually have less analyst coverage and they tend to be cheaper than traditional stocks, due to the socially aware investors avoiding investments in them. Because of this restrain of socially responsible investors, the capital flow is also much lower for the sin stocks, therefore increasing their cost of capital. (Hong et al. 2009; El Ghoul et al. 2011.)

2.3. Fossil Fuel Divestment Movement

Divestment is a branch of socially responsible investing, where an investor, individual or a group, anywhere from universities to public pension funds, withdraws its money from a socially undesirable industry or a firm. These objects of divestment are selected by negative screening. In the past, divestment campaigns have usually gathered supporters in three waves. At first, a core group starts to campaign against an industry which acts in an unwanted or an unethical way. Generally, the first wave is started by religious groups or industry-related public organizations. In the second wave, universities, cities and public institutions such as public pension funds come aboard to support the movement. In the third wave, the larger

market becomes aware of the divestment campaign and political decision-makers feel the pressure to change legislation. (SSEE 2013.)

2.3.1. Introduction of the FFDM

The starting point of the Fossil Fuel Divestment Campaign can be traced to the article of the American author and environmentalist Bill McKibben, which was published in the Rolling Stone magazine on 19th of July 2012. The article titled *"Global Warming's Terrifying New Math"* explained how it is impossible to burn all fossil fuel reserves and still keep the earth's global warming below 2 °C, which has been the target amongst the 167 countries that have signed the Copenhagen Accord (2009). McKibben (2012) states that all of the fossil fuel reserves cannot be burned, because this would produce carbon emissions five times over the *carbon budget* agreed. Therefore, McKibben (2012) urges for global fossil fuel divestment. Furthermore, oil, gas and coal companies are generally valued by their reserves, which would indicate that there is a *carbon bubble* in valuation of the firms due to the fact that either way, all of the reserves cannot be used if the goal is to keep inside the agreed carbon budget. (SSEE 2013.)

In November 2012, 350.org, which is a non-profit organization fighting against climate change, launched a campaign to get *"institutions to immediately freeze any new investment in fossil fuel companies, and divest from direct ownership and any commingled funds that include fossil fuel public equities and corporate bonds within 5 years".* Moreover, 350.org request divesting from the top-200 publicly traded carbon heavy firms. The list of the top-200 carbon heavy firms is attached in the appendix of this thesis. While there are not many studies done on fossil fuel divestments, some research has been done on South African Apartheid Divestment Campaign. The campaign was launched in the 1980's to fight the racist South African government to stop the apartheid. The Fossil Fuel Divestment Movement is largely based on the success of this historic campaign. (Posnikoff 1997; SSEE 2013.)

The FFDM objectives are broadly based on the core principals of the South African Divestment Campaign. As mentioned in the first chapter, FFDM's goal is to get the fossil fuel industry to leave the remaining fossil fuel reserves in the ground and change their operations so that the carbon emissions decrease immensely. Furthermore, FFDM strives to affect legislative decision-making so that governments put restrictions on fossil fuel drilling

and issue laws that contribute in the fight against climate change. The legislation changes include for example a large carbon tax which would decrease the profitability of burning fossil fuels. (SSEE 2013.)

Similarly to the South African Divestment Campaign, FFDM started with just a core group of divesting investors who tried to get publicity for the issue. In the South African divestment campaign, the first wave of divestment were religious groups, but in FFDM the first wave of divestments came from US-based universities. To date, the FFDM has managed to gather pledges of assets not going to be invested in fossil fuels worth over $3.4 trillion and $50 billion in total assets that are eventually going to be divested out of fossil fuel industry. Figure 2 below illustrates the divested assets by sector. (Arabella Advisors 2015; The Guardian 2015.)

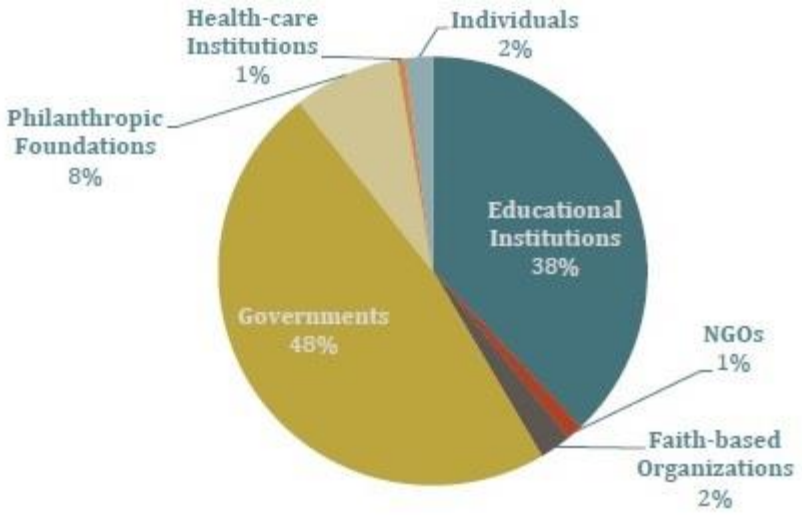

Figure 2. Divested assets by sectors. Note: 82 % of institutions & local governments and 77 % of individuals reported asset sizes. (Arabella Advisors 2015.)

On March 2016, the largest US bank JPMorgan Chase announced that it will not finance coal companies anymore. This news is important due to fact that JPMorgan is the second largest shareholder in the coal companies worldwide. Moreover, Norwegian authorities who are the fifth largest shareholders in the oil & gas companies have pledged to divest,

therefore one can assume that the FFDM can have an immense effect. Figure 3 below demonstrates the largest shareholders of oil & gas and coal companies globally. (Bloomberg 2014, 2016; The Guardian 2015.)

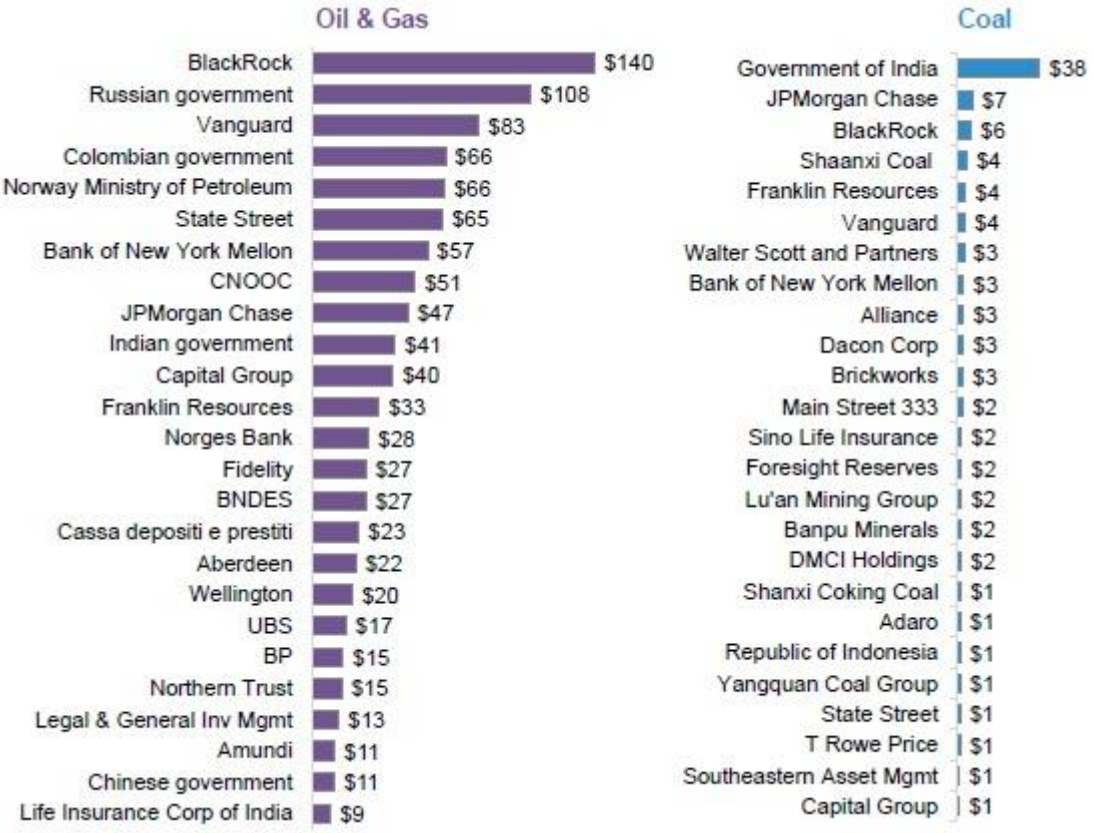

Figure 3. Largest shareholders of oil, gas and coal companies worldwide. ($bn) (Bloomberg 2014.)

It is plausible that the campaign has moved to the third wave: Public pension funds have pledged for divestment and public legislators are feeling the pressure globally as even private firms have taken part in the cause and due to the fact that governments are the largest entities divesting. Therefore, one should consider the impacts of the movement on the fossil fuel industry. (Arabella Advisors 2015; SSEE 2013.)

2.3.2. Effects of the FFDM

The FFDM's impact on fossil fuel companies can be divided into two different categories: direct and indirect effects. The direct effects are the total capital divested from the industry,

changes in market norms and decrease in debt financing. The indirect effects include restrictive legislation and stigmatization of the fossil fuel industry. (SSEE 2013.)

The direct impact of withdrawing capital due to the FFDM is assumed to be rather limited, because the funds which universities and pension funds hold in the fossil fuel industry are not that large. Only if the FFDM becomes globally large enough to get several private firms to take part, then the direct impact of capital withdrawing can be effective and significantly harmful for the industry. Moreover, the coal industry is going to be affected more by direct capital withdraw due to the fact the above mentioned industry is much smaller and illiquid compared to the oil & gas industry.

The changes in the market norms can lead to a decrease of conventional channels of capital flow. The FFDM has already gathered $3.4 trillion in assets that are not going to be invested in the fossil fuel industry, which means that the future capital liquidity is lessened at least with that specific amount. Already a significant amount of assets, it has led to a snowball effect which only continues to grow and take away sources of a potential capital from the industry. This effect leads to a rising cost of capital for the fossil fuel companies.

The third and last direct impact effect of the FFDM is the decrease of debt financing for the fossil fuel industry. When banks retreat from financing fossil fuel companies, due to their stigma or merely due to the bubble-like valuation of carbon, the cost of debt increases for these firms due to the restricted pool of financing. This impact can affect the decision-making of firms, rejecting marginal projects that are not profitable anymore due to the higher cost of debt. (Arabella Advisors 2015; SSEE 2013; The Guardian 2015.)

Additionally, the indirect impact of the FFDM to the fossil fuel industry is significant. As the industry becomes stigmatized, investors have a very low sentiment towards the companies. Kamstra et al. (2000) link investor mood to stock returns and Edmans et al. (2006) find a negative correlation with the investor mood and liquidity. Amihud et al. (2005) state that a decrease in stock liquidity decreases the stock price, thus a stigmatization of the fossil fuel industry can profoundly lower the stock prices of fossil fuel companies. Furthermore, the companies can be for example neglected in future mergers and acquisitions due to the stigma attached to them. Also, the stigma of the industry can affect political will and lead legislators to set in place new laws to restrict the operations of the fossil fuel companies. All of these aforementioned impacts can have a significant effect on multiples and cash-flows of fossil

fuel companies due to the uncertainty around the whole industry, therefore posing a threat of decreasing stock prices. (SSEE 2013.)

3. THEORETICAL BACKGROUND

In this chapter, the theoretical background of this thesis is reviewed. The term market efficiency is explained and two different risk and return models are introduced.

3.1. Market efficiency

An efficient market is often described as a market which always mirrors the available information in stock prices. If the capital market is efficient, it should be impossible to *beat the market*, as the stock prices always reflect all the relevant information available. Thus, in an efficient market, investors are not able to make profits by buying undervalued stocks or selling overvalued stocks. Getting higher profits in an efficient market can be done only by investing in stocks that are more risky than others. Also, there can be a different kind of efficiency in the market as operational efficiency means for example that the trading costs are low in that specific market. An efficient market in a broader perspective of economics means that the market is allocating its resources effectively and frugally. (Fama 1970; Sharpe, Alexander & Bailey 1999: 92.)

Almost half of a century ago, the efficient markets hypothesis was thought of being the prevailing theory of explaining the information's correlation with the stock prices. Prices reflect information perfectly and investors cannot beat the market. The efficient markets hypothesis is often affiliated with the random walk hypothesis. Random walk hypothesis explains the randomness of the price's change. The prices mirror the information correctly and immediately, the information comes unpredictably, hence investors cannot predict what is the stock's price tomorrow based on the stock's price today. Only tomorrow's news can effect on the price of the stock tomorrow, regardless what the price was today. Therefore, anyone should be able to make investment portfolios as profitable as the portfolios done by experts. (Malkiel 2003.)

Capital markets efficiency is often divided in to various levels through the information and the market efficiency terms. Viewing market efficiency through these terms, the researchers can determine are the stock prices predictable and can the stock price predictions be arbitraged in some ways. Fama (1970) in his widely known article divided the capital market's efficiency in to three separate category of efficiency, based on information; weak-

form, semi-strong-form and strong-form efficiency. The levels of efficiency are rigidly related to each other, as the stronger form of efficiency cannot exist without the weaker form's terms being fulfilled first. Consequently, semi-strong-form terms have to be fulfilled before strong-form terms can exist in the market (Malkamäki 1990: 35). Figure 4 clarifies Fama's (1970) levels of market efficiency.

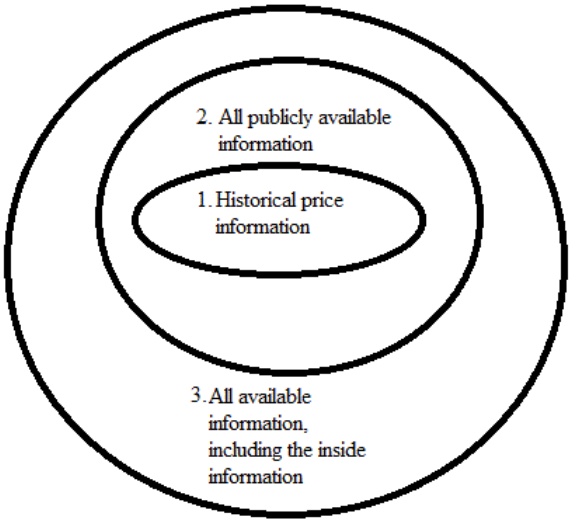

Figure 4. The available information from stock in different efficiency levels and their relationship to each other. (Nikkinen, Rothovius & Sahlström 2002: 84.)

Fama's (1970) three levels of market efficiency levels are:

Weak-form efficiency

The stock's price contains only the information of the previous prices of the stock. Future prices of the stock are random and cannot be predicted. Therefore, the investors cannot use arbitrage to make higher returns. In this type of a market the best investment strategy would be buy-and-hold. Autocorrelation and run-tests are statistical methods used to research any correlation between serials of stock returns.

Semi-strong-form efficiency

The weak-form efficiency terms must be fulfilled before semi-strong-form can exist. Thus, in addition to historical prices of the stock, every bit of public information must be available and the security must reflect the information without a delay. Event study method is used to examine the effect of these public information releases, such as initial public offerings, annual and quarter reports etc., on stock prices. The semi-strong-form of market efficiency definition accepts small amount of delay in implementation of the information to the stock prices, although it requires that arbitrage is not possible due to these delays. (Fama 1970; Malkamäki 1990: 37.)

Strong-form efficiency

In the strong-form of market efficiency the share prices mirror all the information available, public and private. Private information is the inside information that companies executives and managers have that usually company's interest groups such as stockholders do not have. The strong-form market efficiency is researched often via research problem "*Can executives, who have inside information, create excessive returns?*" There have been zero indications towards a strong-form market efficiency existing in any of the known capital markets (Malkamäki 1990: 39).

3.2. Different risk and return models

The capital market efficiency can be measured with different models. These models' aim is to solve the required rate of a capital return. More frequently used models have often the same problem, which is that they tend to be very simple and plain. In this thesis, Capital Asset Pricing Model (CAP Model) and arbitrage pricing theory are reviewed.

3.2.1. Capital Asset Pricing Model

The CAP Model is probably the most known return model used. The CAP Model is very simplified model and it was invented by Treynor in the early 1960's. The CAP Model assumes that the major effective component of expected returns is the systematic risk. The CAP model is still used in finance by experts, although many of these models used are expansions of the original CAP Model. In order for the model to work properly, some assumptions have to be made. Before making any assumptions it is important to understand

the complexity of the capital markets and due to that fact the model is so stripped; defining the required rate of return, only the most important factors have to be observed for the purpose of creating as practical a model as possible. (Sharpe et al. 1999: 227.)

According to Bodie, Kane & Marcus (2002: 264), these assumptions for the CAP Model are: there are no taxes and no transaction costs, all the investors have the same identical holding horizon, all the investors are rational (they choose the portfolio that has the lowest standard deviation given the required rate of return), all the investors share the same economic view of the world and analyze securities in a mutual way, all the investments are publicly traded financial assets and the investors act as though the security prices are not affected by their own trades. As is evident, these presumptions are so simplifying that they do not exist in any of the known markets today. These assumptions would require the market to be perfect and that all the investors would analyze the information identically. (Sharpe et al. 1999: 228.)

The expected return-risk relationship equation in the CAP Model is

$$E(R_i) = R_f + \beta_i \times [E(R_m) - R_f] \quad (1)$$

Where $E(r_i)$ is the expected return of a stock, r_f is the risk free rate, β_i is the beta of the stock and $E(r_m)$ is the expected market return. (Sharpe et al. 1999: 235.)

3.2.2. The Arbitrage Pricing Theory

The arbitrage pricing theory leans on the assumption that there can be many different factors for different stocks which affect the returns in an individual way. According to the arbitrage pricing theory, many macroeconomic factors and noise affect stock returns. Noise is stated as a specific event for any individual firm. The arbitrage pricing theory equation is

$$R_i = E(R_i) + \beta_{i1}F_1 + \beta_{i2}F_2 + \cdots + \varepsilon_i \quad (2)$$

As one can see from the equation, the components are not fixed. In other words, the components of the equation can be whatever is specific for the company examined. Factors can be for example carbon outputs, currency rates etc. Basically, a company carries two kinds

of risks: systemic and systematic. Systematic risk is the macroeconomic risk and systemic risk is the risk relating to the industry and company itself, which can be ignored due to the fact that the systematic risk can be diversified in such a way that the systemic risk does not matter. (Brealey, Myers & Allen 2011.)

The most used arbitrage pricing theory model is the French Three Factor model, which Fama & French (1993) invented after they found out in their 1992 study that the CAP model does not fully explain the stock returns. They claim that the stock risks are multidimensional and that macro-economic factors have an indirect effect on the stock returns through variable components such as debt, sales and profits.

The Fama-French Tree Factor model equation is

$$R_s = \alpha + B_1 R_m + B_2 R_{SMB} + B_3 R_{HML} + \varepsilon \quad (3)$$

Where r_m is the market return, r_{SMB} is the return of a portfolio containing small stock in excess of the return on a portfolio that consist of large stocks, r_{HML} is the return of a portfolio of stocks with high book-to-market value ratios in excess of the return on a portfolio containing low book-to-market ratio stocks.

The additional factors r_{SMB} and r_{HML} have been brought to this equation due to the fact that small firms with a high book-to-market value tend to make higher returns than the CAP model predicts. With these factors, risk can be predicted better, as small firms can be more sensitive to the market changes and a high book-to-market ratio may indicate to some financial predicaments in the company. (Bodie, Kane & Marcus 2002: 311–312.)

4. PREVIOUS STUDIES

In this chapter, previous studies regarding socially responsible investing and divestments will be introduced. Many of the previous studies done on SRI have concentrated on comparing the performance of selected socially responsible funds or indices. Furthermore, the performance of companies which promote socially responsible values has been compared against ordinary benchmark firms. Nevertheless, there are no wide scope of studies done on the effects of different divestments due to the fact that there simply have not been very many. Most of the divestment research focuses on the effects of the divestment of *sin stocks* and the divestment of the South African stocks because of apartheid.

4.1. Socially responsible investing

Schröder (2005) investigates 29 SRI indices globally and measures their risk-adjusted returns against benchmark indices. He finds that although the SRI indices as a whole are more risky, their risk-adjusted returns are similar to the benchmarks. Statman & Meir (2006) do a similar research with similar results: in the four SRI indices they study, no significant difference in returns is found against the benchmark index. Furthermore, Huimin et al. (2010) analyze seven different SRI indices and find no significant differences in the risk-adjusted returns between the examined SRI indices and benchmark indices. Based on these studies, the conclusion can be drawn that generally, SRI indices' risk-adjusted returns do not differ significantly from the benchmark indices' returns.

Maybe the most appreciated study regarding SRI funds has been done by Horst et al. (2008), who study the performance of SRI funds with a dataset that covers almost *all* of the SRI funds world-wide, including 440 SRI funds from 17 countries with a longer time period than the previous studies have done. When using the Capital Asset Pricing Model (CAPM), they find that on average the SRI funds underperform the conventional funds by 2.2 % – 6.5 % per annum. As Kempf & Osthoff (2007) remind, it is important to remember that fund managers are a possible driving factor when observing an actively managed fund's returns, thus Horst et al. (2008) control for the transaction fees, and find that the underperformance remains significant.

Kreander, Gray, Power and Sinclair (2005) investigate 40 different European ethical investment funds and conventional funds from Belgium, Germany, Netherlands, Norway, Sweden and United Kingdom. Even though the ethical funds have a lower systematic risk and a lower standard deviation, there were no significant difference between the performances of the ethical funds compared to the conventional funds, measured by returns. Shank, Manullang and Hill (2005) examine different SRI funds returns against the NYSE Composite Index. They find that the funds do not create an excess returns against the benchmark, neither on long- nor short-term time-period. However, the fund that have the best responsibility rate beat the market returns statistically significantly, when looking at a ten year time-period. Bello (2005) study 42 SRI funds and found, that compared to the non-SRI funds, there were no significant difference in the risk-adjusted returns. Contrary to the findings of Horst et al. (2008), based on the above-mentioned studies, it can be said that the very best SRI funds in the long term can perform better than their conventional benchmark funds. This can be due to their insurance-style features against uncertainty in the market which is addressed in the next paragraph.

Godfrey, Merrill & Hansen (2009) study a dataset of 160 companies from 1991 to 2002, to find out whether good corporate responsibility can act as a buffer against uncertainty in the market. They find that a good corporate social responsibility indeed gives an insurance kind of cover against events that are viewed as negative in the market. The *good* companies suffer statistically significantly less than *bad* companies. Furthermore, Mio & Fasan (2012) study the effects of good corporate responsibility during the financial crisis of 2008, specifically during the time that Lehman Brothers filed for bankruptcy. Their dataset included 398 non-financial US-based companies. They as well find a coverage effect against the negative impact of the Lehman Brothers bankruptcy. Based on these studies, one can say that there is an insurance effect against negative impacts in having good corporate social responsibility among the firm.

Konar & Cohen (2001) examine how the US-based firms' environmental efficiency affects the firms' value. They find that a decrease by 10 % in the emissions of toxic chemicals result in a gain of over $30 million in a company value. Moreover, El Ghoul et al. (2011) have done very robust research to find whether firms which have better corporate social responsibilities (CSR) ratings also have a lower cost of capital. From accounting based data sample of 12 915 US firms from 1992 to 2007, firms that scored a high CSR also had on average 0.56 % lower cost of capital than firms that scored a low CSR. They point out that the findings should

suggest portfolio managers to invest more on companies that promote a good CSR and divest from companies that have a bad CSR rating.

4.2. Divestments

Theoretical framework is very limited on divestments due to the fact that there are not very many divestments. Scholars have studied the effects of SRI extensively but there are only a few studies done on divesting and divestment campaigns. Moreover, a large amount of the studies is done on the South African divestment movement which was in the 1980s. Therefore, in this chapter the studies done on divestments and especially research about the South African and the fossil fuel divestment movement will be analyzed. (SSEE 2013.)

Many public and private pension funds started to divest their money out of firms that operated in South Africa in the 1980s. Institutional investors, such as universities, governments, non-profit organizations and pension funds divested an estimated $450 billion dollars from companies that did business in South Africa.[11]This divestment was a protest against the racist politics which the South African government pursued. Blake & Sharpe (1986) examine the performance of a well-diversified US-based portfolio, free of companies that do business in South Africa versus conventional actively managed funds which has firms operating in South Africa, as well as benchmark indices such as the S&P500. The researchers find that the well-diversified South Africa-free portfolio outperform the benchmarks by a small amount, based on risk-adjusted returns. However, they suggest that the outperformance can be explained through the small-firm effect: companies that do not do business in South Africa were on average smaller than those who do. (Blake et al. 1986).

Moore, Pruitt & Tse (1993) find contradicting results: companies which made public announcements to express their willingness to take part in the South African divestment movement suffered significant negative abnormal returns on the date of the event. Their dataset consisted of 43 companies and a time-period of 1984–1990. Furthermore, Lytle & Joy (1996) find the same effect with 113 firms that announced willingness to divest from South Africa from 1977 to 1989. They compared the *LEAVE* announcements of these firms to *STAY* announcements of 52 firms that were not willing to divest. The researchers found

[11] New York Times (1990).

that the stock market reactions to the announcements of companies willing to divest were significantly negative compared to the reaction of the firms that stayed. The study concludes: *"there was a negative wealth impact of social pressure."* (Lytle et al. 1996.)

Meznar et al. (1994) find similar decreasing value effects on the withdrawing companies' stock in their research and state that firm managers were not thinking about the interest of shareholders when they made the decision to divest. Posnikoff (1997) argues that these negative impact effects are found only due to the fact that the past studies have been done with a too long event window. She states that usually event studies examine only a short period of time to test how the market reacts to the announcement/news, and that for example Meznar et al. (1994) use a 40-day event window. Posnikoff (1997) examine 40 US firms that have a complete returns data during her research period of 1980–1991, and make a divestment announcement. She investigates the event day and the next day to determine how the market reacts to the divestment announcement. She found that companies underwent positive market reaction following the divestment announcement. Also, the trading volume increased, thus the announcement affected the liquidity positively as well.

Kiyar & Wittneben (2015) examine the influence of Fossil Fuel Divestment Movement on the decision-making of the four largest German energy companies. With their qualitative data they conclude that other factors such as electricity prices, company ownership, government regulation and domestic energy sources influence the large German energy firms more than the FFDM on their path to a more sustainable business model due to climate change. Therefore, the FFDM does not affect their decision making directly. Nevertheless, Kiyar et al. (2015) state that in the future the FFDM can have major influence on company decision-making, mainly through political regulation.

5. DATA AND METHODOLOGY

This chapter consists of introducing the data and explaining the statistical methodology used in this thesis. The Fossil Fuel Divestment Movement announcements, endorsements and climate change news are gathered from the Fossil Fuel Divestments Campaign site, which is the 350.org organization that leads the movement. Moreover, outputs are taken also from the newspaper The Guardian. The total amount of 73 FFDM announcements, endorsements and climate change news are collected 23.4.2013-29.1.2016. The daily closing prices of studied indices, stocks and the benchmark index S&P500 are retrieved from Datastream and from the S&P Dow Jones Indices website. (Gofossilfree.org 2016; S&P Dow Jones Indices 2016; The Guardian 2016.)

5.1. Data

The data consists of 73 divestment announcements, endorsements and climate change news which are collected 23.4.2013–29.1.2016. The FFDM started its operations in 2012, but the year 2013 was the first year that the movement truly gained speed as many new organizations pledged to divest. The FFDM has its own websites where the pledges and endorsements are listed. The links of the divestments on the website lead to the original source of the pledgee. The same system applies to the endorsements. Moreover, a large UK-based newspaper The Guardian has dedicated a website for the FFDM, where a series of articles relating to the Fossil Fuel Divestment Movement are collected. Thus, some of the announcements, endorsements and most of the climate change news are gathered from The Guardian. (350.org 2016; SSEE 2013; The Guardian 2016.)

The divestment announcements are divided by the type of the divesting party: public authorities, private companies and social organizations. Also, this division is roughly based on the asset size: Public authorities such as pension funds often have the most funds to pledge out of the fossil fuel industry, private firms have the second highest and social organizations have the least amount of assets invested. The specific amounts of fossil fuel divestment announcements, endorsements and climate change news are illustrated in table 1.

Table 1. Amount of FFDM Announcements, Endorsements & Climate change news gathered.

ANNOUNCEMENTS	*ENDORSEMENTS*	*CLIMATE CHANGE NEWS*
PUBLIC	12	13
19		
PRIVATE		
7		
ORGANIZATIONS		
24		

This thesis examines four different indices' as well as two different stocks' returns and compares them to the benchmark index S&P500 returns. The studied indices are S&P Oil & Gas Exploration & Production (SOGE), S&P Coal & Consumable Fuels (SCBF), The Dow Jones Sustainability Index North America (DJSI) and The S&P Global 1200 Fossil Fuel Free Index (FFFI). The two examined stocks, Exxon Mobil (XOM) and Peabody Energy (BTU), are the most carbon heavy US-based firms in oil and coal industry, measured by their reserves of possible carbon output. Excluding the FFFI index, all studied indices and stocks are US-based, as a large amount of the announcements, endorsements and climate change news come from the US. All of the indices are price indices, which means that the dividends are not added to in to the index price. In order to get a full estimation of returns before the actual event and its' effects on the returns, the research period for the indices and stocks is from 2.4.2012 to 4.3.2016. The price data is collected from Datastream and from the S&P Dow Jones Indices website. (Fossil free indexes 2016; S&P Dow Jones Indices 2016.)

The S&P500 index was founded in 1957 and it is the first market capitalization weighted stock market index in the United States. It is supposed to serve as an overall indicator of the state of US stock markets. It is the best gauge of large cap US equities and it includes the 500 largest US-based companies with a roughly 80 % accurate representation of available market capitalization. The S&P Oil & Gas Exploration & Production is an S&P-Total Markets based index (US-based), which was launched in 19.7.2006 and it consists of the 60 largest Oil & Gas Exploration & Production companies in the US. S&P-Total Markets is a similar benchmark index as S&P500, with an addition of small cap firms. The S&P Coal & Consumable Fuels is a similar index as SOGE, also based on the S&P-Total Markets index. SCBF constitutes from largest GICS Coal & Consumable fuel sub-industry in the US. (S&P Dow Jones Indices 2015.)

Found on 23.11.2005, The Dow Jones Sustainability Index North America is an index which consists of the best 20 % of North American companies measured by sustainability and is weighted by float-adjusted market capitalization. In this context, sustainability is defined based on *"long-term economic, environmental and social criteria".* As of end of February 2016, the top three industries represented in the index are Health Care (17.83 %), Technology (17.71 %) and Financials (15.09 %). Also, 92.08 % of the index is based on US companies and the rest on firms from Canada. Furthermore, as only the top 20 % measured by sustainability are picked on to the DJSI index, it increases the reputation of a company if it is included in the index. On February 2016, Microsoft was the number one on the list, in other words, it had the most weight on the index. (S&P Dow Jones Indices 2016.)

The S&P Global 1200 Fossil Fuel Free Index measures the performance of global stocks that do not own any fossil fuel or have any fossil fuel reserves. In this context, fossil fuels are defined as crude oil, natural gas and coal. FFFI was launched on August 28, 2015 but the first value is dated back to December 30, 2011. The index includes 1 111 constituents from 29 countries mostly from US, with an index weight of 58.8 % and 472 constituents. The largest sector by weight on the index is Financials, with an index weight of 20.8 %. This particular index is the only global stock index, and thus is not expected to react as significantly as the others on the studied inputs due to the wide global diversification. (S&P Dow Jones Indices 2016.)

Table 2. Descriptive statistics of the indices sample.

	Mean	*Median*	*Maximum*	*Minimum*	*Std. Dev.*	*Skewness*	*Kurtosis*
S&P500	0.034 %	0.012 %	3.829 %	-4.021 %	0.830 %	-0.2391	4.7564
SOGE	-0.041 %	0.000 %	6.843 %	-8.503 %	1.691 %	-0.2230	5.6839
SCBF	-0.161 %	-0.051 %	17.589 %	-23.898 %	3.196 %	-0.1442	9.8418
DJSI	0.021 %	0.025 %	3.552 %	-4.114 %	0.817 %	-0.2467	4.7712
FFFI	0.024 %	0.040 %	2.871 %	-3.681 %	0.720 %	-0.3578	5.1644

Table 2 represents the descriptive stats on the indices examined. The carbon industries' index mean daily returns are negative, which is in accord with the expectation that the carbon heavy industries suffer due to the FFDM. Coal index has suffered astonishing -24 % returns at minimum and is also the most volatile of the indices. This is in accord with the assumption that coal industry is quite illiquid and thus volatile. Nevertheless, the skewness is negative

for all the indices, which implies that positive returns are more common in the sample. High levels of kurtosis of the carbon heavy indices explain the negative skewness: even though positive values are more common, there are extreme values in the sample. This can be observed also from the higher volatility of the carbon heavy indices. Conversely, for the two indices which are described as sustainable, the mean daily returns are positive but not over the mean daily returns of S&P500. The interesting fact is that both sustainable indexes' volatility is less than the S&P500's, which is in accord with previous research[12], that being sustainable and having a good SRI can offer insurance against market uncertainty.

Exxon Mobile is a US-based, the largest publicly traded international oil and gas company with global branches. XOM was found on November 30, 1999 and its' headquarters are in Irving, Texas. The CEO of Exxon is Rex W. Tillerson who also acts as the chairman of the company. XOM was selected to this study due to its carbon heavy reserves; it is the world's fourth-most carbon heavy and the most carbon heavy US-based oil & gas company with a total of over 8 000 billion tons of potential carbon output reserves. Peabody Energy is the world's largest private-sector coal company. It acts in 25 nations on six continents and it is the world's tenth-most carbon heavy and the most carbon heavy US coal firm with a total amount of over 10 000 billion tons of potential carbon output reserves. It was found already in 1883, and nowadays it employs approximately 8 300 employees. The CEO of Peabody is Glenn L. Kellow who acts also as a president of the company. The headquarters of BTU is in St. Louis, Missouri. (Exxon Mobile 2016; Fossil Fuel Free Indexes 2016; Peabody Energy 2016.)

Table 3. Descriptive statistics of the stocks sample.

	Mean	*Median*	*Maximum*	*Minimum*	*Std. Dev.*	*Skewness*	*Kurtosis*
XOM	-0.006 %	0.000 %	5.369 %	-4.843 %	1.131 %	-0.0009	5.8635
BTU	-0.475 %	-0.124 %	39.891 %	-35.328 %	4.864 %	0.1138	15.9373

Table 3 represents the descriptive stats for the most carbon heavy stocks of oil and coal industry in the US. The carbon heavy stocks are also in accord with all the assumptions, that especially the coal stock would underperform and present similar figures as the indices: both

[12] For example Kreander et al. (2005) and Shank et al. (2005).

stocks suffer negative daily mean returns and the standard deviation is quite high. Furthermore, the coal stock BTU has an astonishing minimum of -35 % and a standard deviation of almost 5 % daily. Combined with the positive skewness of 0.11, the descriptive statistics indicate that the coal stock BTU has suffered the most negative returns days in this thesis' sample.

5.2. Event study method

As introduced in the theoretical background chapter, Fama (1970) divides market efficiency into three different categories: weak, semi-strong and strong form of efficiency. In this thesis the semi-strong form of market efficiency is examined. The semi-strong form of market efficiency includes all of the public information. The semi-strong form of market efficiency can be examined through an event study method. Event studies can be used in many different branches of science but in the field of economics event studies are used to measure certain events' effects on companies' value and returns. In order for an event study to be effective, semi strong form terms of market efficiency have to be met. This way, any occurring events' effects should be reflected on the stock prices immediately. Thus, observing the stocks' short term returns, events' effects on the stocks' price can be measured. Typical events which are measured with the event study method are for example interim reports, mergers and large acquisitions. (MacKinlay 1997.)

Event studies were first introduced in the late 1960s, when Ball et al. (1968) examine the information in companies' quarterly reports. The same methodology is used nowadays in the economic and finance research. The event study method does not have a unique structure, but is instead used to determine how an event affects company value and to find an event window which is the time period that the stock returns are examined in. Generally, the event window is longer than the event itself, for example at least the next trading day. This way one can observe the whole effect better. Furthermore, when the event is anticipated, the event window is stretched to even before the actual event itself due to the fact that markets usually have expectations towards an event which affects the stock returns. (MacKinlay 1997.)

Event studies are used to calculate abnormal stock returns, with the assumption that the markets are efficient. In order to get abnormal returns, one must subtract expected returns from observed returns. The returns are evaluated daily, comparing the subsequent closing prices. When the abnormal and cumulative abnormal returns are obtained, the results must

be evaluated and analyzed using statistical methods. The purpose of this is to determine the magnitude of the events' effect on the stock returns. The abnormal and cumulative abnormal returns are not absolute measurements, but instead they are compared to a benchmark, such as a common index mean returns. (Lee & Connolly 2010.)

In pursuance of getting the abnormal returns, one has to estimate the expected returns and calculate the observed returns. Observed returns can be calculated using both absolute and logarithmic values. Typically, logarithmic values are used in event study research, thus they are used in this thesis as well. The observed returns of R_{it} can be obtained with the following formula

$$R_{it} = \log[\frac{P_{it}}{P_{i,t-1}}] \quad (4)$$

Where P_{it} is the closing price of index i on day t. $P_{i,t-1}$ is the closing price of index i at a time of $t-1$.

After this, the expected returns for the event window have to be estimated from the historical prices. Generally in an event study method, the previous 250 days' prices are observed in order to create an estimation window. The estimation window is used to create parameters for the statistical model which is used in order to decide whether the results are significant. To make sure that the event window time period does not include prices from the estimation time period, the estimation window cannot overlap the event window. Therefore, the estimation period has to end at least a day before the event window starts. Because there are a lot of fossil fuel divestment announcements, endorsements and climate change news that may overlap each other, in this study the event window is only two days long. (Scholtens & Peenstra 2009; Posnikoff 1997.)

Market returns model is the most accurate and most used method for an event study purposes. Comparing market model returns to market portfolio returns was first used by Brown & Warner (1980) when they measure security price performance. This method enables one to calculate the abnormal and cumulative abnormal returns. The market model includes econometric parameters α and β, which are called the *ordinary least square estimators* (OLS estimators). These estimators are obtained using market portfolio and the stock/index i historical prices. With these OLS estimators, the stock/index i expected returns is a linear

function, where the parameter β is the stocks'/indices' sensitivity against the market portfolios' returns. The market model equation is

(5) $$E(R_{it}) = \alpha_i + \beta_i \, x \, R_{mt} + \varepsilon_{it}$$

Where $E(R_{it})$ is the stock/index i expected return at a time t, R_{mt} is the market portfolio return at a time t, α_i and β_i are the estimation window returns' OLS estimators and ε_{it} is the stock/index i error term at a time t.

The stock/index abnormal returns are obtained by comparing the stock/index to the stock market returns. The stocks'/indices' OLS estimators are obtained by doing a regression on the stock returns, taking the market portfolio's historical returns from 200 trading days, starting 210 trading days before and ending 10 trading days before the actual event. In this kind of an event study, the α_i and β_i parameters are used to estimate the returns of a single stock/index for 21 days, starting 10 days before and ending 10 days after the event. These 21 day estimated returns are then compared against the expected returns and the difference are stated as abnormal returns. Figure 5 below illustrates the event study timeline.

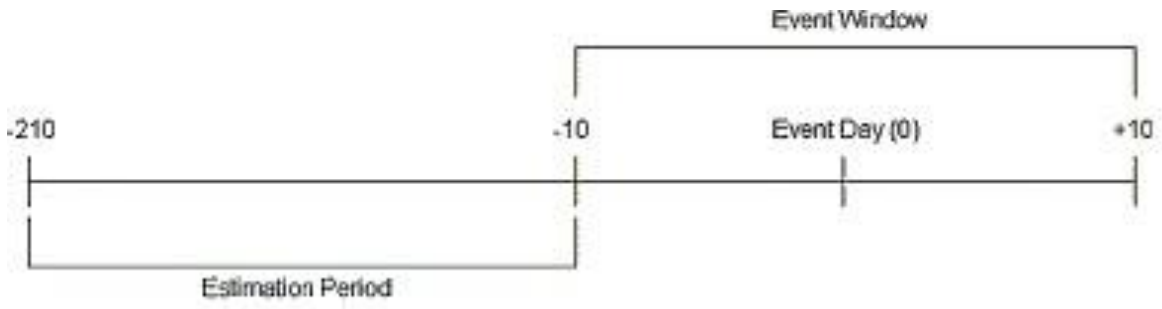

Figure 5. Event study timeline. (Lee & Connolly 2010.)

The error term ε_{it} is expected to capture the company related event entirely. This assumption is based on the theory that the company event information should not affect the returns of the stock in comparison to the market returns. According to the theory, the event should only affect the company related components. Furthermore, the error term mean is expected to be zero and the variance is expected to be constant. The abnormal returns of the stock/index, or

the error term, can be obtained from a modified market model returns equation. (MacKinlay 1997; Lee & Connolly 2010.)

(6) $$E(\varepsilon_{it} = 0)$$

(7) $$var\ (\varepsilon_{it}) = \ \sigma_{\varepsilon}^{2}$$

(8) $$\varepsilon_{it} = \ R_{it} - \ (\alpha_i + \ \beta_i \ x \ R_{mt})$$

After calculating the abnormal returns from every significant day around the event, these abnormal returns are then added to cumulative abnormal returns.[13] As Brown et al. (1980) use mean adjusted returns and state that the returns do not differ from results which are calculated with more sophisticated models, thus the simple model they use is sufficient. MacKinlay (1997) disagrees, because with the market return model the variance of abnormal returns is minimized due to eliminating the portion that is connected to the market returns, which leads to more accurate results when examining the effects of a single event on stock/index returns.

In this thesis, the estimation period is always 276 days or more in order to get an accurate results, starting from 2.4.2012 to 22.4.2013. The estimation window ends always a day before the actual event. Posnikoff (1997) makes an argument for a shorter event window in examining the divestment movement announcement effects and getting accurate results, thus the event window examined in this thesis is the actual event day (day 0) and the next trading day (day 1). For example, if the event happens on Friday, the effects on Friday and Monday returns are examined. If the event happens on a non-trading day, only the next trading day is examined.

[13] Morgan, Peristiani & Savino (2014).

6. RESULTS

This chapter analyzes all the findings of the empirical study relative to hypotheses 1–4. Abnormal returns of four indices and two stocks are calculated from 23.4.2013–29.1.2016 with the market return model, and a total of 73 events are examined during this time period. The effect of these events on these stocks and indices are examined through abnormal returns, which are estimated by comparing the examined returns on the benchmark index S&P500 returns.

6.1. Hypothesis 1.

The effects of the different entities' divestment announcements are examined in this part of the chapter individually. For example, Amihud et al. (2005) states that a decrease in the stock liquidity decreases the stock price, thus the fundamental effect of lost future investors affects the future liquidity of a firm and therefore the future stock prices of oil, gas and coal companies. The first hypothesis is:

H1: Fossil fuel divestment announcements cause negative (positive) abnormal returns among the oil & gas, coal indices and stocks (SRI and fossil fuel free indices).

Table 4. Mean abnormal returns (AR) on day 0, day 1 and cumulative abnormal returns (CAR) for those days, after a social organization has announced to divest their investments. Significance of the findings are determined on 1%, 5% and 10% level, presented by ***, **, *. T-test values are in parentheses.

	Social Organizations					
	SOGE	*SCBF*	*DJSI*	*FFFI*	*BTU*	*XOM*
Day 0 AR	-0.001	-0.014*	-0.000	0.000	-0.021*	-0.002
	(-0.327)	(-2.039)	(-0.934)	(0.544)	(-2.488)	(-0.971)
Day 1 AR	-0.000	0.004	-0.001*	0.000	0.009	-0.000
	(-0.098)	(0.592)	(-1.971)	(0.410)	(1.024)	(-0.095)
CAR (0,1)	-0.002	-0.008	-0.001*	0.001	-0.010	-0.002
	(-0.316)	(-0.870)	(-1.756)	(0.714)	(-0.708)	(-0.877)
Observations Day 0, Day 1 & Cumulative	18, 21, 21	18, 21, 21	18, 21, 21	18, 21, 21	18, 21, 21	18, 21, 21

Table 4 shows the effects on the indices and stocks when social organizations such as universities and religious establishments divest their money out of fossil fuel investments. SOGE index experiences negative returns on all examined days, but not significantly. The same result applies to the XOM stock, which also experiences negative but insignificant returns. Furthermore, the FFFI index undergoes positive returns during these days but these returns are insignificant as well, which was expected due to the wide global diversification of the index. All of these three results fit the assumptions that fossil fuel heavy firms would suffer and fossil fuel free firms would benefit from the announcements. Nevertheless, the results are insignificant, thus the null hypothesis cannot be rejected for these indices and stock.

One of the interesting significant findings is that the DJSI index suffers significant abnormal returns on a 10 % level during the day 1 and cumulatively. This is opposite to the hypothesis, but an explanation can be found when examining the DJSI index more closely: The DJSI index allocates 12.81 % of its funds to Oil & Gas sector, XOM being the top 2 component of the index with an adjusted weight of 5.59 %. This is surprising, considering the fact that DJSI is literally a sustainability index. In light of this information, it is not surprising that the index suffers significant negative returns. (S&P Dow Jones Indices 2016.)

The remaining index and stock are the coal industry ones, SCBF and BTU. Both experience insignificant positive returns on the day 1 and insignificant negative returns cumulatively. However, both suffer significant negative returns on a 10 % level during the day 0, the SCBF index at -0.014 % and BTU at -0.021 %. Therefore, with a 90 % probability, the null hypothesis can be rejected for the SCBF index and the BTU stock: When a social organization announces to divest their investments from a fossil fuels, the SCBF and BTU suffer significant negative returns during the same day as a result.

Table 5. Mean abnormal returns (AR) on day 0, day 1 and cumulative abnormal returns (CAR) for those days, after a private company has announced to divest their investments. Significance of the findings are determined on 1%, 5% and 10% level, presented by ***, **, *. T-test values are in parentheses.

	Private					
	SOGE	*SCBF*	*DJSI*	*FFFI*	*BTU*	*XOM*
Day 0 AR	-0.005	-0.004	-0.001*	-0.001	-0.045**	-0.003
	(-1.374)	(-0.323)	(-2.387)	(-0.930)	(-2.556)	(-1.145)
Day 1 AR	-0.003	-0.017	0.000	-0.001	0.016	0.002
	(-0.745)	(-1.100)	(-0.387)	(-0.718)	(1.148)	(0.744)
CAR (0,1)	-0.007**	-0.022	-0.001*	-0.002	-0.029	-0.001
	(-3.299)	(-0.914)	(-2.1)	(-0.981)	(-1.090)	(-0.595)
Observations Day 0, Day 1 & Cumulative	7, 7, 7	7, 7, 7	7, 7, 7	7, 7, 7	7, 7, 7	7, 7, 7

Table 5 shows the abnormal returns which the examined indices and stocks experience when a private company announces to divest its money from fossil fuel investments. The SCBF and the FFFI indices are not affected by the private company divestment announcements as the results are insignificant on their part. Same applies to the XOM stock. Curiously, the DJSI index again suffers significant negative returns, now during the day 0 as well as cumulatively, with a mean abnormal returns of -0.001 % for both. Same explanation as above applies here for the DJSI index. The most interesting finding is that the SOGE index and, again, the BTU stock suffer robust negative returns on a 5 % level. Although the day 0 and day 1 negative returns are insignificant for the SOGE index, the cumulative mean return of those days is -0.007 %. Moreover, the BTU stock suffers mean abnormal returns of -0.045 % on the same day of the announcement. Both of these findings are robust. Other results for both are insignificant

Table 6. Mean abnormal returns (AR) on day 0, day 1 and cumulative abnormal returns (CAR) for those days, after a public authority has announced to divest their investments. Significance of the findings are determined on 1%, 5% and 10% level, presented by ***, **, *. T-test values are in parentheses.

	Public Authorities					
	SOGE	*SCBF*	*DJSI*	*FFFI*	*BTU*	*XOM*
Day 0 AR	0.000	0.010	-0.000	0.001	-0.001	0.001
	(0.141)	(1.918)*	(-0.393)	(1.046)	(-0.154)	(0.512)
Day 1 AR	-0.004	-0.009	0.000	-0.000	-0.012	-0.005***
	(-1.293)	(-0.854)	(0.057)	(-0.174)	(-1.085)	(-3.293)
CAR (0,1)	-0.004	0.001	-0.000	0.001	-0.013	-0.005*
	(-1.034)	(0.052)	(-0.197)	(0.668)	(-1.258)	(-1.881)
Observations Day 0, Day 1 & Cumulative	18, 19, 19	18, 19, 19	18, 19, 19	18, 19, 19	18, 19, 19	18, 19, 19

Table 6 shows the abnormal returns which the examined indices and stocks experience when a public authority such as a pension fund or a city announces to divest their money from fossil fuel investments. Against the assumption that the public authorities' divestment announcements would be the ones to have the largest effect on the examined indices and stocks due to the possible political factors behind it, SOGE, BTU and DJSI do not undergo any significant abnormal returns during these events. Furthermore, surprisingly the SCBF index gains significant positive abnormal returns with a mean of 0.01 %, during the same day of the announcements at a 10 % level.

The most interesting finding in this table is the very robust effect on XOM stock. The XOM stock suffers strong abnormal returns during the day 1 due to the announcements. The mean abnormal return of -0.005 % is significant on a 1 % level. This can be traced to the fact that out of the top five largest shareholders in Oil & Gas industry, three of them are governments (ie. public authorities). Furthermore, especially US pension funds and cities might have a large portion of their investments in the XOM stock. For example, on 23.4.2013, when The San Francisco Employee's Retirement System (SFERS) passed a resolution to divest their investments from fossil fuels, the XOM stock suffered negative abnormal return of -0.019 % during the day 1. With a significance level of 1 % and an R^2 of 0.65, this finding is very robust. One can understand the reaction of the stock on this single announcement, as SFERS holds over 112$ million worth of shares in ExxonMobil. Further research should be examine why the stock did not react significantly during the same day (day 0). Despite the day 0

returns, the cumulative mean abnormal return of -0.005 % were significant on a 10 % level as well, therefore, regarding the XOM stock, the null hypothesis can be confidently rejected, as the stock's returns react negatively to public authorities' divestment announcements. (Bloomberg 2014; 350.org 2013).

6.2. Hypothesis 2.

The effects of public endorsements on examined indices and stocks are viewed in this part of the chapter. Especially the endorsements of public and political figures can further stigmatize the industry, thus create unease among the fossil fuel heavy companies (SSEE 2013). The second hypothesis is:

H2: Fossil fuel divestment endorsements cause negative (positive) abnormal returns among the oil & gas, coal indices and stocks (SRI and fossil fuel free indices).

Table 7. Mean abnormal returns (AR) on day 0, day 1 and cumulative abnormal (CAR) returns for those days, after a public endorsement of the FFDM. Significance of the findings are determined on 1%, 5% and 10% level, presented by ***, **, *. T-test values are in parentheses.

	Endorsements					
	SOGE	*SCBF*	*DJSI*	*FFFI*	*BTU*	*XOM*
Day 0 AR	-0.004	-0.003	-0.001	0.000	0.006	-0.001
	(-0.605)	(-0.249)	(-1.521)	(0.168)	(0.422)	(-0.300)
Day 1 AR	-0.002	0.002	-0.000	0.001	-0.036	-0.005*
	(-0.665)	(0.105)	(-0.519)	(0.257)	(-1.263)	(-2.228)
CAR (0,1)	-0.006	-0.000	-0.001	0.001	-0.031	-0.006*
	(-0.783)	(-0.012)	(-1.223)	(0.869)	(-0.991)	(-2.255)
Observations Day 0, Day 1 & Cumulative	9, 10, 10	9, 10, 10	9, 10, 10	9, 10, 10	9, 10, 10	9, 10, 10

Table 7 shows the abnormal returns which the examined indices and stocks experience when a public figure or a party endorses the fossil fuel divestment campaign. Especially the political figures who endorse the FFDM can have an impact, due to the political factors and the urge to affect the political will. Although almost all of the indices undergo negative mean abnormal returns, none of them seem to have a statistical significance. This applies to the

FFFI index as well, which gains positive abnormal returns following the assumptions, however, the returns fail to be statistically significant. Therefore, for all the examined indices and the stock BTU, the null hypothesis cannot be rejected: endorsements do not seem to affect these assets returns.

The most interesting item in table 7 is again the XOM stock. It undergoes significant negative abnormal returns during the day 1 and cumulatively both at a 10 % level. The mean abnormal returns for the day 1 and cumulatively are -0.005 % and -0.006 %, respectively. The endorsements are largely done by political figures, thus one can consider if the XOM stock is sensitive to public outputs that have political weight. Altogether, the null hypothesis can be rejected at a 10 % level: the XOM stock returns react negatively to FFDM endorsements.

6.3. Hypothesis 3.

The effects of all the divestment announcements as a whole, regardless of the acting party, on examined indices and stocks are viewed in this part of the chapter. This will give a good signal on how the FFDM announcements as a whole affect the researched indices and stocks. The third hypothesis is:

H3: All fossil fuel divestment announcements cause negative (positive) abnormal returns among the oil & gas, coal indices and stocks (SRI and fossil fuel free indices).

Table 8. Mean abnormal returns (AR) on day 0, day 1 and cumulative abnormal (CAR) returns for those days, after all of the observed divestment announcements, regardless of the divesting party. Significance of the findings are determined on 1%, 5% and 10% level, presented by ***, **, *. T-test values are in parentheses.

All Divestment Announcements						
	SOGE	*SCBF*	*DJSI*	*FFFI*	*BTU*	*XOM*
Day 0 AR	-0.001	-0.003	-0.0004*	0.000	-0.018***	-0.001
	(-0.419)	(-0.568)	(-1.706)	(0.684)	(-2.954)	(-0.735)
Day 1 AR	-0.002	-0.004	0.000	0.000	0.001	-0.002*
	(1.105)	(-0.752)	(1.503)	(0.140)	(0.207)	(1.733)
CAR (0,1)	-0.003	-0.007	-0.001**	0.000	-0.015	-0.003*
	(-1.138)	(-0.980)	(-2.045)	(0.654)	(-1.674)	(-1.987)
Observations Day 0, Day 1 & Cumulative	40, 45, 45	40, 45, 45	40, 45, 45	40, 45, 45	41, 45, 45	41, 45, 45

Table 8 shows the abnormal returns on how the examined indices and stocks react when studying all of the observed divestment announcements, regardless of the divesting party. In essence, table 8 shows what kind of an effect the FFDM has a whole on the examined indices and stocks as all announcement are taken in to consideration. SOGE and SCBF indices suffer abnormal returns after the announcements, but the abnormal returns are insignificant. Similarly, according to the assumptions, the FFFI index gains abnormal returns, but which fail to be statistically significant again. Thus, regarding the indices SOGE, SCBF and FFFI, it can be stated that the researched divestment announcements as a whole do not cause any significant abnormal returns within these indices. The null hypothesis is accepted.

DJSI index against all assumptions and hypotheses development suffers significant negative abnormal returns during the same day (-0.0004 %) of the announcement and cumulatively as well (-0,001 %). This is an eye opening finding, because an individual investor might invest in to the DJSI index thinking that the investment has an insurance against volatility and negative news, as previous research has found. This finding proofs on a 90 % probability, that the sustainability index does not offer an insurance against the Fossil Fuel Divestment Campaign, but actually reacts vice versa. As discussed earlier, the underperformance of this index during the divestment announcements can be traced due to the fact that the index has 12.81 % of its funds in Oil & Gas sector, for example XOM stock being the top 2 component

of the index. Further research should be done on finding out if the portfolio allocation is the main driver of the negative abnormal returns.

When looking at the stock results, it can be seen that the XOM stock reacts negatively to all divestment announcements during the day 1 and cumulatively. The negative abnormal returns of -0.002 and -0.003 are both significant on a 10 % level, which leads to a rejection of the null hypothesis. Furthermore, the BTU stock suffers a -0.018 % abnormal returns on the same day of all of the announcements. This finding is very robust, thus with a 99 % probability the null hypothesis can be rejected: BTU stock reacts negatively during the same day to the divestment announcements of the FFDM.

6.4. Hypothesis 4.

The effects of climate change news on examined indices and stocks are viewed in this part of the chapter. The idea behind the hypothesis is that the investor changes his/her investment behavior in light of a new unsettling news of global warming. In other words, divestment from a fossil fuel heavy industries as they are one of the main causes for the global warming. The fourth hypothesis goes as follows:

H4: Climate change news cause negative (positive) abnormal returns among the oil & gas, coal indices and stocks (SRI and fossil fuel free indices).

Table 9. Mean abnormal returns (AR) on day 0, day 1 and cumulative abnormal (CAR) returns for those days, after a climate change news. Significance of the findings are determined on 1%, 5% and 10% level, presented by ***, **, *. T-test values are in parentheses.

	Climate Change News					
	SOGE	*SCBF*	*DJSI*	*FFFI*	*BTU*	*XOM*
Day 0 AR	0.003	0.015	0.001	0.003	0.016*	-0.003
	(0.376)	(0.733)	(0.826)	(1.150)	(1.88)	(-0.800)
Day 1 AR	0.015**	0.020	0.000	0.022	0.004	0.001
	(2.820)	(1.305)	(0.816)	(0.760)	(0.443)	(0.355)
CAR (0,1)	0.018	0.035	0.001	0.005	0.020*	-0.002
	(1.760)	(1.351)	(0.968)	(1.564)	(2.067)	(-0.373)
Observations Day 0, Day 1 & Cumulative	13, 13, 13	13, 13, 13	13, 13, 13	13, 13, 13	13, 13, 13	13, 13, 13

Table 9 shows the abnormal returns on how the examined indices and stocks react when testing climate change news. This is only loosely connected with the main part of the thesis, which shows also in the results. Major part of the indices do not react to the climate change news. This concerns of SCBF, DJSI and FFI. Also, the XOM stock does not react. Surprisingly, the SOGE index and the BTU stock both gain some significant abnormal returns: BTU cumulatively and during the same day of the climate change news. Both at a 10 % level. SOGE oddly enough gains significant abnormal returns on the day 1, at a 5 % level. These results are against the assumptions and work as an opening puzzle for further research on climate change news affecting stock and index returns.

7. CONCLUSIONS

In order to stop the climate change, socially responsible investing (SRI) has become largely popular in the United Stated of America, almost doubling in assets from 2012 to 2014. In addition to the traditional SRI, the sustainable investing scene has found a new way of impacting: the Fossil Fuel Divestment Movement (FFDM). Since, the FFDM has managed to gather pledges worth over $3.4 trillion in assets. The main purpose of this thesis is to examine whether the FFDM divestment announcements, endorsements and climate change news have an effect on three different US indices, one global index and two stocks, which consist of the four main features that could be affected by the FFDM: oil, gas, coal and sustainable assets. (Arabella Advisors 2015; USSIF 2014.)

To be more exact, an event study was made to investigate whether fossil fuel indices or stocks suffer any negative abnormal returns after a divestment announcement, endorsement or a climate change news, or conversely, whether SRI and fossil fuel free indices gain any abnormal returns during the aforementioned event. The researched indices are S&P Oil & Gas Exploration & Production (SOGE), S&P Coal & Consumable Fuels (SCBF), The Dow Jones Sustainability Index North America (DJSI) and The S&P Global 1200 Fossil Fuel Free Index (FFFI). The two examined stocks, Exxon Mobil (XOM) and Peabody Energy (BTU),

Although getting positive abnormal returns throughout the tables, FFFI is the only examined index that did not react significantly to any of the studied announcements, news or endorsements. This is expected, as the index is global, and a large part of the outputs studied are US-based. Thus, with a great confidence, one can say that the FFDM outputs does not have an effect on the FFFI index.

The other sustainable index examined is a more complex issue and the second most important finding of this thesis is connected to it. The assumption that the sustainable option should benefit after a divestment announcement, in light of the evidence, is wrong. Excluding public authorities divestment announcements, all the other announcements and endorsements affect the DJSI index to suffer significant negative cumulative abnormal returns. One explanation for the effect can be based on the fact that the DJSI index allocates 12.81 % its funds to Oil & Gas sector, XOM being the top 2 component of the index with an adjusted weight of 5.59 %. This finding is important, because an individual investor might invest in the DJSI index

thinking that the investment has an insurance against volatility and negative news. This finding proves with a 90 % probability that the sustainability index does not offer insurance against the Fossil Fuel Divestment Campaign, but actually reacts vice versa. Further research should concentrate on examining whether the large proportion of fossil fuel portfolio allocation is the main driver for the effect.

SOGE index reacts strongly only to the divestment announcements of private firms. This effect is very robust, and with a 99 % probability the null hypothesis can be rejected. Other findings were not found significant for SOGE.

The SCBF index reacted only to social organizations divestment announcements. The 10 % level significance for these announcements was the only statistically significant result for SCBF. Based on these findings arises a question, whether the indices are so well diversified that the effect of a direct divestment will not affect them largely. Thus, further research should continue either by concentrating on stocks or finding indices that are heavily weighted by stocks that react strongly to divestment announcements of the FFDM, for example the top 200 carbon heavy stocks.

Climate change news portion of this thesis offers some interesting results. Some of the indices and stocks actually gained statistically significant abnormal returns after climate change news. This is completely opposite to the fourth hypothesis. Due to the similarity of the significant results, further research should use these positive abnormal returns as a base to study the explanation behind the effect.

The most important and interesting result of this thesis is the existence of negative abnormal returns regarding the examined stocks. Excluding the public authorities announcements, the BTU stock suffers significant negative abnormal returns during the day of all of the examined divestment announcements. Furthermore, regarding the hypothesis 3, when studying all of the divestment announcements as a single group, BTU has a 99 % probability to experience negative abnormal returns during the day of any kind of divestment announcement, regardless of the divestor. This is a robust indicator that all FFDM outputs have an effect on the stock.

The XOM stock suffers similar effects. The most important finding for the XOM concerns the divestment announcement made by public authorities: the next day after the announcement has been made, the XOM suffers statistically significant negative abnormal

returns with a 99 % probability. This is not a surprise, as of the top five largest shareholders in Oil & Gas industry, three are governments (i.e. public authorities). Furthermore, especially US pension funds and cities might have a large portion of their investments in the XOM stock. One example of this was observed when on 23.4.2014, The San Francisco Employee's Retirement System (SFERS) passed a resolution to divest their investments from fossil fuels. This affected the XOM stock to suffer an abnormal return of -0.019 % during day 1. With a significance level of 1 % and an R^2 of 0.65, this finding is very robust. One can understand the reaction of the stock on this single announcement, as SFERS holds over $112 million worth of shares in ExxonMobil. (350.org 2013; Bloomberg 2014.)

Further research should be done with a larger dataset to find more stocks that seem to be sensitive to the divestment announcements of the FFDM, because obviously there seem to be a connection on the fossil fuel stock returns and the divestment announcements. The best proponents for sensitive stocks would be the top 200 carbon list. If enough stocks are found, one can study the true effect of the FFDM on the fossil fuel industry. The FFDM has just started to build up steam in late 2015 and as more and more advocates have backed up the campaign, the effect can be much stronger in the future. Moreover, as the Paris 2015 Climate Summit agreement was signed on 22.4.2016, the war against climate change has merely begun. (BBC 2016; SSEE 2013.)

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APPENDIX

1. Appendix

All the gathered outputs by date and type.

Climate Change News

Date	Output	World Wide Web source
17.12.2014	With unresolved health risks and few signs of an economic boom, Cuomo to ban gas fracking	http://dotearth.blogs.nytimes.com/2014/12/17/with-unresolved-health-risks-and-few-signs-of-an-economic-boon-cuomo-to-ban-gas-fracking/
4.3.2015	Fracking chemicals detected in Pennsylvania drinking water	http://www.nytimes.com/2015/05/05/science/earth/fracking-chemicals-detected-in-pennsylvania-drinking-water.html
20.3.2015	New federal rules are set for fracking	http://www.nytimes.com/2015/03/21/us/politics/obama-administration-unveils-federal-fracking-regulations.html
8.6.2015	Fracking associated with smaller babies	http://well.blogs.nytimes.com/2015/06/08/fracking-associated-with-smaller-babies/
14.8.2015	Air pollution in China is killing 4,000 people every day, a new study finds	http://www.theguardian.com/world/2015/aug/14/air-pollution-in-china-is-killing-4000-people-every-day-a-new-study-finds
7.10.2015	California governor signs aggressive climate change bill	http://www.usatoday.com/videos/news/nation/2015/10/07/73541644/
17.10.2015	Kerry Talks climate change	http://www.usatoday.com/videos/news/nation/2015/10/17/74125792/
1.12.2015	China's smog closes schools and highways	www.usatoday.com/story/news/world/2015/12/01/chinas-smog-closes-schools-and-highways/76611310/
4.12.2015	Obama: climate change is a major threat	http://www.usatoday.com/story/theoval/2015/12/04/obama-climate-change-terrorism-cbs-news-islamic-state/76773860/
12.12.2015	UN climate change agreement	http://www.cop21.gouv.fr/en/195-countries-adopt-the-first-universal-climate-agreement/
29.12.2015	Obama seeks every possibility to push climate change plans in 2016	http://www.theguardian.com/us-news/2015/dec/29/obama-climate-change-agenda-congress-republicans-environment
19.1.2016	China coal-burning declining	http://www.theguardian.com/environment/2016/jan/19/chinas-coal-burning-in-significant-decline-figures-show
20.1.2016	2015 hottest year ever	http://www.theguardian.com/environment/2016/jan/20/2015-smashes-record-for-hottest-year-final-figures-confirm
25.1.2016	Study finds that 2015 record hot year impossible without manmade climate change	http://www.theguardian.com/environment/2016/jan/25/record-hot-years-near-impossible-without-manmade-climate-change-study
26.1.2016	Sea level rise underestimated	http://www.theguardian.com/environment/2016/jan/26/sea-level-rise-from-ocean-warming-underestimated-scientists-say

Endorsements

Date	Output	World Wide Web source
19.9.2014	181 institutions and local governments and 656 individuals representing over $50 billion in divestments	http://www.arabellaadvisors.com/wp-content/uploads/2014/09/Measuring-the-Global-Divestment-Movement.pdf
11.3.2015	London mayor endorsing divestment	http://www.theguardian.com/environment/2015/mar/11/london-assembly-votes-to-divest-48bn-pension-fund-from-fossil-fuel
6.5.2015	Al Gore's business partner endorses divestment	http://www.theguardian.com/environment/2015/may/06/climate-change-must-be-tackled-by-the-markets-say-city-grandees
7.5.2015	Bank of America warns the riskiness of coal investments	http://www.theguardian.com/environment/2015/may/07/coal-investments-are-increasingly-risky-say-bank-of-america
18.6.2015	The Pope endorses divestment	http://www.theguardian.com/world/2015/jun/18/popes-climate-change-encyclical-calls-on-rich-nations-to-pay-social-debt
14.8.2015	Former EU climate chief endorses divestment	http://www.theguardian.com/environment/2015/aug/14/former-eu-climate-chief-hedegaard-backs-fossil-fuel-divestment
21.9.2015	Divest-Invest announced number of institutions jumped to 400 and 2,6 trillion $	http://350.org/cop21-divestment/
27.10.2015	Prince Charles endorses divestment	http://www.theguardian.com/environment/2015/oct/27/prince-charles-warns-financial-sector-charities-fossil-fuel-risk
14.11.2015	Thomas Piketty endorses divestment	http://www.theguardian.com/environment/2015/nov/14/thomas-piketty-economist-investors-divest-fossil-fuels-ahead-climate-talks
25.11.2015	French Parliament endorsed divestment	http://ecowatch.com/2015/12/02/divest-fossil-fuels-cop21/
29.11.2015	New York Mayor endorses divestment	http://www.theguardian.com/us-news/2015/sep/29/new-york-bill-de-blasio-coal-divestment
27.1.2016	UN endorses divestment	http://www.theguardian.com/environment/2016/jan/27/un-urges-business-leaders-to-double-investment-in-green-energy-by-2020
29.1.2016	Copenhagen's Mayor endorses divestment	http://www.theguardian.com/environment/2016/jan/29/copenhagen-set-to-divest-from-fossil-fuels

Public Authorities divestment announcements

Date	Output	World Wide Web source
23.4.2013	San Francisco commits to divest	https://firstheretheneverywhere.org/2013/04/23/san-francisco-supervisors-vote-unanimously-for-fossil-fuel-divestment/
25.4.2013	10 US cities commit to divest	http://www.commondreams.org/newswire/2013/04/25/ten-us-cities-commit-pursue-fossil-fuel-divestment
6.6.2013	Dane County commits do divest	http://www.nbc15.com/home/headlines/Dane-County-divests-from-fossil-fuels-210517061.html
6.11.2013	Northampton, MA commits to divest	http://gofossilfree.org/breaking-northampton-ma-commits-to-fossil-fuel-divestment-pushes-for-statewide-action/
15.3.2014	Dunedin commits to divest	http://www.theguardian.com/sustainable-business/dunedin-council-fossil-fuel-divestment-new-zealand
28.3.2014	Framingham, Concord and Sudbury commits to divest	http://www.treehugger.com/corporate-responsibility/fossil-fuel-divestment-spreads-massachusetts-3-towns-ten-days.html
18.6.2014	Oakland, California commits to divest	http://350.org/press-release/oakland-city-council-votes-to-divest-from-fossil-fuel-companies/
21.10.2014	Ashland city commits to divest	http://www.opb.org/news/article/ashland-city-council-pass-fossil-fuel-divestment-r/
16.11.2014	Oxford City commits to divest	http://gofossilfree.org/uk/historic-commitment-from-oxford-city-council/
27.3.2015	Norway commits to divest oil pension funds	http://www.theguardian.com/environment/2015/jun/05/norways-pension-fund-to-divest-8bn-from-coal-a-new-analysis-shows
5.5.2015	3 Danish pension funds commits to divestments	http://www.theguardian.com/environment/2015/may/05/members-of-three-danish-pension-funds-vote-to-divest-from-fossil-fuels
5.6.2015	Norway formally commits to divest oil pension funds	http://www.theguardian.com/environment/2015/jun/05/norways-pension-fund-to-divest-8bn-from-coal-a-new-analysis-shows
8.10.2015	West Yorkshire commits to divest	http://gofossilfree.org/uk/press-release/kirklees-council-calls-on-west-yorkshire-pension-fund-to-divest/
19.10.2015	UK's Environment Agency pension fund commits to divest	http://www.theguardian.com/environment/2015/oct/19/uk-environment-agency-divests-landmark-move-help-meet-2c-limit
3.11.2015	California Public Employees' Retirement System (CalPERS) and California State Teachers' Retirement System commits to divest	http://www.sfbos.org/ftp/uploadedfiles/bdsupvrs/bosagendas/materials/bag042313_130123.pdf
5.11.2015	City of Münster divested	http://www.businessgreen.com/bg/news/2433513/munster-becomes-first-german-city-to-pledge-divestment-from-fossil-fuels
17.11.2015	Dutch fund PFZW to divest	http://www.reuters.com/article/netherlands-pension-fund-emissions-idUSL8N13C1DU20151117
23.11.2015	Albury and Armadale commits to divestment	http://350.org.au/news/albury-and-armadale-city-councils-divests-from-fossil-fuels/
2.12.2015	19 French cities announced to divest their money	http://350.org/cop21-divestment/

Private Company divestment announcements

Date	Output	World Wide Web source
6.6.2014	BENDIGO and Adelaide Bank commits to divest	http://www.afr.com/markets/commodities/metals/bendigo-and-adelaide-bank-joins-super-funds-in-fossil-fuel-rethink-20140605-iwa2n
13.3.2015	Trending: Big Banks Bringing Sustainable Investing Further Into the Mainstream	http://www.sustainablebrands.com/news_and_views/leadership/brynn_mcnally/trending_big_banks_bringing_sustainable_investing_further_ma
26.3.2015	Axa commits to divest	https://cleantechnica.com/2015/05/26/axa-divest-e500-million-coal-assets-end-2015/
15.6.2015	SunCommon commits to divest	http://www.vermontbiz.com/news/june/suncommon-401k-divests-fossil-fuels-and-invests-clean-energy
21.9.2015	Rockefellers Brothers Fund commits to divest	http://www.nytimes.com/2014/09/22/us/heirs-to-an-oil-fortune-join-the-divestment-drive.html?_r=0
19.11.2015	Nordea bank commits to divestment	http://www.nordea.com/en/press-and-news/news-and-press-releases/press-releases/2015/11-19-09h00-nordea-goes-carbon-neutral.html
24.11.2015	Allianz SE commits to divest	http://www.theguardian.com/environment/2015/nov/24/allianz-to-cut-investments-in-companies-using-coal-in-favour-of-renewable-energy

Social Organizations divestment announcements

Date	Output	World Wide Web source
13.6.2013	the First Universalist Church of Pittsfield commits to divest	http://gofossilfree.org/pittsfield-me-unitarian-universalists-put-their-money-where-their-faith-is/
30.6.2013	United Church of Christ to become first U.S. denomination to move toward divestment from fossil fuel companies	http://www.ucc.org/gs2013-fossil-fuel-divestment-vote
1.8.2013	The Melbourne Unitarian Church commits to divest	http://www.abc.net.au/environment/articles/2013/08/01/3816046.htm
6.5.2014	Stanford University commits to divest	http://news.stanford.edu/news/2014/may/divest-coal-trustees-050714.html
10.6.2014	Union Theological Seminary commits to divest	http://www.huffingtonpost.com/2014/06/10/union-theological-seminary-fossil-fuels_n_5481417.html
9.7.2014	The East minster United Church commits to divest	http://www.insidetoronto.com/news-story/4621937-eastminster-united-church-divests-from-fossil-fuel-investments/
29.8.2014	The Uniting Church in Australia Assembly commits to divest	https://assembly.uca.org.au/news/item/1585-assembly-to-divest-from-fossil-fuels
17.9.2014	The Church of Sweden commits to divest	http://gofossilfree.org/se/divestment-accomplished-cos/
8.10.2014	The University of Glasgow commits to divest	http://www.gla.ac.uk/news/archiveofnews/2014/october/headline_364008_en.html
13.10.2014	The Presbyterian Church of Aotearoa New Zealand commits to divest	http://gofossilfree.org/the-presbyterian-church-of-new-zealand-joins-a-chorus-of-faith-based-action-down-under/
17.11.2014	The Diocese of Oxford commits to divest	http://www.oxford.anglican.org/diocese-disinvest-fossil-fuels
2.12.2014	Victoria University of Wellington commits to divest	http://sustainable.org.nz/sustainability-news/victoria-university-to-divest-from-fossil-fuels#.VyGkNDCLSVM
23.12.2014	California Institute of Arts commits to divest	http://blog.calarts.edu/2014/12/23/calarts-moves-to-divest-from-fossil-fuels/
15.3.2015	George School commits to divest	http://insideclimatenews.org/news/15052015/pennsylvania-high-school-students-convince-school-divest-coal
31.3.2015	Syracuse University commits to divest	http://www.nytimes.com/2015/04/01/science/syracuse-to-drop-fossil-fuel-stocks-from-endowment.html?_r=0
21.5.2015	University of Hawaii commits to divest	http://350hawaii.org/?p=274&utm_content=bufferb794a&utm_medium=social&utm_source=twitter.com&utm_campaign=buffer
17.6.2015	Lund University commits to divest	http://gofossilfree.org/se/lund-university-divest-direct-donations-from-fossil-fuels/
9.9.2015	University of California commits to divest	http://www.latimes.com/local/education/la-me-ln-uc-coal-20150909-story.html
10.11.2015	10 UK universities commit to divest commits to divest	http://www.theguardian.com/environment/2015/nov/10/ten-uk-universities-dive
26.11.2015	London School of Economics commits to divest	http://blog.peopleandplanet.org/blog/2015/11/26/press-release-london-school-of-economics-divest-97-2m-from-coal-tar-sands/
22.12.2015	Diocese of Quebec commits to divest	http://www.anglicanjournal.com/articles/diocese-of-quebec-divests-from-fossil-fuels-mining

2015 Rank	Coal Companies	Coal Gt CO_2	2015 Rank	Oil and Gas Companies	Oil Gt CO_2	Gas Gt CO_2	Total O&G Gt CO_2
1	Coal India	57.722	1	Gazprom	6.749	37.166	43.915
2	China Shenhua	36.807	2	Rosneft	10.666	2.558	13.224
3	Adani	25.383	3	PetroChina	4.790	3.801	8.591
4	Shanxi Coking	18.445	4	ExxonMobil	4.307	3.916	8.223
5	Anglo American	13.488	5	Lukoil	5.699	1.288	6.988
6	BHP Billiton	12.351	6	BP	4.214	2.506	6.719
7	Yitai Coal	12.223	7	Petrobras	4.707	0.724	5.432
8	Datang Intl	12.206	8	Royal Dutch Shell	2.229	2.315	4.544
9	China Coal	12.103	9	Chevron	2.485	1.588	4.073
10	Peabody Energy	11.484	10	Novatek	0.497	3.356	3.853
11	Glencore Xstrata	10.698	11	Total	2.002	1.800	3.802
12	Datong Coal	10.281	12	ConocoPhillips	1.687	1.111	2.798
13	Yanzhou Coal	9.788	13	Tatneft	2.556	0.064	2.620
14	DEH	9.339	14	ONGC	1.594	0.862	2.457
15	Exxaro	8.793	15	ENI	1.366	0.990	2.356
16	Yangquan Coal	7.298	16	Statoil	0.981	1.004	1.985
17	Mechel	6.739	17	Sinopec	1.340	0.381	1.722
18	Arch Coal	6.513	18	CNOOC	1.175	0.373	1.548
19	Alpha Natural Resources	5.458	19	Occidental	1.024	0.303	1.327
20	EVRAZ	4.855	20	BG Group	0.533	0.588	1.122
21	Mitsubishi	4.738	21	Canadian Natural Resources	0.788	0.208	0.995
22	Vale	4.401	22	Anadarko Petroleum	0.482	0.502	0.984
23	Raspadskaya	4.084	23	Apache	0.569	0.400	0.969
24	Rio Tinto	3.696	24	Chesapeake Energy	0.269	0.639	0.909
25	Asia Resource	3.181	25	Inpex	0.541	0.367	0.908
26	Rusal	3.081	26	Bashneft	0.892	0.000	0.892
27	Neyveli Lignite	3.035	27	Devon Energy	0.381	0.507	0.889
28	Pingdingshan	3.023	28	BHP Billiton	0.333	0.521	0.854
29	Cloud Peak	2.753	29	Repsol	0.271	0.551	0.823
30	Sasol	2.731	30	Ecopetrol	0.607	0.167	0.774
31	Tata Steel	2.709	31	EOG Resources	0.497	0.275	0.772
32	AGL	2.704	32	Suncor Energy	0.713	0.003	0.715
33	Teck	2.603	33	Marathon Oil	0.538	0.146	0.683
34	Severstal	2.577	34	Hess	0.457	0.108	0.565
35	Coalspur	2.545	35	Imperial Oil	0.527	0.025	0.552
36	Kuzbass Fuel	2.504	36	Encana	0.081	0.467	0.548
37	Polyus Gold	2.294	37	Noble Energy	0.173	0.318	0.490
38	Energy Ventures	2.184	38	BASF	0.134	0.348	0.483
39	Whitehaven Coal	2.055	39	EQT	0.037	0.412	0.449
40	Banpu	2.040	40	Range Resources	0.134	0.309	0.443
41	Bayan	1.957	41	Continental Resources	0.312	0.113	0.426
42	RWE	1.943	42	OMV	0.269	0.151	0.420
43	Consol Energy	1.887	43	Antero Resources	0.042	0.368	0.410
44	WHSP	1.851	44	KazMunaiGas EP	0.382	0.018	0.400
45	Westmoreland	1.835	45	YPF	0.250	0.139	0.389
46	Resource Generation	1.818	46	Southwestern Energy	0.000	0.380	0.380
47	Churchill Mining	1.745	47	Cenovus Energy	0.326	0.048	0.374
48	NTPC	1.740	48	Linn Energy	0.199	0.164	0.364
49	Adaro	1.607	49	Woodside Petroleum	0.049	0.311	0.360
50	Nacco	1.557	50	Husky Energy	0.215	0.128	0.343
51	Idemitsu Kosan	1.530	51	PTT	0.106	0.211	0.317
52	ARLP	1.468	52	Consol Energy	0.000	0.312	0.312
53	Huolinhe Opencut	1.387	53	Pioneer Natural Resources	0.198	0.104	0.302
54	Golden Energy	1.354	54	Cabot Oil & Gas	0.011	0.289	0.300
55	Mitsui & Co	1.344	55	WPX Energy	0.072	0.203	0.275
56	CoAL	1.339	56	SK Innovation	0.263	0.000	0.263
57	NLMK	1.288	57	Whiting Petroleum	0.219	0.025	0.244
58	Tata Power	1.062	58	Murphy Oil	0.179	0.063	0.242
59	MMK OJSC	1.046	59	QEP Resources	0.094	0.139	0.233
60	Wesfarmers	1.011	60	Newfield Exploration	0.134	0.090	0.223
61	Kazakhmys	0.998	61	Dragon Oil	0.159	0.043	0.202
62	New World Resources	0.972	62	Sasol	0.115	0.085	0.201
63	MMC	0.903	63	Ultra Petroleum	0.014	0.186	0.200
64	Itochu	0.878	64	Santos	0.027	0.167	0.195
65	Cockatoo	0.800	65	Concho Resources	0.130	0.064	0.194
66	Shanxi Meijin Energy	0.784	66	Denbury Resources	0.164	0.027	0.190
67	Jizhong Energy	0.742	67	Freeport-McMoRan	0.152	0.031	0.183
68	Bandanna	0.731	68	Maersk Group	0.174	0.000	0.174
69	Polo Resources	0.726	69	MEG Energy	0.173	0.000	0.173
70	Allete	0.723	70	SandRidge Energy	0.081	0.076	0.157
71	CLP Holdings	0.696	71	Crescent Point Energy	0.146	0.011	0.157
72	Aspire	0.670	72	GDF SUEZ	0.044	0.111	0.155
73	Marubeni	0.568	73	Pacific Rubiales Energy	0.124	0.030	0.154
74	China Resources	0.567	74	SM Energy	0.084	0.065	0.148
75	Walter Energy	0.556	75	JX Holdings	0.146	0.000	0.146
76	Coal Energy	0.503	76	Cimarex Energy	0.074	0.070	0.144
77	Indika	0.485	77	Mitsui & Co	0.048	0.095	0.142
78	Arcelor Mittal	0.464	78	Penn West Petroleum	0.100	0.036	0.137
79	FirstEnergy	0.458	79	Polish Oil & Gas	0.033	0.100	0.132
80	Black Hills	0.431	80	MOL	0.076	0.055	0.131
81	Wescoal	0.430	81	Energen	0.088	0.039	0.128
82	Grupo Mexico	0.420	82	TAQA	0.066	0.057	0.123
83	ARM	0.383	83	Oil Search	0.026	0.088	0.114
84	Shanxi Coal	0.376	84	Oil India	0.062	0.051	0.113
85	Capital Power	0.367	85	ARC Resources	0.046	0.066	0.112
86	PTT	0.359	86	Genel Energy	0.107	0.000	0.107
87	Shanxi Lanhua Sci-Tech	0.338	87	Canadian Oil Sands	0.102	0.000	0.102
88	Fortune	0.328	88	Energy XXI	0.076	0.020	0.096
89	Cardero	0.323	89	PDC Energy	0.055	0.040	0.095
90	Zhengzhou Coal	0.319	90	Oasis Petroleum	0.084	0.010	0.094
91	SAIL	0.307	91	Tourmaline Oil	0.014	0.079	0.093
92	JSPL	0.301	92	Rosetta Resources	0.056	0.037	0.093
93	Shougang Fushan	0.299	93	RWE	0.030	0.063	0.093
94	Jingyuan	0.297	94	National Fuel Gas	0.018	0.071	0.088
95	Stanmore	0.287	95	Peyto E&D	0.008	0.079	0.088
96	Prophecy Coal	0.272	96	Xcite Energy	0.086	0.001	0.088
97	Cliffs Natural Resources	0.247	97	Tullow Oil	0.077	0.010	0.087
98	James River	0.195	98	Energi Mega Persada	0.016	0.069	0.085
99	CESC	0.185	99	Breitburn Energy Partners	0.053	0.028	0.081
100	Alcoa	0.180	100	Enerplus	0.043	0.037	0.080

2. Appendix

Top 200 publicly traded carbon heavy firms. (Fossil free indexes 2016.)