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Master Thesis Financial Economics[1]

The Effect of ESG Index Constituent Changes on Co-Movement and Returns

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Inspired by behavioural finance related theories such as the sentiment-based view theory and the investor awareness hypothesis, this study examines the constituent change effect of the MSCI USA ESG index on stock price co-movement and returns. This research applies event-study methodologies and fills a gap in the literature since it uses a more appropriate ESG-index than earlier research studies used in the determination of the effect on returns and it is the first attempt to examine co-movement changes caused by constituent changes of an ESG-index. Due to the constituent policy of MSCI constituent changes do not affect the return of a stock nor its co-movement with the index. This research adds evidence to the literature stream about index characteristics and dynamics affecting co-movement and returns. Furthermore, it shows that future research should focus on decomposing the informational content of a constituent change from the effect of the index change itself.

Keywords: ESG-index, co-movement, return, investors' awareness, sentiment

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1. Introduction

The aim of this research is to investigate the effect of constituent changes of an Environmental, Social & Governance- (ESG-) index. This is an index with high exposure to firms conducting a business policy that, to some extent, takes the three ESG-factors into account. Within the research area of Finance, most researchers focus on the differences between the so-called ESG-firms and their conventional counterparts. For example, whether ESG-companies are more profitable, less risky or whether the stock price returns are different. However, the impact of obtaining an ESG-label through constituent changes on a stock's co-movement with the index in conjunction with the examination of abnormal returns has not been investigated yet. Moreover, empirical research that examines leading theories about co-movement and abnormal returns, such as the sentiment based-view theory of Barberis, Shleifer & Wurgler (2005) and the investor awareness hypothesis of Chen, Noronha & Singal (2004), do not provide conclusive answers in different settings, or even no answers at all, with respect to ESG-stocks.

This research demonstrates the effect of ESG-index constituent changes on the co-movement between the stock and the index, and the effect on the return of the stock. More specifically, this study hones in on the co-movement between an ESG-firm and an ESG-index before and after it was included in or deleted from the index, and the abnormal returns that follow such events. For this, the MSCI USA ESG index will be used which is the ESG equity leader in the United States.

The broad definition of ESG-compliant business policy is well-understood, namely, companies should take their responsibility towards its environmental and social impact, and they should monitor and manage those impacts accordingly. However, the implementation of this definition could prove troublesome since a lot of actions should be valued and taken into account to determine to what extent companies conduct an ESG-compliant business policy. This research uses and substantiates the definition employed by the MSCI USA ESG index and their implementation policy. The research question of this thesis is the following:

What is the effect of additions to and deletions from the MSCI USA ESG index on co-movement and stock price returns?

Based on the theory and findings of Barberis, Shleifer & Wurgler (2005) and some related papers, a change in co-movement for additions to and deletions from the index is expected even if nothing fundamentally has changed within a company. Following the sentiment-based view theory derived by the authors, a positive increase in beta for additions and decrease in beta for

deletions is hypothesized. Moreover, the price response to the added or deleted stock will be investigated as well. While this has been done before, the disparity with earlier studies is that an asymmetric response of stock prices between additions to and deletions from the index is expected based on the investor awareness theory of Chen, Noronha & Singal (2004). A second divergence between this study and prior, is that it examines this theory in conjunction with the sentiment-based theory of Barberis, Shleifer & Wurgler, which provides a new perspective and could spark new debates on these two theories. For example, if the sentiment-based theory is not rejected, but the investor awareness hypothesis is rejected, what kind of factors drive the sentiment-based theory to hold? At least, one should expect an increase in investor awareness if the sentiment-based theory explains changes in stock price co-movement. Lastly, due to differences in constituent policies between the MSCI USA ESG index and other ESG-indices, results could provide a new perspective on the two leading theories.

The relevance of this research originates from the increasing importance of responsible investing (RI). Largely due to the increase in importance of topics such as climate change and ethical finance, firms' sense of responsibility towards the society is becoming a significant part of its business management policy. However, several questions can be raised with respect to an ESG-compliant policy, for example: what are the benefits for a firm taking its responsibility towards the environment and community? Are the differences between ESG-companies and their conventional counterparts substantial enough in order to obtain diversification benefits for investors? The findings of this research can help firms and investors derive answers for such questions, since it displays the effect of an ESG-index' constituent changes on stock price returns and co-movement. Changes in co-movement and abnormal returns caused by investors' sentiment and trading behaviour can have a massive impact on trading, hedging and wealth distribution. For example, Tang & Xiong (2012) show an increase of correlation between non-energy commodity futures and oil prices caused by investor behaviour, and hereby reducing the diversification benefits, possibility to hedge and the risk premium for commodity futures.

Moreover, this research contributes to the academic literature about co-movement and stock price returns. Barberis, Shleifer & Wurgler (2005) explain and show changes in beta for additions to and deletions from the S&P 500, whereas Chen, Noronho, & Singal (2004) demonstrate and explain the asymmetry in abnormal returns for S&P 500 constituent changes. Related theories are not able to explain the asymmetry in abnormal returns since these would predict a symmetric response, and the literature is not able to explain the changes in betas as well. Therefore, the authors propose their own theory, and this research contributes to the evidence for, or contradicts, their reasoning since it shows the changes in co-movement and the

impact on stock price returns for additions to and deletions from an ESG-index. Since both theories are not based on fundamental changes, but on behavioural arguments and frictions within the economy, it is captivating to investigate these theories together in one paper. The underlying problem is the same, namely: fundamental changes cannot explain the results, and therefore Barberis, Shleifer & Wurgler (2005) propose the sentiment-based view to explain changes in co-movement and Chen, Noronho, & Singal (2004) use their investor awareness hypothesis to explain asymmetry in abnormal returns.

In addition, by investigating an ESG-index, this research sheds more light on the debate of index characteristics affecting changes in co-movement and abnormal returns. Despite Barberis, Shleifer & Wurgler (2005) and Chen, Noronho & Singal (2004) being one of the leading papers within their field of research, several other papers show contradicting results which are possibly caused by differences in index characteristics (Miller & Shankar, 2006), such as large, medium or small market capitalization indices (Biktimirov, Cowan, & Jordan, 2004), indices for which there is no index-fund tracker or derivative market (Bildik & Gülay, 2008), indices including stocks with short-sales constraints (Chang & Cheng, 2007) or indices with a different constituent change policy (Mase, 2007).

In fact, this research shows that the sentiment-based view theory and the investor awareness hypothesis does not hold for the MSCI USA ESG index. Robustness inferences explain some of the results, but the main explanation of these results can be found in MSCI's constituent change policy since it ensures no fundamental differences between the MSCI USA ESG index and its parent index, the MSCI USA index. Because of that, firms with high (low) ESG-scores are not necessarily added (deleted) immediately or even at all. Therefore, the MSCI USA ESG index is a relatively more appropriate index to use than other ESG indices since results will only be driven by the constituent change itself and do not provide information about a firm's ESG performance. As Barberis, Shleifer & Wurgler (2005) and Chen, Noronho, & Singal (2004) argue to ensure the validity of their theories, one has to make sure that fundamental changes do not affect the results. Since the results oppose the findings of related research papers, future studies should focus on decomposing the informational content of a constituent change from the effect of the index change itself.

This paper is structured as follows: section 2 contains the theoretical framework with respect to sentiment-based view theory, investor awareness hypothesis and ESG-compliant business policy. Section 3 describes the data collection process and some data characteristics. Section 4 describes the research methodology after which the results will be discussed in section 5. A discussion is set forth and conclusions will be drawn in section 6 & 7, respectively.

2. Theoretical Framework

The key papers this research is built upon are Barberis, Shleifer & Wurgler (2005) and Chen, Noronho, & Singal (2004). Both papers show and explain the effect of additions to and deletions from the S&P 500 index. The former covers changes in co-movement which cannot be explained by changes in fundamentals, whereas the latter explains the asymmetrical price response of stocks caused by the constituent changes. First, the relevant literature about co-movement changes will be discussed. Second, studies examining abnormal returns caused by constituent changes will be reviewed and lastly, the concept of Responsible Investing will be discussed.

2.1 Changes in Co-movement

Previous studies show co-movement of certain stocks because of strong common factors. However, there is an apparent gap in regards to an explanation for why common factors arise in the first place. Barberis, Shleifer & Wurgler (2005) provide such an explanation and they consider two different streams of co-movement theories. The first one is the so-called "traditional view" which holds in a frictionless economy with rational investors and entails that changes in co-movement are caused by changes in fundamental values. However, academics find changes in co-movements that cannot be attributed to changes in fundamentals. Therefore, the authors propose a "sentiment-based" theory to explain these findings which originates from the effect of frictions in the economy and irrational investors. The theory consists of three parts: the category view, the habitat view and the information diffusion view.

The category view implies that investors do not allocate funds at the individual asset level, but at the level of certain predefined categories, such as oil industry stocks or tech-stocks. In case a stock is added to a particular category, the co-movement of the stock with that category will increase even if nothing fundamentally has changed, e.g. the company's underlying fundamental metrics such as profitability and risk did not change.

The habitat view states that investors only trade stocks that fall into their "habitat" because of lack of information or transaction costs for example. If investors make changes in their portfolio, they will only use a subset of stocks which causes these stocks to co-move together.

The information diffusion view states that the speed of processing information into prices is different for certain types of stocks. This results in a greater co-movement between stocks for which new information is quickly processed into the stock price and a greater co-movement between less efficient stocks. So, whenever a stock falls into a particular investors' category,

habitat or stock price information is processed more or less efficiently, the co-movement of the stock with its new group of assets will increase and the co-movement with the group it previously belonged to decreases.

The sentiment-based theory implies that even in the absence of a fundamental change within a company, the co-movement of stocks will change if a stock is added to or deleted from an index due to the effect of investors' sentiment. Barberis, Shleifer & Wurgler (2005) use the S&P 500 index, and further clean their observations which could be influenced by fundamental changes and show that indeed for additions to the S&P 500, the co-movement increases with this index, and vice versa for deletions.

The link between this research and the paper of Barberis, Shleifer & Wurgler (2005) is that this study examines the changes in co-movement of stocks added to (deleted from) the MSCI USA ESG index and use the theory formulated in their paper in conjunction with some index characteristics to explain the results. There is no paper yet that investigates the changes in co-movement due to index inclusions and deletions for an ESG index. However, co-movement changes could have substantial consequences since an increase in co-movement results in a less diversified portfolio or index and therefore, idiosyncratic risk can be less easily mitigated.

As mentioned earlier, the sentiment based view theory has not been examined using an ESG-index, but it is used to hypothesize, and it sometimes explains results, of other related studies. This research fills the gap that the following related research papers do not touch upon: Golombik, Kumar & Panwada (2011) test whether religious beliefs affects stock price co-movement using the constituent changes of the MSCI US Catholics Values Index. The authors find that inclusions and deletions do not have an impact on co-movement. Despite the fact that Royal Dutch Shares and Shell shares are claims on the same cash-flow stream, Froot & Dabora (1999) find Royal Dutch shares to be remarkably delinked from the returns of Shell shares. Kumar & Lee (2006) show that systematic trading by retail investors caused by common investor sentiment, results in stock return co-movements beyond the usual risk factors. Peng & Xiong (2006) demonstrate that limited investor attention leads to category-learning behaviour. The authors show that combined with investor overconfidence, this generates important features observed in return co-movement that are otherwise difficult to explain. Greenwood & Sosner (2007) show that the friction- or sentiment-based view explains the co-movements changes of additions to and deletions from the Nikkei 225 index. Consistent with the habitat version of the sentiment-based model, the authors find that stocks preferred by retail investors are the ones most sensitive to shifts in retail investor sentiment. Tang & Xiong (2012) show an

increase in correlation between non-energy commodity futures and oil prices caused by investor behaviour. Boyer (2011) finds that marginal value stocks, defined as those that recently switched from the growth into the value index, co-move significantly more with the value than with the growth index, whereas the reverse is true for marginal growth stocks. These effects are hard to explain within standard Finance models because marginal value stocks have very similar characteristics to marginal growth stocks. Veldkamp (2006) derives a micro-founded theory of a competitive information market and shows that, in equilibrium, investors purchase the kind of information that generates co-movement.

This research is not only interesting because it bridges the gap in the literature since it scrutinize the effect of ESG constituent changes, but also because the results itself are relevant for researchers, practitioners and investors; as earlier noted, index characteristics, such as large, medium or small market capitalization indices (Miller & Shankar, 2006) (Biktimirov, Cowan, & Jordan, 2004), indices for which there is no index-fund tracker or derivative market (Bildik & Gülay, 2008), indices including stocks with short-sales constraints (Chang & Cheng, 2007) or indices with a different constituent change policy (Mase, 2007), do have an impact on abnormal returns generated by constituent changes and subsequently affect the robustness of the investor awareness hypothesis of Chen, Noronho, & Singal (2004). Therefore, it is interesting to research other indices to examine the robustness of the sentiment-based view theory of Barberis, Shleifer & Wurgler (2005) with respect to index characteristics as well. For example, it is plausible that co-movement changes are more prevalent for indices that have popular ETF-trackers. The quantity of same types of indices can be relevant as well, e.g. ESG-firms can be viewed as a particular habitat or category, but the amount of comparable ESG-indices could disperse investors and therefore diminish the individual index effect on co-movement.

In sum, the sentiment based view that originates from investors' assets allocation behaviour can explain co-movement changes. However, co-movement changes has not been examined yet for ESG indices despite the potential of index characteristics affecting co-movement changes and the effect of co-movement changes on diversification, and therefore, its effect on financial performance and investment strategies.

2.2 Asymmetry in Abnormal Returns

Chen, Noronho, & Singal (2004) do not find a permanent decrease in stock prices for firms deleted from the S&P 500 index, but the authors show a permanent increase in stock prices for firms added to the index. The asymmetry between the stock price reaction of additions and

deletions cannot be explained by changing expectations of future cash flows, downward sloping demand curve, the trading volume-related liquidity hypotheses or the effect of ETF-rebalancing since these would predict a symmetric, and in some cases only a temporarily, response.

First, a change in the expected future cash flow could be caused by the certification hypothesis or improved monitoring by investors. The certification hypothesis entails that a deletion entails negative information about a stock and an addition reveals positive information (Dhillon & Johnson, 1991). Therefore, one would expect a permanent increase in stock price for firms added, and the opposite reaction for deleted firms. An addition to (deletion from) an index can improve (worsen) monitoring by investor which forces firms to perform more efficiently and therefore stock prices increase (decrease) (Denis D. , McConnell, Ovtchinnikov, & Yu, 2003).

Second, the reasoning based on a downward sloping demand curve is that an addition functions as the foundation for excess demand since an index must purchase the added stocks and, therefore, the stock price increases. However, a deletion will result in a decrease of the price since the index has to sell the stocks, again a symmetric response. Third, an addition could result in an increase in liquidity and therefore a lower illiquidity premium is required which increases the stock price and vice versa for deletions. Lastly, rebalancing of ETF-trackers could increase stock prices for additions since they will buy the stock when it is included in the index, but sell the stock of deleted firms resulting in a stock price decrease, which is again a symmetric response. In conclusion, the permanent increase of stock prices for additions and no permanent change for deletions cannot be explained by these theories. Therefore, Chen, Noronha & Singal (2004) proposes the investor awareness hypothesis as an explanation for their results.

Investor awareness about a stock could increase whenever a stock is added to an index, but does not necessarily decrease for deleted stocks since investor do not simply “forget” the stock. Because of that, one would expect an increase in stock price after an addition, but not a decrease of the same magnitude for deletions. This paper uses the “investor awareness” hypothesis to predict the changes in returns for constituent changes in the MSCI USA ESG index. The first question that arises with this hypothesis is: why does investor awareness affect stock price returns in the first place? One of the explanations is a combination of the earlier mentioned factors, for example intensified monitoring, and investor awareness. Recall that intensified monitoring increases stock prices for additions, since these firms may be forced to perform more efficiently, and vice versa for deleted companies. However, assuming that investor awareness drives the monitoring behaviour of analysts and investors, the monitoring does increase for additions, but does not necessarily decrease for deletions since they are still

familiar with the stock. Another reason can be found in a stock's liquidity. Investor awareness could increase liquidity if a stock is added to an index since more investors do know about the stock, and therefore a lower liquidity premium is required resulting in a higher stock price. Stock's liquidity does not decrease for a deletion as much as the increase is for an addition since investors are still aware of the existence of a stock, and therefore trading frequencies and liquidity will not dramatically decline.

In contrast to the sentiment-based view theory of Barberis, Shleifer & Wurgler (2005) discussed in the previous subsection, the investor awareness hypothesis has frequently been scrutinized. Chan, Kot & Tang (2013) find evidence for significant long term abnormal returns for S&P 500 constituent changes and show that the long-term price increase of additions are caused by an increase in analyst coverage, liquidity and institutional ownership and a decrease in Merton's shadow cost. Moreover, deletions do have a substantial effect on institutional ownership and liquidity but do not have a significant effect on shadow cost and analyst coverage; this explains the asymmetry in permanent abnormal returns between inclusions and deletions. Chang & Cheng (2007) demonstrate that indeed stocks added to the Hong Kong stock market experience positive abnormal returns, but in addition to that, short-sale constraints and a wider dispersion of investor opinions enhance these returns. Elliot, Van Ness & Walker (2006) show that an increase in investor awareness is the primary factor causing abnormal returns for inclusions in the S&P 500, but they find some evidence of temporary price pressure around the inclusion date as well. Miller & Shankar (2006) show that firms entering the S&P universe for the first time experience a larger price increase. However, in contrast to the permanent effects of S&P 500 additions and deletions, the authors only find a temporary price and volume change for the S&P 600 small index which supports the price-pressure hypothesis. The findings of Biktimirov, Cowan & Jordan (2004) are incompatible with the investor awareness hypothesis but are in line with the S&P 600 small index results, namely, they find only temporary price changes for the small-cap Russell 2000 index. Moreover, different results are not merely obtained using a small-cap index, Mase (2007) does not find evidence for the investor awareness hypothesis using the FTSE100 constituent changes. The result of indices for which there is no index-fund tracker or derivative market (Bildik & Gülay, 2008) are also not in line with the investor awareness hypothesis. Therefore, this paper will add new insights about index characteristics affecting constituent change returns since it uses an ESG-index.

There is a limited selection of research examining the impact of constituent changes of an ESG-index, however, these studies do have their complications and differences. For example, Curran & Moran (2007) do not find significant abnormal returns for additions to and

deletions from the FTSE4Good Index. However, since the FTSE4Good index only includes 50 companies, there is a lack of constituent changes and it is also questionable whether the FTSE40Good index is an appropriate index since constituent changes are also heavily affected by market capitalization. All of these problems, do not apply to the MSCI USA ESG index used in this paper. Lopez, Garcia & Rodriguez (2007) examine the effect of CSR-compliant business policy on accounting based performance metrics. However, the authors do not investigate the effect of obtaining an ESG-label on stock price co-movement and returns. The studies of Consolandi, Jaiswal-Dale, Poggiani & Vercelli (2009) and Doh, Howton, Howton & Siegel (2010) only examine the short term market reaction of constituent changes for the Calvert Social index and the Dow Jones Sustainability Stoxx Index, respectively. Lastly, Robinson, Kleffner & Bertels (2011) investigate the reputational effect of CSR on stock price returns by looking at the effect of index additions to and deletions from the DJSI World Index. However, the methodological approach of this index is to include the top 10% CSR-compliant firms of each industry and therefore, the index does not aim to obtain a representative basket of CSR-compliant firms with the same risk-return characteristics as the parent index. As will be explained in section 2.3, the MSCI USA ESG index does not suffer from this problem since the goal is to achieve a representative basket of ESG-firms, while maintaining same fundamental characteristics as the parent index. Therefore, fundamental changes are not present, meaning that any significant result with respect to abnormal returns and co-movement changes can only be attributed to the investor awareness hypothesis.

2.3 Effect of Responsible Investing

The literature that examines the effect of responsible investing is extensive, but provides different results and entails studies on different kind of factors. One of these factors is financial performance, however, Faleye & Trahan (2011) review the literature but conclude that there is need for more empirical analysis since prior research and theoretical arguments do not provide conclusive answers. For instance, from a theoretical perspective, Berrone et al. (2007) argue that the effects of CSR on firm performance is ambiguous. Moreover, from an empirical point of view, there is no clear evidence about the direction of the effect of CSR on corporate performance (Bird, Hall, Momente, & Reggiani, 2007). The authors argue that this could be due to a lack of appropriate measures, a large enough sample and a strong conceptual framework. However, the different results on financial performance are not problematic for this paper. The main objective is to investigate the effect of being added to or deleted from an ESG-index on stock price co-movement and returns in order to examine whether the sentiment based

view theory and the investor awareness hypothesis holds for ESG-stocks, just as it does for S&P 500 stocks. Due to the index characteristics, which will be discussed below, there are no concerns about the ambiguous effect of responsible investing on financial performance, and therefore on stock price returns and co-movement.

One important aspect of the two key papers is that their predictions hold, even if nothing fundamentally has changed within the company. Since the MSCI USA ESG index is just a representative basket for companies conducting an ESG compliant business policy, nothing fundamentally changed with respect to a company added to or deleted from that index. Less ESG-compliant firms could be in the index whereas some more ESG-compliant firms are not in the index. This is due to the fact that MSCI aims to obtain a representative basket of ESG-compliant firms with the same characteristics as the benchmark index, e.g. the MSCI USA index (MSCI, 2018). Thus, in essence, an addition or deletion is not necessarily determined by a fundamental change and does not entail informational content about the ESG-performance of companies. However, it could be caused by fundamental changes such as mergers, acquisitions and bankruptcy, but the data & methodology section deals with these confounding events. Furthermore, a company added to the index should already have a steady ESG-score, and even then it could be added later due to the index's requirement of facing the same degree of certain risk characteristics as the parent index. The resemblance with the two key papers is that the authors use the S&P 500 index for which the composition is not affected by fundamentals since constituent changes are purely made in order to obtain a basket of companies which is representative for the US economy. The rest of this section explains the index composition policy more in details but first, based on the previous discussion about the Barberis, Shleifer & Wurgler (2005) paper, the findings of Chen, Noronho, & Singal (2004) and the constituent policy of the MSCI USA ESG index, the hypotheses are the following:

(1) An addition to (deletion from) the MSCI USA ESG index will result in an increase (decrease) in co-movement of the stock with this index.

(2) An addition to (deletion from) the MSCI USA ESG index will result in a significantly positive (an insignificant) abnormal return for these stocks.

Certain criteria determine the overall ESG Quality Score (MSCI, 2018). First of all, companies operating in or assisting certain industries are excluded. The considered industries are the nuclear power, tobacco, alcohol and gambling industry as well as firearms related industries such as conventional, controversial and the civilian weapons sectors. Next, companies with severe controversies determined in line with international regulations and

norms including the UN Declaration of Human Rights, the UN Global Compact and the ILO Declaration on Fundamental Principles and Rights at Work or without an ESG-rating are excluded. The score assesses the controversies with respect to the ESG impact of a company's operations, products and services. MSCI considers 37 ESG Key issues using thousands of data points focussing on industry characteristics creating risk and opportunities for the company, as well as a company's core business and its policy. Companies with a score above 2 (on a scale of 10) are considered to be included in the index, but these are not necessarily included since the last objective of the index is to create an ESG-index with the same index characteristics as the parent index, the MSCI USA index. This feature is extremely interesting since it ensures no fundamental differences between the two indices except the ESG-feature. Furthermore, the scores are benchmarked against the industry and transposed into ratings ranging from AAA to CCC.

The index does not only contain companies considered to be industry leaders, e.g. companies with a AAA or AA rating, but also companies with an A or even BB-rating. For example, in 2018 73% of the companies in the MSCI USA ESG index at least an AA rating whereas the same figure for the MSCI USA index is only 17%.

In sum, the index' methodology aims to obtain a representative basket of ESG-compliant companies without fundamental differences between this index and the MSCI USA index. This feature justifies the assumption that there should be no fundamental changes or differences affecting co-movement and stock price returns. Therefore, this index is suitable to test the sentiment based view theory and the investor awareness hypothesis discussed earlier.

One important note has to be made with respect to the constituent policy. Namely, MSCI migrated the index to an enhanced methodology, which subsequently allowed MSCI to make a better judgement about the ESG impact of a company (MSCI, 2012). From May 2012 onwards, three important methodological metrics, in conjunction with some minor adjustments, were added to the ESG evaluation process. First, MSCI enhanced the methodology with the use of normalized Intangible Value Assessment-scores (IVA-scores) for the assessment of the overall best-in-class ESG-company performance. Second, the Impact Monitor controversy assessment will be used to exclude companies with controversial business practices. Lastly, the constituent changes will be announced nine days before the effective date instead of five days. As shown in the results about the S&P 500 with respect to co-movement changes and abnormal returns a change in a constituent's policy, causes different results for the periods before and after the policy effectively changed. The methodology will deal with the policy adjustment.

3. Data

MSCI, DataStream, and Thomson One provide the required data for this research. MSCI constituent changes are not directly available, however, these can be retrieved using the list of companies included in the MSCI USA ESG index at the end of each month. By using these lists, differences between two consecutive months can be obtained and, therefore, a Spreadsheet Comparison Tool can be used to retrieve the constituent changes of the index. The constitutions lists data is available from September 2006 until April 2019. The uncleaned dataset of constituent changes contains 834 observations made up by 497 different firms. Disregarding a few exceptions, constituent changes are made every quarter. The co-movement changes and abnormal returns of these 834 observations could be affected by confounding events around the constituent change date which are often the cause for the constituent change itself. Addition events are excluded whenever the company engaged in a merger or takeover around the inclusion event, or in case there is a lack of data, e.g. one year pre- and post- stock price data is not available. Deletion events are excluded if the firm is involved in a merger, takeover or bankruptcy proceedings and if the required stock price data is not available.

Moreover, some deletions from the MSCI USA ESG index are caused by a delisting of the company from the MSCI USA (the parent index) since the MSCI USA ESG index only includes companies from the parent index. The effect of the deletion from only the MSCI USA ESG index cannot be isolated from the dual effect of the delisting from both indices. Therefore, observations caused by a delisting from the parent index are deleted. Companies added to the MSCI USA index and shortly hereafter added to the MSCI USA ESG index are not suitable to use for the same reason.

Thomson One provides Mergers & Acquisition data (M&A-data) for whether a company is either a target or an acquirer. For all 834 observation (497 different) firms, M&A-data (including M&A announcements which were not completed) is obtained over the period 2005-2019 in which at least one of the 497 companies is either a target or acquirer. To assure no confounding effect of M&A's on the constituent change effect, observations are deleted if the company was involved in an M&A process within one year from the constituent change date.

Due to the earlier described data cleaning process, 310 observations (137 additions, 173 deletions) remained to be furtherly examined. Subsequently, stock price data can be obtained from DataStream. For 26 observations stock price data one year prior and after the event were not available due to IPO-timing, too close to the present or the company went private within the one-year period from the event. Observations for which there is no data at all are deleted as

well. This resulted in a massive loss, primarily because 95 ISIN-codes were not recognized. The use of SEDOL-codes for these 95 missing occurrences only retrieved 9 observations out of which 5 were suitable because of the data requirements. This left a total of 194 observations (91 additions and 103 deletions).

Finally, when observing the data, a lot of stock prices were repeated for consecutive days. First, for some observations the stock prices might look available but in fact, a lot of consecutive days had the exact same stock price. For example, the last 146 available stock prices for Quicksilver Resources Inc. were all exactly $0.01. These repetitive prices were caused by a trading stop initiated by bankruptcy filings and M&A-processes for example, which were not completed yet or which were completed far in the past. In all of these cases, the repetitive prices were deleted and left as missing. Secondly, for some dates the stock price for all observations were exactly the same as the day before, but this was not repeated for more than two days. It is odd that this is the case for all firms but some special event dates on which trading was not possible caused these patterns. Therefore, 98 out of 3554 trading dates were deleted due to public holidays such as Good Friday, Christmas Day, Boxing Day, New Year's Day and Easter Monday as well as bank holidays such as Spring bank holiday, early May bank holiday and the Summer bank holiday. In the end, a final check is made to assure no odd stock price patterns for individual observations due to trading halts or missing data.

One important aspect to be considered is whether the 194 observations left are representative for the population of 834 constituent changes. First of all, the loss of 524 observations (roughly 63%) due to confounding events is not uncommon. Especially because the 2008 crisis is within the sample period, there are many confounding events for observations around the constituent change dates in the 2007-2009 period which, as described earlier, had to be deleted. Barberis, Shleifer & Wurgler (2005) and Chen, Noronha & Singal (2004) lost 54% and 45% data points, respectively. However, the total loss of observations (from 834 to 194 observations) is still unfortunate and substantially large because of the loss of 95 observations due to lack of data, of which only 5 were retrieved using SEDOL-codes. Despite the loss due to missing data, the 194 observation used over the 12 year period (roughly 16 observations per year) is still reasonable to use. The two papers mentioned earlier used roughly 22 and 26 observations per year. The difference in the number of observations between this paper and the two leading researches seems large, however, this is driven by the fact that the S&P 500 consists of 500 firms whereas the MSCI USA ESG consists of 350 companies at most. Secondly, the 194 observations are indeed representative for the total amount of constituent changes in the

2006-2018 period. None of the difference between the proportions per industry is significant (Table 1).

Table 1: Similarities between sample and population

Industry	Population	% of population	Sample	% of sample
Financials	147	17.6	36	18.6
Industrials	117	14.0	25	12.9
Health Care	82	9.8	14	7.2
Consumer Discretionary	67	8.0	15	7.7
Consumer Services	62	7.4	16	8.2
Oil & Gas	48	5.8	12	6.2
Energy	47	5.6	14	7.2
Information Technology	46	5.5	6	3.1
Consumer Goods	39	4.7	10	5.2
Consumer Staples	32	3.8	6	3.1
Utilities	28	3.4	15	7.7
Unclassified	28	3.4	4	2.1
Basic Materials	25	3.0	4	2.1
Technology	23	2.8	5	2.6
Materials	21	2.5	7	3.6
Telecommunications	11	1.3	3	1.5
Communication	4	0.5	1	0.5
Telecommunication services	4	0.5	0	0.0
Real Estate	3	0.4	1	0.5
TOTAL	834		194	

*, **, and *** denote significance at the 10%, 5% or 1% level, respectively.

The total market capitalization of the MSCI USA index and the MSCI USA ESG index are retrieved from the constituent list provided at the end of each month. Since the companies in the ESG-index are also part of the parent index's constituent, the returns of the parent index need to be decomposed into a non-ESG part and an ESG part which is the MSCI USA ESG index. This will be furtherly explained in the methodology, but to be able to decompose the returns, the relative weight of the ESG-component in the parent index needs to be estimated. To be able to achieve this, the total market capitalization of both indices are used. Important to note is that due to the constituent policy, there is no fundamental difference other than the ESG-exposure between the MSCI USA index and the MSCI USA ESG index. Therefore, results are not driven by factors such as size, volatility and industry concentration.

4. Methodology

The main methods and techniques are based upon the approach of the two leading papers; Barberis, Shleifer & Wurgler (2005) and Chen, Noronha & Singal (2004). It is convenient to use their methodologies as a benchmark since this will make the results not be driven by differences in methodology, and therefore these can only be explained by differences in the index being used.

All returns, e.g. the returns of firms, the MSCI USA index, the MSCI USA ESG index and the non-ESG index, are calculated by taking the natural logarithm of the quotient between the price at t and t-1.

$$R_t = ln\left(\frac{P_t}{P_{t-1}}\right) \tag{1}$$

Where R_t and P_t represent return and price, respectively, at time t and P_{t-1} the price at t-1.

4.1 Changes in Co-movement

To obtain the change in co-movement, the difference between post- and pre-beta is computed for which the post-beta is defined as the co-movement between the company and the index after the event, and the pre-beta is the co-movement before the constituent change. Univariate regressions are calculated by regressing the company's return on the returns of the MSCI USA ESG index, for which β_j represents the co-movement since the coefficient measures the systematic risk, or volatility, of an individual stock relative to the unsystematic risk of the entire market.

Note, regressing the post-beta of an addition with the MSCI USA ESG index will, by definition, co-move partially since the added firm is part of the index. The same is true for the calculation of pre-betas for deleted firms. Therefore, using the company's weight (w_j) in the index, the returns on the ESG-index at time t ($R_{ESG,t}$) and the return of the company ($R_{j,t}$) at time t, the return of the index at time t without the company ($R_{ESGISO,t}$) can be isolated and used in the regressions.

$$R_{ESG,t} = w_j R_{j,t} + (1 - w_j) R_{ESGISO,t} \tag{2}$$

Formula 2 can be restated to obtain the return of the MSCI USA ESG index without the added or deleted firm to avoid the co-movement-by-construction problem.

$$R_{ESGISO,t} = \frac{R_{ESG,t} - w_j R_{j,t}}{1 - w_j} \tag{3}$$

The pre-beta is computed using an estimation period of one year before the announcement date starting one month prior to the announcement, whereas the post-beta is calculated over a one year period after the effective date starting one month after the effective date. As noted in the theoretical framework, the announcement date is five days before the effective date for the period before May 2012, whereas it is nine days for the period after May 2012. Exceptions are made if the announcement would take place during the weekend, then, it is on the Friday before the weekend. All regressions will be executed with daily, weekly and monthly frequency data to be able to draw conclusion on whether slowly diffusing information is eventually incorporated and noise trader sentiment is reverted. For monthly frequency data, the estimation period is extended to three years. To estimate co-movement the following regression is employed:

$$R_{j,t} = \alpha_j + \beta_j R_{ESGISO,t} + \varepsilon_{j,t} \quad (4)$$

Where $R_{j,t}$ is the return of company j at time t, α_j is the intercept, β_j represent the co-movement coefficient, $R_{ESGISO,t}$ is the return of the ESG index at time t without company j as computed using formula 3 and $\varepsilon_{j,t}$ represent the error term of company j at time t.

The sentiment-based view theory does not only predict an increase in beta for firms added to the ESG index, but also a decrease in beta with the non-ESG index. The same holds for deletions; a decrease in co-movement between a company and the ESG-index is expected for firms deleted from this index, whereas the co-movement of these firms with the non-ESG index increases. This can be tested using the following bivariate regression:

$$R_{j,t} = \alpha_j + \beta_{j,ESG} R_{ESGISO,t} + \beta_{j,nonESG} R_{nonESG,t} + \varepsilon_{j,t} \quad (5)$$

In formula 5, $R_{j,t}$, α_j, $R_{ESGISO,t}$ and $\varepsilon_{j,t}$ have the same definition as in formula 4, $\beta_{j,ESG}$ is the co-movement coefficient with the ESG index, $\beta_{j,nonESG}$ is the co-movement coefficient with the non-ESG index and $R_{nonESG,t}$ is the return of the non-ESG index at time t.

To obtain the non-ESG index returns ($R_{nonESG,t}$), the returns on the MSCI USA index ($R_{MSCIUSA,t}$) and the MSCI USA ESG ($R_{ESG,t}$) index at time t can be used. In conjunction with the market capitalization (MC) of the MSCI USA and MSCI USA ESG index, the following equation can be derived:

$$R_{MSCIUSA,t} = \left[\frac{MC_{MSCIUSA,t-1} - MC_{ESG,t-1}}{MC_{MSCIUSA,t-1}}\right] R_{nonESG,t} + \left[\frac{MC_{ESG,t-1}}{MC_{MSCIUSA,t-1}}\right] R_{ESG,t} \quad (6)$$

Where $MC_{MSCIUSA,t-1}$ and $MC_{ESG,t-1}$ are the market capitalization of the MSCI USA and MSCI USA ESG index, respectively, at time t-1. Formula 6 can be restated in the following manner to extract the non-ESG returns:

$$R_{nonESG,t} = \frac{R_{MSCIUSA,t} - \left[\frac{MC_{ESG,t-1}}{MC_{ESG,t-1}}\right] R_{ESG,t}}{\left[\frac{MC_{MSCIUSA,t-1} - MC_{ESG,t-1}}{MC_{MSCIUSA,t-1}}\right]} \quad (7)$$

4.1 Abnormal Returns

Abnormal returns are calculated relative to the MSCI USA index return. The market model will be used to calculate normal returns. Over a 250 trading day period before the announcement date, the company's return will be regressed on the return of the MSCI USA index. In conjunction with the realized index return after the announcement period, the regression coefficients will be used to estimate normal returns for the company. Subsequently, the difference between the company's realized and the normal returns is defined as the abnormal return.

$$AR_{j,t} = R_{j,t} - \hat{R}_{j,t} = R_{j,t} - (\hat{\alpha}_j + \hat{\beta}_j R_{m,t}) \quad (8)$$

Formula 8 calculates the abnormal return of company j at time t ($AR_{j,t}$), where $R_{j,t}$ is the return of firm j at time t and $\hat{R}_{j,t}$ is the estimated normal return of company j at time t using the market model with $\hat{\alpha}_j$ and $\hat{\beta}_j$ representing the estimated intercept and beta coefficient, respectively, of company j and $R_{m,t}$ is the market return at time t. Several event windows will be used to assess the presence of lacked and permanent changes in returns:

- Announcement date
- Effective date
- Announcement to effective date
- Announcement to effective date + 20 trading days
- Announcement to effective date + 60 trading days

5. Results

First, the co-movement output will be presented and explained after which the robustness of the results will be examined. Second, the results with respect to the abnormal returns will be presented and several robustness inferences will be discussed.

5.1 Changes in Co-movement

Overall, the changes in co-movement do not exhibit the patterns that the sentiment-based view theory predicts. Examining the results for additions, included firms do not experience an increase in co-movement. With the exception of the univariate regression in the 2006-2012 and the 2006-2018 period using daily and weekly frequency data (Table 2), additions to the ESG-index do not result in a significant increase of a stock's co-movement with the ESG-index examining both the univariate, as well as, the bivariate regressions for all three data frequencies (daily, weekly and monthly). Moreover, the significant increases in beta using weekly frequency data are merely significant at a 10%-level and these turn into insignificant coefficients in case bivariate regressions are employed; the significance of the increases with daily frequency data disappears as well. Therefore, the two weakly significant increases in beta and even the two 5%-significant increases cannot be used to support the sentiment-based view theory. Furthermore, the monthly frequency results show even a highly significant decrease in beta for additions in the 2012-2018 period, which completely opposes the theory. However, due to a very low amount of observations for the monthly frequency data, this result is not reliable. The lack of significance for other stock price frequencies, the bivariate regressions and other sample periods in conjunction with the weak support of the significant increases give rise to the conclusion that the co-movement with the ESG index of an added stock does not increase.

The univariate regressions show that deletions only experience a significant decrease in co-movement in the 2012-2018 period for both daily (a 1%-significance) and weekly frequency (5%-significance) data; monthly returns are not significant for this period. The decrease in significance over the three stock price frequencies is in line with the sentiment-based theory since one would expect, eventually, that even slowly diffusing information will be incorporated and that noise trader sentiment will revert. However, comparing the univariate with the bivariate regressions, the coefficients decrease in magnitude and becomes insignificant at weekly frequency. Moreover, the change in beta for deletions using daily frequency data in the 2012-2018 for the non-ESG index is also significantly negative, whereas a significantly positive change is predicted. Furthermore, none of the bivariate regressions show a significant decrease of the ESG beta and at the same time a significant increase for the non-ESG beta.

Table 2: Co-movement changes for additions to and deletions from the MSCI USA ESG index

	Sample	N	Univariate	Bivariate	
			$\Delta\beta_{ESG}$(s.e.)	$\Delta\beta_{ESG}$(s.e.)	$\Delta\beta_{NONESG}$(s.e.)
Panel A: daily returns					
Deletions	2006-2012	58	0.050	-0.061	0.111*
			(0.109)	(0.135)	(0.073)
	2012-2018	45	-0.223***	-0.110**	-0.128**
			(0.086)	(0.051)	(0.054)
	2006-2018	103	0.021	-0.065	0.083*
			(0.113)	(0.114)	(0.060)
Additions	2006-2012	69	0.286**	0.234	0.056
			(0.157)	(0.187)	(0.056)
	2012-2018	22	-0.017	-0.109	0.086***
			(0.094)	(0.097)	(0.032)
	2006-2018	91	0.266**	0.203	0.065
			(0.149)	(0.175)	(0.053)
Panel B: weekly returns					
Deletions	2006-2012	58	0.040	-0.161	0.198
			(0.186)	(0.343)	(0.211)
	2012-2018	45	-0.224**	-0.130	-0.099
			(0.114)	(0.124)	(0.188)
	2006-2018	103	0.009	-0.143	0.150
			(0.175)	(0.230)	(0.135)
Additions	2006-2012	69	0.313*	0.275	0.044
			(0.225)	(0.336)	(0.121)
	2012-2018	22	-0.049	-0.119	0.063
			(0.075)	(0.149)	(0.188)
	2006-2018	91	0.282*	0.222	0.064
			(0.208)	(0.299)	(0.106)
Panel C: monthly returns					
Deletions	2006-2012	42	-0.121	-0.222	0.121
			(0.116)	(0.355)	(0.326)
	2012-2018	33	-0.019	0.045	-0.043
			(0.120)	(0.141)	(0.263)
	2006-2018	75	-0.101	-0.169	0.096
			(0.084)	(0.223)	(0.229)
Additions	2006-2012	41	-0.085	-0.026	-0.063
			(0.304)	(0.309)	(0.309)
	2012-2018	7	-0.115***	0.284	-0.411*
			(0.021)	(0.216)	(0.214)
	2006-2018	48	-0.087	0.010	-0.101
			(0.269)	(0.274)	(0.260)

*, **, and *** denote significance at the 10%, 5% or 1% level, respectively.

Differences between sample periods do not point towards a clear pattern. One could expect different results since, for example, the ESG-stocks were not viewed as a particular investors category in the 2006-2012 period, but they are afterwards due to an increase in popularity; the change in constituent policy in May 2012 could have an effect as well. The univariate regressions for deletions are in line with this way of reasoning, since the betas are significantly negative in the 2012-2018 period but not in the period before, however, additions do not exhibit the expected pattern and the results are different for the bivariate regressions.

Bivariate regressions are employed since, by definition, the theory not only predicts an increase (decrease) in beta for a stock added to (deleted from) a particular index, but also a decrease (increase) in beta with the index it previously belonged (subsequently belongs) to. Some of the periods show this pattern, however only one (or even none) of the ESG and non-ESG betas is (are) significant at the same time. Even more remarkable is that in the 2012-2018 period, deletions show a significant decrease in both the ESG and the non-ESG beta. Moreover, a greater (smaller) increase in co-movement for additions (deletions) with the ESG index is expected if one would employ bivariate regressions instead of univariate regression. Statistically speaking, this is because adding a coefficient which is positively correlated with the other independent variable, but negatively correlated with the dependent variable, will increase the coefficient of the other independent variable, which is in this case the return on the ESG-index. However, this pattern is not observed in Table 2. The most obvious reason for all of these findings is that the MSCI USA ESG index is not perceived as a particular category[2].

5.2 Robustness of the Changes in Co-movement Results

There is substantial overlap in the time periods of the events used in the regressions since the constituent changes are made on a quarterly basis. Therefore, ex ante, a random effects model using standard errors clustered by time period is preferred since it produces efficient estimators if the assumptions of no correlation between the error term and the regressors holds. The Breusch-Pagan Lagrange multiplier test is employed to judge whether to use a random effects regression or OLS regression (Appendix A, Table 6). The null hypothesis, that the variances across entities is zero, cannot be rejected in most cases; therefore, a random effects model is preferred. To determine whether the assumption of no correlation between the error term and the regressors holds, the Hausman-test can be used. In most of the cases, the Hausman-tests were not able to reject the null-hypothesis (Appendix A, Table 7), therefore, the random effects

[2] Possible explanations and a discussion will be set forth in chapter 6

model used in the regressions which clusters the standard errors by time period produces consistent and efficient estimators[3]. Since the panel data structure is used and the vce (cluster-name *cluster variable)* option in Stata, by construction, standard errors are robust implying that heteroscedasticity is not an issue. There is some serious serial autocorrelation in the errors present (Appendix A, Table 8), however, since the random effects model is a GLS version of Pooled OLS model, serial autocorrelation is not a big concern.

Another metric of measuring the change in co-movement is the change in correlation, assuming that the index' and company's returns follow a linear relationship. In fact, it is the beta standardized through the use of the standard deviation of the market's and company's return and it explains how complete market movements explain the stock price returns instead of how much market movements affect stock prices. Therefore, it could be used as a measurement to calculate co-movement. The changes in correlation do not show any pattern that the sentiment-based view theory predicts (Table 3). The additions (deletions) neither show an increase (decrease) in correlation with the ESG-index nor a decrease (increase) with the non-ESG index; all one-sided p-values exceed even the 10% significance level.

The assumptions of the panel data regression do not hold in all cases, therefore it is convenient to examine the regressions that disregard the panel data structure (Table 4). These results, compared with the correlation results, show the same pattern with the exception of the univariate regressions in the 2012-2018 period. However, this result is driven by only a few outliers and therefore, the same conclusion as with the correlation table can be drawn; the changes in co-movement do not show any pattern that the sentiment-based view theory predicts. There are substantial differences between the co-movement results using panel data regressions and the ones without, which is intuitive due to the different regression methodology and the fact that with non-panel data regressions it is not possible to cluster the standard errors.

[3] The choice between models (OLS, fixed effects or random effects) changes the betas and S.E. slightly, but does not alter the significance levels

Table 3: Correlation changes

			Δcorr (p-value)	
		N	ESG	NONESG
Panel A:daily returns				
Deletions	2006-2012	58	0,027	0,039
			(0,579)	(0,387)
	2012-2018	45	-0,084	-0,087
			(0,307)	(0,698)
	2006-2018	103	0,013	0,025
			(0,552)	(0,404)
Additions	2006-2012	69	-0,014	-0,022
			(0,547)	(0,429)
	2012-2018	22	-0,024	-0,006
			(0,537)	(0,490)
	2006-2018	91	-0,012	-0,017
			(0,544)	(0,438)
Panel B: weekly returns				
Deletions	2006-2012	58	0,033	0,033
			(0,597)	(0,384)
	2012-2018	45	-0,069	-0,069
			(0,336)	(0,657)
	2006-2018	103	0,018	0,018
			(0,571)	(0,403)
Additions	2006-2012	69	0,027	0,027
			(0,410)	(0,579)
	2012-2018	22	0,005	0,005
			(0,492)	(0,518)
	2006-2018	91	0,027	0,027
			(0,398)	(0,595)
Panel C: monthly returns				
Deletions	2006-2012	42	-0,081	-0,077
			(0,308)	(0,681)
	2012-2018	33	-0,245	-0,245
			(0,113)	(0,885)
	2006-2018	75	-0,147	-0,143
			(0,118)	(0,874)
Additions	2006-2012	41	0,030	0,016
			(0,421)	(0,541)
	2012-2018	7	-0,094	-0,117
			(0,569)	(0,415)
	2006-2018	48	0,015	0,000
			(0,458)	(0,500)

*, **, and *** denote significance at the 10%, 5% or 1% level, respectively.

Table 4: Co-movement changes using non-panel data regression

Panel A: daily returns					
Sample		N	Univariate	Bivariate	
			$\Delta\beta_{ESG}$(s.e.)	$\Delta\beta_{ESG}$(s.e.)	$\Delta\beta_{NONESG}$(s.e.)
Deletions	2006-2012	58	0,009	0,036	-0,006
			0,063	0,082	0,050
	2012-2018	45	-0,118**	-0,085	-0,046
			0,044	0,052	0,040
	2006-2018	103	-0,047	-0,017	-0,023
			0,041	0,051	0,033
Additions	2006-2012	69	0,038	0,080	-0,034
			0,043	0,062	0,040
	2012-2018	22	0,064	0,029	-0,005
			0,067	0,093	0,119
	2006-2018	91	0,044	0,068	-0,027
			0,036	0,052	0,042
Panel B: weekly returns					
Deletions	2006-2012	58	-0,021	0,048	-0,046
			0,087	0,213	0,167
	2012-2018	45	-0,192**	-0,153	-0,034
			0,076	0,134	0,113
	2006-2018	103	-0,096	-0,040	-0,041
			0,060	0,133	0,106
Additions	2006-2012	69	0,085	0,209	-0,109
			0,083	0,142	0,134
	2012-2018	22	-0,053	-0,074	-0,001
			0,100	0,199	0,216
	2006-2018	91	0,052	0,140	-0,083
			0,067	0,118	0,114
Panel C: monthly returns					
Deletions	2006-2012	42	-0,089	-0,342	0,251
			0,116	0,358	0,337
	2012-2018	33	0,037	0,038	0,014
			0,083	0,171	0,195
	2006-2018	75	-0,034	-0,176	0,147
			0,075	0,215	0,208
Additions	2006-2012	41	0,137	0,246	-0,154
			0,104	0,191	0,214
	2012-2018	7	0,131	0,037	0,695
			0,268	0,337	0,988
	2006-2018	48	0,135	0,195	0,051
			0,101	0,166	0,287

*, **, and *** denote significance at the 10%, 5% or 1% level, respectively.

5.3 Abnormal Returns

The abnormal returns do not exhibit the expected pattern of positively significant (insignificant) returns for additions (deletions). If at all, the deletions results show some weak evidence but the additions show even the opposite of what is stated in the hypotheses.

For deletions (Panel A, Table 5), there are no significant abnormal returns on the event or announcement date which is in line with the hypothesis. However, in the timespan between these two dates, there is a significant positive abnormal return of 1.081% for the 2012-2018 period. Even three months after the effective date, there is a significant abnormal return of 3.371% for this sub-period. This implies that stocks deleted from the MSCI USA ESG index earn a positive significant abnormal return which opposes the hypothesis. Moreover, it is also not in line with other theories related to stock price reactions of constituent changes since these predict a negative sign. However, the abnormal returns over the whole sample are insignificant.

Table 5: Abnormal returns

Period	2006-2012	2012-2018	2006-2018
Returns in %	Panel A: Deletions		
AR Anndate	0.371	0.200	0.296
AR Effdate	-0.253	-0.018	-0.150
CAR Ann to Effdate	-0.590	1.081**	0.140
CAR Ann to Effdate + 20	-0.595	1.365	0.257
CAR Ann to Effdate +60	-0.169	3.371**	1.378
Returns in %	Panel B: Additions		
AR Anndate	-0.560	0.062	-0.044*
AR Effdate	-0.414	-0.220	-0.367
CAR Ann to Effdate	-1.268*	-0.043	-0.951*
CAR Ann to Effdate + 20	-2.054	-2.057	-2.054**
CAR Ann to Effdate +60	-1.714	-6.487**	-2.866

*, **, and *** denote significance at the 10%, 5% or 1% level, respectively.

The results for additions (Panel B, Table 5) opposes the hypothesis to a larger extent; 14 out of the 15 abnormal returns show a negative sign, with five being significant. However, there are no significant abnormal returns on the effective day and for the announcement day there is only one weakly significant decrease of 0.044%. In two sub-periods, there is a weakly significant negative abnormal return in the timespan between the announcement and effective date. Examining the overall sample period, the negative return decreases further and becomes more significant over the 20 day period after the effective date. Touching upon the 2012-2018 sub-sample, it is remarkable that the cumulative abnormal return (CAR) over the announcement to effective date plus 60 trading days period is significantly negative (-6.487%) whereas the

shorter CAR-periods are not significant at all. All of these results are not in line with the investor awareness hypothesis. Robustness checks will be used to determine whether the results are valid and reliable.

5.4 Robustness of the Abnormal Returns Results

To determine the significance of the abnormal returns, a standard T-test is used. However, this test assumes that the abnormal returns are independent and identically distributed and follow a normal distribution. Using the Swilk test (Appendix B, Table 9) the null hypothesis of normal distributed returns is rejected in 23 out of the 30 different combinations between time periods and abnormal return event windows. Due to the central limit theorem, the normality assumption is not a big issue in case the number of observations is sufficiently large and when the returns are independent and identically distributed. However, these two requirements are not met since the number of observations ranges from 22 to 103 and, as the Woolridge test already indicated (Appendix A, Table 8), there is some serial autocorrelation.

Therefore, despite exhibiting less discriminative power, a non-parametric test should be used. For this reason, the Wilcoxon Rank Sum test is preferred since it has more discriminative power than the Sign Test. The abnormal returns table for which significance is determined using the Wilcoxon Rank Sum test can be found in Appendix B Table 10. The test shows that deletions only have one weakly significant positive value (statistically significant at a 10%-level) instead of two 5% significant values when the T-test is used. For additions, three significantly negative values turn into non-significant values if the Wilcoxon Rank Sum test is used. Therefore, the odd significant findings in the previous sub-section can partially be explained by the way significance is determined.

A closer look at the observations which drive the results, reveals that the odd results are primarily driven by only a few outliers. Removing three observations in the deletion sample, out of the 103 observations, vanishes all significant abnormal returns in this sample. Analogously, deleting three added stocks after 2012 and three additions before 2012 removes all significance within the additions results (Appendix B, Table 11).

Another issue regarding robustness is the methodology used to calculate normal returns; these are estimated using the market model but as in Chen, Noronha & Singal (2004), the average return of the market can also be used to determine normal returns. Table 12 (Appendix C) shows the abnormal returns for which the average market return over the last 250 trading days is used to estimate the normal return. As with the market model approach, these results are not in line with the hypotheses. None of the abnormal returns in the additions sample are

significant; only four different abnormal returns are significant in the deletion sample out of which two are weakly significant (10%-level). Again, the significance levels are different if the Wilcoxon Rank Sum test is employed (Appendix C, Table 13) and the obtained significant values turn into non-significant results if only four outliers are deleted (Appendix C, Table 14).

6. Discussion

6.1 Plausible Explanations

The results are not in line with the sentiment-based view theory of Barberis, Shleifer & Wurgler (2005) nor with the investor awareness hypothesis of Chen, Noronha & Singal: co-movement of stocks added to (deleted from) the ESG-index do not significantly increase (decrease) and the abnormal returns related to the event are not significantly positive (insignificant).

The sentiment-based view theory assumes that the index is viewed as a particular category or habitat and since investors alter their portfolios to the category level or only within their habitat, constituent changes generate symmetrical co-movement changes even in case nothing fundamentally changed within the firm. The investor awareness hypothesis assumes that investors become more aware of a particular stock if a stock is added to the index, which also heavily depends on the perception of investors on the index. Therefore, one possible explanation for the results is that the MSCI USA ESG index is not viewed as a particular category or habitat by investors. In comparison with the S&P 500 index used in the two earlier mentioned papers, the difference in being included in the MSCI USA ESG index or not is less severe since the S&P 500 is one of the top benchmark indices whereas the ESG index is within its asset class large and popular, but not in the overall universe of indices. However, this way of reasoning could explain the difference in results between the S&P 500 index and the MSCI USA ESG index, but it does not explain the results compared to other sustainable indices[4].

The research of Robinson, Kleffner & Bertels (2011) shows evidence for the investor awareness hypothesis using the Dow Jones Sustainability Index (DJSI). However, the use of the DJSI is questionable since Barberis, Shleifer & Wurgler (2005) explicitly state the following: “to control for fundamentals-based co-movement, a security’s inclusion or removal from the group should not change investors’ perception of the correlation of the security’s fundamental value with the fundamental values of other securities in the group”. Nevertheless, as noted in the Theoretical Framework, an important difference between DJSI and the MSCI USA ESG index is that the DJSI includes the top 10% ESG-compliant firms of each industry and therefore, the index does not aim to obtain a representative basket of ESG-compliant firms with the same risk-return characteristics as the parent index. The DJSI-board changes the index primarily based on this 10%-requirement, meaning that (large) shifts in ESG-scores immediately impacts the index composition, and therefore it does not satisfy the earlier

[4] The Theoretical Framework reviews differences between this research and related papers extensively

mentioned statement of Barberis, Shleifer & Wurgler (2005). The MSCI USA ESG index does satisfy their statement since it seeks to obtain a high ESG-exposure for which shifts in ESG-scores does not necessarily immediately impacts the index. This is because to be included in the MSCI USA ESG index, a company must already have a steady ESG-score and, therefore, a constituent change is not an informational signal about ESG performance to investors. Moreover, companies with high ESG-scores are not necessarily added to the index if, for example, an addition results in a substantial deviation from the parent index. Analogously, companies with low ESG-scores are not necessarily deleted if this causes the index to be not representative anymore for the parent index. These features are extremely interesting since it allows to investigate the effect of the constituent change itself decomposed from the informational effect of ESG-compliant business practices, e.g. there are no fundamental changes that potentially generate changes in co-movement and returns. Therefore, the results of this paper compared to the earlier mentioned research could be explained by the difference in constituent composition methodology. In fact, being included in or deleted from an index does necessarily mean that a stock enters or leaves an investor's category or habitat. Since the stocks in the MSCI USA ESG index is a representative basket of ESG stocks, it does not (necessarily) contribute to the judgement and awareness of investors whether or not the firm conducts an ESG-compliant business policy. To conclude this argument, an index is not by definition a particular investor's category; if constituent changes would affect returns and co-movement, it should alter the investor's category or habitat composition and the awareness about the stock, apparently, the MSCI USA ESG index does not alter this.

O'Brien, Liao & Campagna (2018) analyse the performance of five well-known Responsible Investing (RI) indices and show that there are no statistical differences between broad market benchmarks and these ESG-indices in the long run. Furthermore, the ESG criteria do not create additional risk; based on Sharpe Ratios and standard deviations the RI indices had similar risk profiles. However, short term discrepancies are present since there are significant tracking errors and return differences between the RI indices and their benchmarks. The authors conclude the following: "Investors should consider specific ESG methodology and the relevant market benchmark when selecting an IR strategy". Relating this to the sentiment-based view theory and the investor awareness hypothesis, one could argue that the constituent change methodology of an index affects the co-movement changes and abnormal returns generated by the event. For example, an ESG index with high tracking error and standard deviation can be viewed as a particular category resulting in larger co-movement changes and abnormal returns, whereas an ESG index with low tracking error and standard deviation is not viewed as a

particular category since it is closely related to the benchmark index. Therefore, co-movement changes and abnormal returns are less severe. Exhibit 5 of the O'Brien, Liao & Campagna (2018) paper quantifies the expected results of the effect of MSCI's constituent methodology since the two RI-indices of MSCI exhibit the lowest tracking error, whereas the DJSI US has the highest tracking error.

This research adds evidence to the existing literature on the effect of index characteristics and methodologies on co-movement changes and abnormal returns. Moreover, this paper shows that even within a group of particular indices (e.g. within the ESG-index universe), the investor awareness hypothesis and the sentiment-based view theory do not always hold presumably due to differences in constituent policy.

In sum, due to the index methodology of MSCI, constituent changes do not seem to increase investor awareness, change a particular investor's category or habitat, and therefore there are no abnormal returns and co-movement changes generated by the event. Investors and researchers should take index' methodology into account in examining the effect of constituent changes.

6.2 Limitations and Future Research

As noted in the discussion, an explanation for the difference in results between this research and studies that also examine ESG-indices is MSCI's constituent change policy. However, to genuinely judge whether or not the constituent policy does not have informational content about the ESG-performance of firms and therefore does not change investors' awareness, trading category or habitat, one should compare these results with a study that examines the abnormal returns and co-movement changes on the day the ESG-score changed. In other words, if MSCI USA ESG constituent changes do not reveal the ESG-performance of companies, do changes in ESG-scores reveal something to investors about the ESG-performance? Future research should aim add decomposing the informational content of ESG compliant business practices and ESG constituent changes.

Furthermore, future research on the effect of constituent changes in general should focus more on the observation specific factors that influence the abnormal returns and co-movement changes generated by the constituent change event. The two leading papers of Barberis, Shleifer & Wurgler (2005) & Chen, Noronha & Singal (2004) and this paper do not dive deeper into factors, such as industry, first-listening and country effects. For example, investor awareness could increase to a larger extent, and therefore generate greater abnormal returns if a stock is added for the first time, or from a less popular and well-known industry or country. This has

not been touched upon in this research due to a low amount of observations for the MSCI USA ESG index in case of dividing the observation by industry, but data about other indices might be large enough to examine this.

Due to the constituent change policy, the data cleaning process and the methodology, co-movement changes and abnormal returns are not driven by changes in fundamental values and therefore, should be driven by the sentiment-based view theory and the investor awareness hypothesis. However, in order to provide conclusive answers one should assess whether investors truly trade upon certain predefined categories or within their habitat. Barberis, Shleifer & Wurgler (2005) show that the habitat and category view explain the largest share of co-movement changes; the theory based on the speed of processing information is not so prevalent. However, the authors were not able to disentangle the relative importance between the habitat and category view and, there are no researches yet that disentangle the relative importance of these three theories for other indices. Furthermore, increase in investor awareness after an addition should be quantified; number of shareholders, institutional ownership, stock's turnover and analyst coverage could be used to quantify investor awareness. As stated in the theoretical framework, increase in investor awareness could result in abnormal returns through different channels such as increased monitoring, reduction in information asymmetry, improved access to capital markets and a reduction in Merton's shadow costs. This research does not touch upon the investor awareness metrics and the channels that are affected by an increase in investor awareness.

Methodologically speaking, this research could be improved by using extensions of the market model to determine normal returns; the Fama-French 3-factor model, the Carhart 4-factor model or the matched firm approach could enhance the estimations. These models are not used in this paper since the objective was to take a look at whether or not ESG constituent changes generate the same results as the leading papers that used the S&P 500 index. It was convenient to stay as close as possible to their methodology to be able to draw conclusions which would be only driven by differences in index characteristics, and thus not by methodology. Another methodological concern is the relationship between investor awareness and abnormal returns, since endogeneity in the shape of reverse causality could be present. Furthermore, the fact that constituent change are often made on a quarterly basis results in serial autocorrelation of the error term which implies that the changes in co-movement are not independent. This research clusters the standard error by time period to take the serial autocorrelation into account, but other metrics could be used as well. Simulation methods and calendar time test could be used to address this problem (Barberis, Shleifer, & Wurgler, 2005).

7. Conclusion

This paper examines the effect of constituent changes of the MSCI USA ESG index on stock price returns and co-movement. Based on the sentiment-based view theory of Barberis, Shleifer & Wurgler (2005), an increase (decrease) in co-movement for firms added to (deleted from) the index was expected. The investor awareness hypothesis of Chen, Noronha & Singal (2004) predicts significant positive (insignificant) abnormal returns for additions (deletions). This paper is the first study that examines co-movement changes for an ESG index and uses a more appropriate ESG index than earlier research studies to examine abnormal returns generated by constituent changes.

Co-movement is estimated by using the market-model and bivariate regressions for daily, weekly, as well as monthly frequency data. To calculate changes in co-movement, the regressions are ran before and after the event and subsequently subtracted from each other. Different models, testing models' assumptions and other co-movement metrics are put in place to validate the results' robustness. The effect on stock price returns is estimated through the use of abnormal returns which is the difference between the realized and normal returns. Robustness inferences are obtained by examining the T-test assumptions, using a non-parametric test, deleting only a few outliers and using a different metric to estimate normal returns.

Examining the results and the robustness inferences, both hypotheses are rejected; the results do not provide evidence for the sentiment-based view theory and investor awareness hypothesis. There are two main, plausible reasons for this. First, the MSCI USA ESG index is not viewed as a particular investors' category or habitat due to the relatively low importance of the index compared to, for example, a benchmark index such as the S&P 500. Second, due to MSCI's methodology that determines whether or not a firm is added to or deleted from the index, the constituent changes do not entail new information about a company's ESG performance, and therefore does not alter investors' awareness, trading categories or habitat. This implies that constituent changes themselves do not alter investors' view on the stock but, since some other studies do find evidence for the investor awareness hypothesis, the provision of information to investor through a change in constituents does alter investors' view on stocks.

Future research should focus on decomposing the informational content of a constituent change from the index' change itself, e.g. does the change in constituents provide new information about a company, and what kind of factors drive the magnitude of the effect of constituent changes. Investors and researchers should take index' methodology into account in order to properly examine the effect of constituent changes.

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9. Appendix

9.1 Appendix A

Table 6: Breusch and Pagan LM test for random effects

			Daily data		Weekly data		Monthly data	
Status	Period	Beta	univariate	bivariate	univariate	bivariate	univariate	bivariate
Deletion	Before 2012	Post	-	-	-	-	**	**
		Pre	***	***	***	***	-	-
	After 2012	Post	*	*	*	**	-	-
		Pre	-	-	-	-	-	-
	Whole period	Post	-	-	-	-	**	**
		Pre	***	***	**	***	-	-
Addition	Before 2012	Post	-	-	-	-	**	**
		Pre	-	-	-	-	-	-
	After 2012	Post	-	-	-	-	-	-
		Pre	*	**	-	**	-	-
	Whole period	Post	-	-	-	-	**	**
		Pre	-	-	-	-	-	-

*, **, and *** denote significance at the 10%, 5% or 1% level, respectively.

Table 7: Hausman test on Fixed vs. Random effects

			Daily data		Weekly data		Monthly data	
Status	Period	Beta	univariate	bivariate	univariate	bivariate	univariate	bivariate
Deletion	Before 2012	Post	-	-	-	-	-	-
		Pre	**	*	*	*	-	-
	After 2012	Post	***	***	***	**	-	-
		Pre	-	-	-	-	-	-
	Whole period	Post	-	-	-	-	-	-
		Pre	**	*	**	-	-	-
Addition	Before 2012	Post	-	-	-	-	*	**
		Pre	-	-	-	-	-	-
	After 2012	Post	-	-	-	-	-	-
		Pre	-	-	-	-	-	-
	Whole period	Post	-	-	-	-	-	-
		Pre	-	-	-	-	-	-

*, **, and *** denote significance at the 10%, 5% or 1% level, respectively.

Table 8: Woolridge test for serial autocorrelation

Status	Period	Beta	univariate	bivariate
Deletion	Before 2012	Post	*	*
		Pre	-	-
	After 2012	Post	***	***
		Pre	***	***
	Whole period	Post	**	**
		Pre	-	-
Addition	Before 2012	Post	**	**
		Pre	-	-
	After 2012	Post	-	-
		Pre	-	-
	Whole period	Post	**	**
		Pre	-	-

*, **, and *** denote significance at the 10%, 5% or 1% level, respectively.

9.2 Appendix B

Table 9: Swilk test on normality of abnormal returns

Period	2006-2012	2012-2018	2006-2018
Panel A: Deletions			
AR anndate	***	***	***
AR effdate	***	*	***
CAR ann to effdate	***	-	***
CAR ann to effdate + 20	***	-	***
CAR ann to effdate +60	***	-	***
Panel B: Additions			
AR anndate	***	-	***
AR effdate	***	-	***
CAR ann to effdate	***	***	***
CAR ann to effdate + 20	**	-	**
CAR ann to effdate +60	***	-	***

*, **, and *** denote significance at the 10%, 5% or 1% level, respectively.

Table 10: Abnormal returns table (Wilcoxon Rank Sum test)

Period	2006-2012	2012-2018	2006-2018
Returns in %	Panel A: Deletions		
AR Anndate	0.371	0.200	0.296
AR Effdate	-0.253	-0.018	-0.150
CAR Ann to Effdate	-0.590	1.081	0.140*
CAR Ann to Effdate + 20	-0.595	1.365	0.257
CAR Ann to Effdate +60	-0.169	3.371	1.378
Returns in %	Panel B: Additions		
AR Anndate	-0.560	0.062	-0.044
AR Effdate	-0.414**	-0.220	-0.367
CAR Ann to Effdate	-1.268*	-0.043	-0.951
CAR Ann to Effdate + 20	-2.054	-2.057	-2.054
CAR Ann to Effdate +60	-1.714	-6.487**	-2.866

*, **, and *** denote significance at the 10%, 5% or 1% level, respectively.

Table 11: Abnormal returns without outliers

Period	2006-2012	2012-2018	2006-2018
Returns in %	Panel A: Deletions		
AR Anndate	0,371	0,179	0,290
AR Effdate	-0,253	-0,058	-0,171
CAR Ann to Effdate	-0,590	0,611	-0,086
CAR Ann to Effdate + 20	-0,595	0,965	0,060
CAR Ann to Effdate +60	-0,169	2,293	0,865
Returns in %	Panel B: Additions		
AR Anndate	-0,316	0,060	-0,232
AR Effdate	-0,188	-0,236	-0,199
CAR Ann to Effdate	-0,841	-0,016	-0,657
CAR Ann to Effdate + 20	-1,180	-1,347	-1,217
CAR Ann to Effdate +60	-0,290	-2,257	-0,730

*, **, and *** denote significance at the 10%, 5% or 1% level, respectively.

9.3 Appendix C

Table 12: Abnormal returns using the average return of the market as normal returns

Period	2006-2012	2012-2018	2006-2018
Returns in %	Panel A: Deletions		
AR Anndate	0,116	0,373	0,228
AR Effdate	-0,379	0.651**	0.071
CAR Ann to Effdate	-1.050	0.816*	-0.235
CAR Ann to Effdate + 20	0.738	2.199**	1.376
CAR Ann to Effdate +60	1.178	3,170*	2.049
Returns in %	Panel B: Additions		
AR Anndate	-0,552	0,009	-0,416
AR Effdate	-0,362	0.294	-0,203
CAR Ann to Effdate	-1,438	0.869	-0,880
CAR Ann to Effdate + 20	0.509	-1.282	0.076
CAR Ann to Effdate +60	3.396	-2.925	1.868

*, **, and *** denote significance at the 10%, 5% or 1% level, respectively.

Table 13: Abnormal returns using the average return of the market as normal returns (Wilcoxon Rank Sum Test)

Period	2006-2012	2012-2018	2006-2018
Returns in %	Panel A: Deletions		
AR Anndate	0,116	0,373	0,228
AR Effdate	-0,379**	0.651***	0.071***
CAR Ann to Effdate	-1.050*	0.816	-0.235
CAR Ann to Effdate + 20	0.738	2.199	1.376
CAR Ann to Effdate +60	1.178**	3,170	2.049
Returns in %	Panel B: Additions		
AR Anndate	-0,552	0,009	-0,416
AR Effdate	-0,362**	0.294	-0,203*
CAR Ann to Effdate	-1,438*	0.869	-0,880**
CAR Ann to Effdate + 20	0.509	-1.282	0.076
CAR Ann to Effdate +60	3.396	-2.925	1.868

*, **, and *** denote significance at the 10%, 5% or 1% level, respectively.

Table 14: Abnormal returns using the average return of the market as normal returns and deleting 4 outliers

Period	2006-2012	2012-2018	2006-2018
Returns in %	Panel A: Deletions		
AR Anndate	0,086	0,337	0,192
AR Effdate	-0,377	0.411	-0.042
CAR Ann to Effdate	-0.952	0.511	-0.331
CAR Ann to Effdate + 20	0.974	1.328	1.124
CAR Ann to Effdate +60	1.784	1.389	1.616
Returns in %	Panel B: Additions		
AR Anndate	-0,552	0,009	-0,416
AR Effdate	-0,362	0.294	-0,203
CAR Ann to Effdate	-1,438	0.869	-0,880
CAR Ann to Effdate + 20	0.509	-1.282	0.076
CAR Ann to Effdate +60	3.396	-2.925	1.868

*, **, and *** denote significance at the 10%, 5% or 1% level, respectively.