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Evidence from VIX, Google Searches and Twitter

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Abstract

We study whether sustainable companies generate higher stock returns when investors are concerned about 1) the stock market in general, 2) individual companies and 3) environmental, social and governance (ESG) topics. We measure these concerns using 1) the VIX index, 2) Google search volumes on company names and 3) Google search volumes and Twitter sentiment related to ESG topics. The sustainability level of a company is assessed by its environmental, social, governance and overall ESG score. We find that higher ESG scores are not associated with higher stock returns on average. However, companies with high ESG scores deliver high returns when the uncertainty (the VIX index) is high. Sustainable companies also generate higher returns when there is an increased attention on Google to ESG topics or the Twitter mood related to ESG topics is negative. ESG scores are useful also in stock return predictions. Increased company attention on Google predicts negative returns for companies with low ESG scores, but positive returns for companies with high ESG scores. Furthermore, a positive mood related to ESG topics on Twitter predicts higher stock returns for companies with high ESG scores. Altogether, sustainable companies serve as a partial safe haven: when investors are worried, companies with high ESG scores deliver higher returns than companies with low ESG scores. However, this comes at a price: on average, companies with high ESG scores deliver lower returns than companies with low ESG scores.

Sammendrag

Vi undersøker om bærekraftige selskaper genererer høyere aksjeavkastning når investorer er bekymret for 1) aksjemarkedet generelt, 2) individuelle selskaper og 3) miljømessige forhold, sosiale forhold og virksomhetsstyring (ESG). Vi måler disse bekymringene ved å bruke 1) VIX, 2) søkevolum på Google på selskapsnavn og 3) søkevolum på Google og Twitter sentiment relatert til bærekraft. Hvor bærekraftig et selskap er, vurderes ut fra selskapets score på miljømessige forhold (E), sosiale forhold (S), virksomhetsstyring (G) og overordnet ESG score. Resultatene våre viser at høyere ESG scorer ikke er assosiert med høyere aksjeavkastning normalt sett. Bærekraftige selskaper opplever imidlertid høyere aksjeavkastning når usikkerheten (VIX-indeksen) er høy. I tillegg genererer bærekraftige selskaper høyere avkastning når det er økt oppmerksomhet rundt ESG på Google eller en negativ stemning på Twitter relatert til ESG. ESG scorer er også nyttige for å predikere avkastning. Økt interesse for selskaper på Google predikerer negativ avkastning for selskaper med lave ESG scorer, men positiv avkastning for selskaper med høye ESG scorer. Videre kan positiv stemning rundt ESG på Twitter predikere høyere avkastning for selskaper med høye ESG scorer. I det store og hele kan bærekraftige selskaper delvis være trygge havner: når investorer er bekymret får selskaper med høye ESG scorer høyere aksjeavkastning enn selskaper med lave ESG scorer. Dette kommer imidlertid ikke gratis: i gjennomsnitt vil selskaper med høye ESG scorer oppleve lavere aksjeavkastning enn selskaper med lave ESG scorer.

Preface

This master's thesis marks the end of our Master of Science degree in Industrial Economics and Technology Management at the Norwegian University of Science and Technology (NTNU) in Trondheim, Norway.

Our motivation for choosing sustainability as our topic is that we wanted to study a current topic that can benefit both investors and society as a whole. ESG has gained increased attention over the recent years, both by companies and investors. However, the impact of sustainability engagement on stock returns is not agreed upon. We believe our findings can be valuable for asset managers in understanding what drives the returns of sustainable investments, thus lay a foundation for using sustainable investment strategies.

We would like to thank our supervisor Peter Molnar for giving us great freedom in shaping our thesis, both in terms of topic and applied methods. His thoughtful comments and flexibility has been highly appreciated.

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1 Introduction

During the last decades, there has been a growing demand in society for environmental and social responsibility (Amel-Zadeh and Serafeim, 2018). This has spilled over to financial markets and, accordingly, increased the investor attention to companies' performance on environmental, social and governance (ESG) factors (Bassen and Kovacs, 2008; van Duuren et al., 2016; Amel-Zadeh and Serafeim, 2018). Subsequently, the field of ESG investing has risen; a concept where non-financial metrics are included in investment decisions (Johnsen, 2003; Eccles and Viviers, 2011). Today, one third of U.S. assets under management is subject to a sustainable investment strategy (SIF, 2020). Although ethical concerns were the primary drivers of such investments (Jemel-Fornetty et al., 2011), portfolio managers nowadays mainly use ESG measures in risk management and red-flagging (van Duuren et al., 2016).

Despite the growing popularity of ESG investing, there is no conclusive evidence of a relationship between ESG and financial performance. Some find that ESG investments provide similar returns as the general stock market (Hong and Kacperczyk, 2009; Dorfleitner et al., 2015; Cornell, 2021), while others argue that ESG investments deliver higher returns (De and Clayman, 2015; Verheyden et al., 2016). Cornell (2021) claims that sustainable investments solely provide higher returns when there is an increased preference for sustainability among investors. Halbritter and Dorfleitner (2015) show that sustainable companies outperformed the market until 2007, but thereafter, generated lower returns. Verheyden et al. (2016), on the other hand, find a positive relationship between ESG performance and stock returns, studying stocks returns between 2010 to 2015. They report that sustainable portfolios improve annual returns, but only by 0.16 % on average. Nevertheless, most studies report a positive relationship between ESG and financial performance (Friede et al., 2015).

Although there are disagreements on the impact of ESG on stock returns, most researchers agree that sustainable investments provide lower risk (Fulton et al., 2012; De and Clayman, 2015; Kumar et al., 2016; Verheyden et al., 2016; Pollard et al., 2018; Giese et al., 2019). Thus, asserting that there is a negative relationship between ESG performance and volatility. This relationship strengthens when market volatility increases (De and Clayman, 2015). In most studies, the ESG scores are found to be negatively correlated with the cost of capital in terms

of debt and equity (Fulton et al., 2012). The market recognises the lower risk of sustainable companies and rewards them accordingly. Furthermore, Drei et al. (2019) argue that the three ESG factors are associated with different risks. The governance factor strongly reflects short-term event risks (Giese et al., 2021). In the long term, however, the environmental and social factors are more important for investors as they deal with cumulative issues, presenting risks to long-term performance. Thus, to assess the risks of sustainable investments, a thorough understanding of each factor may be necessary.

Verheyden et al. (2016) assert that investors struggle to assess the ESG performance of companies' due to the lack of reporting standards and cross-company comparability of ESG information. Accordingly, investors tend to use processed data, such as ESG ratings, over raw data (van Duuren et al., 2016). ESG ratings are numeric values assigned to companies by third-party providers based on their performance on environmental (E), social (S) and governance (G) metrics. Boffo and Patalano (2020) argue that ESG scoring and reporting has the potential to unlock a significant amount of information when pursuing long-term value creation. However, a barrier for this is the large variation in scores across rating providers (Dorfleitner et al., 2015; Boffo and Patalano, 2020; Dimson et al., 2020; Li and Polychronopoulos, 2020), which makes it difficult for investors to assess a company's sustainability level. As a contribution to the ongoing discussion of ESG's importance for stock returns, we use the ESG score, as well as its constituting scores on E, S and G, to evaluate the relationship between ESG rating and stock returns. We investigate this with respect to investor concern, indicated by investor sentiment. In particular, we study VIX, Google search volumes on companies and ESG topics, and Twitter volume and sentiment related to ESG topics as measures of investor sentiment. We hypothesise that companies with high ESG scores are associated with lower risk and, as a result, generate higher returns when investors are concerned.

Investor sentiment represents the expectations of the market participants relative to a norm (Brown and Cliff, 2004). A belief of higher returns than average is a positive sentiment, while expectations of lower returns than average is a negative sentiment. The investor sentiment is important for explaining stock returns, as it pushes asset prices away from the equilibrium level justified by underlying fundamentals (Smales, 2017). Sentiment cannot be directly observed and proxies must therefore be used. However, no perfect proxy for investor sentiment exists

(Baker and Wurgler, 2007). Nonetheless, several measures are found to significantly affect stock returns (Neal and Wheatley, 1998; Schmeling, 2009; Stambaugh et al., 2012; Yu et al., 2013; Arif and Lee, 2014), one of which is public sentiment related to sustainability. Capelle-Blancard and Petit (2019) show that negative ESG news cause a drop in companies' stock prices, while Serafeim (2020) finds that negative public sentiment on corporate sustainability leads to positive future abnormal returns. In this thesis, we use investor sentiment measured by implied market volatility and public attention to companies. Additionally, we consider public sentiment on sustainability, measured by attention to and engagement on ESG topics.

The first proxy for investor sentiment that we use, is the CBOE Volatility Index (VIX). This is a measure of the implied short-term volatility for the U.S. stock market, calculated from option prices (CBOE Exchange, 2021). VIX reflects investor uncertainty and is known as the «investor fear gauge» (Whaley, 2000). The index has been widely studied by researchers and is one of the most recognised proxies for investor sentiment (Simon and Wiggins III, 2001; Kurov, 2010; Smales, 2017). VIX spikes during crisis. Its highest level yet is 82.69, reached during the recent COVID-19 pandemic. Such events are also reflected in the stock market, as stock returns are negatively correlated with implied market volatility (French et al., 1987; Whaley, 2000; Sarwar, 2012). This relationship is found to be asymmetric, thus the stock market reacts more negatively to an increase in VIX than it reacts positively to a decline in VIX. Therefore, VIX is more a barometer of investors' fear of the downside than of the excitement in a market rally (Whaley, 2000).

The second proxies for investor sentiment that we use are public attention to companies and ESG topics. We measure this by search volumes on Google, the most used search engine in the world (Statista, 2021). Terms submitted to search engines reflect people's needs, wants, interests and concerns (Ettredge et al., 2005). Therefore, Google search volumes have been studied in a variety of settings. For instance, it has been used to estimate the current level of influenza (Carneiro and Mylonakis, 2009; Ginsberg et al., 2009; Pelat et al., 2009), to study public sentiment related to conservation topics (Nghiem et al., 2016), and to forecast consumer behaviour (Vosen and Schmidt, 2011; Choi and Varian, 2012) and stock returns (Da et al., 2011; Joseph et al., 2011; Bijl et al., 2016). While Da et al. (2011) and Joseph et al. (2011) find that high Google search volumes predicts high future returns, Bijl et al. (2016) find that

high Google search volumes predicts low future returns. Chen (2017) find that more searches for the Dow Jones Industrial Index (DJIA) is related to higher index returns. Despite a variety of topics studied using Google search volumes, there is limited research on the dependency between attention to sustainability and stock returns.

The last proxies for investor sentiment that we study, are the number of Twitter posts (tweets) related to ESG and the content of these. The content is analysed using sentiment analysis to capture the public mood about ESG. Sentiment analysis studies people's opinions, attitudes and emotions from written language (Nasukawa and Yi, 2003; Liu, 2012; Medhat et al., 2014), and is a popular technique within natural language processing (NLP). A perfect representation of the public sentiment and opinion about current events is social media (Pagolu et al., 2016). One social media service is Twitter; a public micro-blogging platform that allows its users to share opinions and interact with others. Due to the character limit and the informal and specialised language of tweets, sentiment analysis on Twitter is popular among researchers for studying public mood (Go et al., 2009; Agarwal et al., 2011; Kouloumpis et al., 2011; Wang et al., 2012; Severyn and Moschitti, 2015). While there has been studies using Twitter to predict stock returns (Bollen et al., 2011; Mittal and Goel, 2012; Sul et al., 2014; Pagolu et al., 2016) and research on the attitudes towards climate (Cody et al., 2015; Dahal et al., 2019), the two topics have assumingly not yet been studied together.

We find that investors' concerns related to the stock market, individual stocks and ESG affect stock returns differently for companies with high and low ESG, environmental, social and governance scores. In particular, we find that on days with high fear in the stock market, measured by deviation in VIX from its one year median and the daily change in VIX, a high ESG score is associated with higher returns. Furthermore, for Google searches on company names, our results indicate that high search volumes predict higher returns for the companies with the highest ESG scores the following week. Additionally, we find that higher search volumes on ESG topics are related to higher returns for companies with high ESG scores. The Twitter mood seems to be superior to the amount of tweets in explaining stock returns for companies with high and low ESG scores. We find that a more negative mood about ESG topics is related to higher returns for companies with high ESG scores. We conclude that when investors are concerned about the stock market, individual companies or ESG topics, sustainable companies

generate superior returns.

The rest of this thesis is structured as follows. Section 2 explains the dataset and methodology used. Section 3 presents the results, and finally, Section 4 concludes.

2   Data

Daily stock data and the Chicago Board Options Exchange's CBOE Volatility Index (VIX) are obtained from The Center for Research in Security Prices (CRSP). ESG scores are obtained from Refinitiv Eikon. The time period examined is 01.01.2010-31.12.2019. Due to the nature of our variables, data from 2009 are also collected. The dataset consists of common stocks issued by companies listed on the New York Stock Exchange (NYSE) and NASDAQ.

In order for a company to be included in the dataset, it must have at least 750 trading days, with a maximum of five consecutive inactive trading days. This requirement reduces our sample from 5 522 to 4 039 companies. Further, companies without any record of an ESG score are excluded. Thus, our final sample consists of 2030 companies, whereby 1139 are listed on NASDAQ and 891 on NYSE. For a full list of the companies included, see Appendix A.

The variable used for stock returns, R_t, is daily or weekly values in basis points. Throughout this thesis, t is the time, indicated as either a trading day or a week.

2.1   ESG Scores

The ESG, environmental (E), social (S) and governance (G) scores are numeric values between 0 and 100, with 100 being the best. The ESG score is an overall, combined measure of the E, S and G factors. Each factor is based on a weighted sum of either environmental, social or governance metrics. ESG, E, S and G are further used as variables in the thesis, with their original values divided by 100. Details on how Refinitiv calculates the scores, and where they obtain the ESG information, can be found in Refinitiv (2021).

Some descriptive statistics of the scores are presented in Table 1. The correlation between the scores are stated in Table 2.

Table 1: Minimum, maximum and median ESG, environmental, social and governance scores in our sample.

	Measure			
Score	Mean	Median	Min	Max
ESG score	40.79	37.30	0.26	95.14
Environmental score	25.03	13.05	0.00	98.53
Social score	42.30	38.36	0.60	97.88
Governance score	50.05	50.62	0.04	98.72

Table 2: Correlation between the ESG, environmental, social and governance score.

Score	ESG score	Environmental score	Social score	Governance score
ESG score	1			
Environmental score	0.859	1		
Social score	0.875	0.730	1	
Governance score	0.705	0.451	0.373	1

2.2 VIX

We consider two transformations for VIX, the first one being the deviation from the previous one year's median, AbVIX, calculated as stated in equation (1).

$$AbVIX_t = log(VIX_t) - log\left(Median(VIX_{t-1}, VIX_{t-2}, ..., VIX_{t-252})\right) \quad (1)$$

The second transformation for VIX is the percentage deviation from previous day's VIX, calculated as

$$\Delta VIX_t = \frac{VIX_t - VIX_{t-1}}{VIX_{t-1}}. \quad (2)$$

The mean VIX for the studied period is 16.86, the median is 15.47, the maximum is 48.0 and the minimum is 9.14. A plot of the VIX and its one year rolling median is presented in Figure 1.
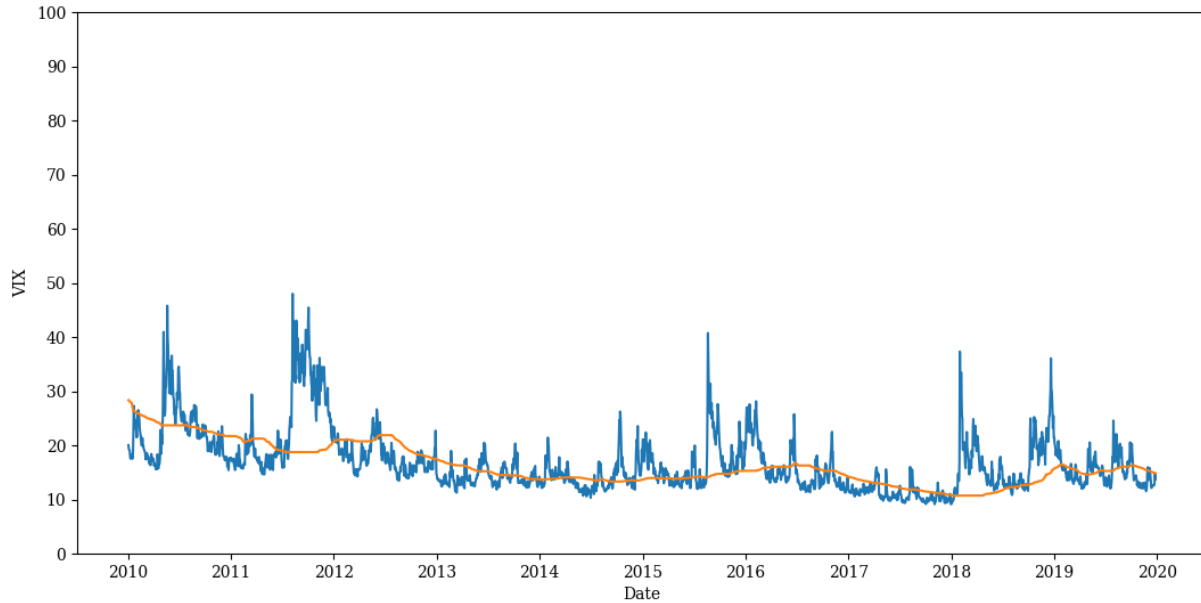
Figure 1: Plot of VIX (blue) and its one year rolling median (orange).

2.3 Google Search Volumes

Google search volume indices (SVIs) are obtained from Google Trends. The indices represent the relative popularity of a query within a specified time frame and a geographical range. The values lie within the range of 0 to 100, where 100 is the maximum search interest. Zero is by Google given to terms with low search volumes. For a detailed description of how Google estimates the indices, see Google (2021).

To create the search volume indices, Google Trends uses a sub-sample of all searches. Consequently, identical queries in Google Trends may produce results that are slightly different (Baker and Fradkin, 2011; Da et al., 2011; Carrière-Swallow and Labbé, 2013; Dietzel, 2016).

2.3.1 Search Volumes on Companies

In this thesis, we consider search volumes on company names to capture public attention to individual companies. We use company names, as oppose to tickers, as many tickers are common abbreviations. In addition, the search volumes on tickers are low. To retrieve the search volume on each company, we use the company names found in Appendix A. Minor adjustments are made to the official company names to better capture public interest in the companies. This

includes removing «Inc», «International», «Global», «Group» and «Corp». Additionally, words like «energy» and «bank» are added to limit noise in the search queries. We manually validate the relevancy of the search terms based on content and volume.

For searches on company names, we use weekly values due to low daily search volumes. For weekly data, Google Trends limits retrieval to batches of five years. Due to the large number of companies, a different approach than the one used for ESG topics is taken. To obtain data for the entire period for all companies the values are collected in three batches, with one overlapping year between each batch, for each company. We remove the scaling effect of the batches by detrending the data points according to equation (3), where t denotes weeks. If the SVI for a given time period is zero, $log(SVI_{t,comp})$ is set to zero.

$$AbSVI_{t,comp} = log(SVI_{t,comp}) - log\left(Median(SVI_{t-1,comp}, SVI_{t-2,comp}, ..., SVI_{t-52,comp})\right) \quad (3)$$

2.3.2 Search Volumes on ESG Topics

Separate search volume indices on ESG, environmental, social and governance topics are created. The search terms included in each index can be observed in Appendix B. The terms are selected based on the metrics within each score formulated by Refinitiv (2021) and the studies of Preis et al. (2013) and Nghiem et al. (2016). We manually validate the relevancy of the search terms based on content and volume.

Search volume indices (SVIs) are constructed for each ESG topic based on the search volumes of the constituting search terms. Google Trends limits the retrieval of daily values to a batch of nine months. Hence, to obtain daily values for the entire time period for each term, we first collect monthly values and then daily values for each month. Further, the daily search volume is weighted based on its monthly value, thus creating comparable daily values for the entire time period in the range 0 to 100. Then, the SVI for each topic is constructed taking the average of all included search term's daily values. Using a similar approach as Da et al. (2011), the SVIs are detrended using equation (4) to account for day-of-the-week effects and an upward trend in search volume over time. Here t denotes days. The search volumes over the weekend is included on the first trading day of the following week. If the SVI for a given time

period is zero, $log(SVI_t)$ is set to zero.

$$AbSVI_t = log(SVI_t) - log\left(Median(SVI_{t-7}, SVI_{t-14}, ..., SVI_{t-364})\right) \tag{4}$$

2.4 Twitter

Public English tweets containing the words «climate change», «corporate governance», «ESG», «social responsibility» or «sustainability» are scraped from Twitter. We exclude the tweets that satisfy either of the following:

- Identical content by the same user on the same day, disregarding hyperlinks. These tweets are usually spam.

- Contains the word «ESG» and either «music», «song», «concert», «album» or «band». These tweets are related to a band called ESG.

This results in a total of 42 087 585 tweets for the period 2009-2019, from 5 591 528 distinct users. 31 058 349 tweets contain the word «climate change», 437 602 contain «corporate governance», 750 574 contain «ESG», 930 463 contain «social responsibility» and 8 910 587 contain «sustainability». A certain amount of tweets, even after pre-processing, might not be related to ESG topics, and some tweets might still be regarded as spam. This creates unavoidable noise in our dataset.

The volume of tweets, TV, is detrended to account for the variation in Twitter usage during the week and over the years. This is done according to equation (5). The time period, t, is a day, regarded as the time from the previous market close until the current day's close. If there are no tweets for a given time period, $log(TV_t)$ is set to zero.

$$AbTV_t = log(TV_t) - log\left(Median(TV_{t-7}, TV_{t-14}, ..., TV_{t-364})\right) \tag{5}$$

The abnormal volume of tweets, AbTV, is used as a variable in this thesis. Table 3 presents the correlation between the five keywords' abnormal Twitter volume.

Table 3: Correlation between abnormal Twitter volume, AbTV, based on each keyword.

Keyword	Climate change	Corporate governance	ESG	Social responsibility	Sustainability
Climate change	1				
Corporate governance	0.284	1			
ESG	0.304	0.509	1		
Social responsibility	0.245	0.383	0.423	1	
Sustainability	0.389	0.579	0.684	0.445	1

2.4.1 Sentiment Analysis

To evaluate public mood, sentiment analysis is performed on the tweets. Before using sentiment analysis, the tweet content is cleaned to improve accuracy. All tweets are therefore stripped from URLs, hashtags (#), mentions (@), retweet indicators (RT) and other symbols.

We use three pre-trained models to categorise each tweet into positive, neutral or negative sentiment. The first two models use a lexicon-based approach, while the third uses a machine learning method.

The first model uses the natural language processing (NLP) package TextBlob, built on the Natural Language Toolkit (NLTK) package in Python. This model, further referred to as TextBlob, analyses the content based on the word pattern in each tweet, and has been trained on movie reviews. TextBlob sets a polarity score in the range highly positive, +1, to highly negative, -1, with zero being neutral. Hasan et al. (2018) and Laksono et al. (2019) find a 76 % and 69 % accuracy respectively in using TextBlob for Twitter sentiment analysis. According to TextBlob, 38 % of our tweets are positive, 44 % are neutral and 18 % are negative.

The second model is NLTK's VADER, further referred to as VADER. This model also categorises into positive, neutral or negative sentiment indicated by values between +1 and -1. In addition to using a sentiment lexicon approach, VADER uses grammatical rules and syntactical conventions. The model is by design made for micro-blogging content. Hutto and Gilbert (2014), the creators of VADER, claim to achieve a 96 % accuracy. According to VADER, 38 % of our tweets are positive, 34 % are neutral and 28 % are negative.

The third model uses a machine learning based sentiment analyser called Flair, further referred to as Flair. Flair's sentiment classifier is based on a character-level long-short term memory (LSTM) neural network that takes sequences of letters and words into account when predicting a sentiment. An advantage over the two other presented models is that Flair can predict a sentiment for words it has never seen before. This model has been trained on 25 000 highly polarised IMDb reviews and categorises into positive or negative. The model classifies 58 % of our tweets as positive and 42 % as negative.

We base our sentiment analysis on pre-trained models. This results in an uncertain accuracy, and to conclude on a sentiment, we choose the most agreed upon polarity by the three models. This is either the sentiment that at least two of the models agree upon, or if all three disagrees, a neutral polarity is set. See examples of tweets in our dataset, the corresponding polarity score by the three models and the resulting sentiment in Table 4. The distribution of tweets into the sentiments by each model can be found in Table 5. We observe that the three models agree on the polarity of 24 % of the tweets and disagrees on 12 %. Thus, in most cases, there is a high agreement on the polarity and presumably a satisfying level of accuracy.

Tweet	TextBlob	VADER	Flair	Total Polarity
Social responsibility is not just about selling the product but enhancing the quality of life for all.	0	0.033	Positive	Positive
@realDonaldTrump Of course, her happiness, the world's happiness, and a bright and wonderful future can only be accomplished when your future as US president ends and nations unite in a common purpose to slow down or stop warming world temperatures and related adverse climate change.	0.2120	0.9274	Positive	Positive
Corporate governance: What kind of world would you like your children and your children's' children to inherit? http://ow.ly/39Ijn	0.3	0.3612	Negative	Positive
More Funds Are Formally Considering ESG in Their Investment Processes https://t.co/QqFS0oTIvR #esg	0.5	0	Negative	Neutral
Pope Francis tells oil chiefs to keep it in the ground https://t.co/btdTdhBHZl vía @ClimateHome #ESG	0	0	Negative	Neutral
Rise in index funds creates corporate governance risks #shareholderactivism https://t.co/51AhmxdTXQ	0	0	Negative	Neutral
You want to reduce the anxiety about #climatechange @ScottMorrisonMP - then fucking do something about it. #triggeredbygreta #auspol #climateemergency @GretaThunberg #ClimateCrisis #UnitedNations https://t.co/ZN5oluJ5O4	-0.6	-0.1027	Negative	Negative
Carrying a plastic bag in Kenya is now punishable with jail time https://t.co/rZRIuuOozK via @qzafrica #environment #sustainability	-0.1	-0.4404	Negative	Negative
Keep the environment and sustainability, because after all destroyed we will realize the money ill be eaten. #fz7	-0.5	-0.7184	Positive	Negative

Table 5: Matrices of tweet classification based on the sentiment analysis models.

Flair

		Positive	Negative	Total
VADER	Positive	11 441 367	4 703 288	16 144 655
	Neutral	9 532 326	4 737 648	14 269 974
	Negative	3 629 199	8 043 757	11 672 956
	Total	24 602 892	17 484 693	42 087 585

Flair

		Positive	Negative	Total
TextBlob	Positive	10 506 046	5 832 057	16 338 103
	Neutral	11 591 499	7 357 399	18 948 898
	Negative	2 505 347	4 295 237	6 800 584
	Total	24 602 892	17 484 693	42 087 585

VADER

		Positive	Neutral	Negative	Total
TextBlob	Positive	9 622 642	3 437 769	3 277 692	16 338 103
	Neutral	4 954 116	9 368 874	4 625 908	18 948 898
	Negative	1 567 897	1 463 331	3 769 356	6 800 584
	Total	16 144 655	14 269 974	11 672 956	42 087 585

We define $AbTV^+$ and $AbTV^-$ as the abnormal volume of tweets that the sentiment analysis label as positive and negative respectively. These variables are calculated as stated in equation (6).

$$AbTV_t^{sentiment} = log(TV_t^{sentiment}) - log\left(Median(TV_{t-7}^{sentiment}, TV_{t-14}^{sentiment}, ..., TV_{t-364}^{sentiment})\right) \quad (6)$$

Here *sentiment* represents either the positive, $+$, or negative, $-$, sentiment, and t is day.

We also create a mood index, called MOOD. This is calculated as stated in equation (7). The variable combines the amount of tweets per day labelled as positive, neutral and negative to give an indication of the overall mood.

$$MOOD = \frac{TV_t^+ - TV_t^-}{TV_t} \quad (7)$$

2.5 Trading Volume

Previous research find that trading volume is significant in explaining stock returns (Campbell et al., 1993; Conrad et al., 1994; Chordia and Swaminathan, 2000). Using a similar approach as Campbell et al. (1993), abnormal trading volume, *AbVolume*, is calculated for each company using the daily or weekly trading volume, VOL. The calculation is shown in equation (8).

$$AbVolume_t = log(VOL_t) - log(Median(VOL_{t-1}, VOL_{t-2}, ..., VOL_{t-n})) \tag{8}$$

Here $n = 252$ for daily volume and $n = 52$ for weekly volume.

2.6   Bid-Ask Spread

Liquidity is found to significantly affect stock returns (Amihud and Mendelson, 1986; Brennan and Subrahmanyam, 1996; Datar et al., 1998). We measure daily liquidity using the relative bid-ask spread, calculated as follows,

$$BidAsk_t = \frac{ask_t - bid_t}{\frac{1}{2}(ask_t + bid_t)}. \tag{9}$$

The weekly liquidity variable is taken as the average of the daily relative bid-ask spreads over a given week.

2.7   Market Capitalization

We measure the daily market capitalization for each company, $MCAP$, as stated in equation (10).

$$MCAP_t = log(shares\ outstanding_t * price_t) \tag{10}$$

The weekly market capitalization is taken as the market capitalization of the last trading day of the week.

3 Results

In this section, we study how the stock returns of companies relate to their ESG, environmental, social and governance scores. The intention of doing so is to find out whether or not sustainable companies generate higher stock returns, and if so, under which circumstances. We start by investigating how the scores explain average stock returns. We expect that companies with high ESG scores are associated with lower risk, and therefore, on average, generate lower returns. In times of high investor concern, we anticipate that these companies generate higher stock returns. First, we evaluate the effect of VIX. Second, we consider the effect of public attention to individual companies and ESG topics, measured by Google search volumes. Lastly, we use public sentiment on Twitter to study how the amount of tweets, and positivity and negativity about ESG topics affect the stock returns of companies depending on their ESG scores.

Throughout this section, we mainly use panel data regressions with company-fixed effects and robust standard errors. In order to test the validity of this model, we perform F-tests to check if the intercepts are the same. We find significance at the 5 % level, indicating that the fixed effects are non-zero. Subsequently, we also test endogeneity using the Hausman-test with a 5 % significance level. We find that endogeneity might be present, hence panel data regressions with fixed effects might be more appropriate than panel data regressions with random effects.

Stock return is the dependent variable in all regressions. To check the validity of our results, we also test the presented relationships using abnormal returns, estimated using Fama-French three-factor model. This produces similar results, and the conclusions drawn from using return as dependent variable remain unchanged. Hence, we establish that the stock returns of companies with high and low ESG scores are not driven by companies' betas.

In all regressions, we include abnormal volume, bid-ask spread and market capitalization as control variables.

3.1 Relationship between ESG Scores and Stock Returns

We begin by evaluating the relationship between stock returns and the overall ESG score, and environmental, social and governance subscores. This establishes the general relationship between a company's sustainability level and its stock returns. The results using OLS regressions

are presented in Table 6.

Table 6: OLS regressions explaining stock returns using ESG, environmental (E), social (S) and governance (G) scores.

| Exogenous variable | Endogenous variable: Daily return, R_t | | | |
	(1)	(2)	(3)	(4)
ESG_t	-0.1464**			
	(0.010)			
E_t		-0.0937**		
		(0.006)		
S_t			-0.0755**	
			(0.009)	
G_t				-0.0831**
				(0.008)
$AbVolume_t$	0.1125**	0.1122**	0.1125**	0.1133**
	(0.006)	(0.006)	(0.006)	(0.006)
$BidAsk_t$	-1.3241*	-1.2876*	-1.2841*	-1.3759*
	(0.552)	(0.552)	(0.553)	(0.553)
$MCAP_t$	0.0145**	0.0139**	0.0094**	0.0074**
	(0.002)	(0.002)	(0.003)	(0.002)
R^2	0.001	0.001	0.001	0.001
No. of observations	2 662 419	2 662 419	2 662 419	2 662 419

*$p<0.05$, **$p<0.01$

We also check these relationship using panel data regression with fixed effects presented in Table 7. By doing so, we account for the fact that a company's ESG scores may change over time.

Table 7: Panel data regressions with company fixed effects explaining stock returns using ESG, environmental (E), social (S) and governance (G) scores.

Exogenous variable	Endogenous variable: Daily return, R_t			
	(1)	(2)	(3)	(4)
ESG_t	-0.0033**			
	(0.000)			
E_t		-0.0025**		
		(0.000)		
S_t			-0.0024**	
			(0.000)	
G_t				-0.0011**
				(0.000)
$AbVolume_t$	0.1134**	0.1136**	0.1136**	0.1140**
	(0.007)	(0.007)	(0.007)	(0.007)
$BidAsk_t$	-1.6591*	-1.6638*	-1.6690*	-1.6948*
	(0.685)	(0.685)	(0.685)	(0.684)
$MCAP_t$	0.1636**	0.1609**	0.1603**	0.1516**
	(0.008)	(0.008)	(0.008)	(0.007)
R^2	0.001	0.001	0.001	0.001
No. of observations	2 662 419	2 662 419	2 662 419	2 662 419

*$p<0.05$, **$p<0.01$

The results in Table 6 show that all scores are significant in explaining stock returns. The companies with the highest scores experience the lowest returns. Thus, on average, sustainable companies deliver inferior returns. Table 7, with similar negative and significant relationships, verifies that these findings hold when companies' ESG scores change over time. Next, we investigate stock returns when investors are concerned about the stock market.

3.2 The Impact of VIX on Stock Returns

The first measure of investor concern that we study is VIX, a measure of implied market volatility. We start by investigating how the deviation in VIX from its one year rolling median affects stock returns. We do this to evaluate whether the companies with high ESG scores generate superior returns in times of high market uncertainty. Subsequently, we study the relationship between stock returns and deviations in VIX from the previous day's VIX. The motivation for this is to investigate if sudden changes in investor fear, and not just the abnormal uncertainty level itself, affects stock returns of companies with high and low ESG scores differently.

3.2.1 Deviation in VIX from Its One Year Median

Table 8 shows how the ESG, environmental, social and governance score explain stock returns when the deviation in VIX from its one year rolling median is high or low.

Table 8: Panel data regressions with company fixed effects explaining stock returns of companies with different ESG, environmental (E), social (S) and governance (G) score using the deviation in VIX from its one year rolling median, AbVIX.

Exogenous variable	Endogenous variable: Daily return, R_t				
	(1)	(2)	(3)	(4)	(5)
$AbVIX_t$	-0.8926**	-0.9636**	-0.9219**	-0.9046**	-0.9911**
	(0.006)	(0.014)	(0.008)	(0.013)	(0.015)
$AbVIX_t * ESG_t$		0.1735**			
		(0.031)			
$AbVIX_t * E_t$			0.1164**		
			(0.021)		
$AbVIX_t * S_t$				0.0283**	
				(0.028)	
$AbVIX_t * G_t$					0.1962**
					(0.068)
$AbVolume_t$	0.1373**	0.1368**	0.1368**	0.1372**	0.1368**
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
$BidAsk_t$	0.8813**	0.8893**	0.8875**	0.8820**	0.8920**
	(0.094)	(0.094)	(0.094)	(0.094)	(0.094)
$MCAP_t$	0.1800**	0.1798**	0.1800**	0.1799**	0.1801**
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
R^2	0.010	0.010	0.010	0.010	0.010
No. of observations	2 662 419	2 662 419	2 662 419	2 662 419	2 662 419

*$p<0.05$, **$p<0.01$

We observe that stock returns and deviation in VIX from its one year rolling median have a negative and significant relationship. This is a well-known observation; stock prices fall when market uncertainty is high, see e.g. Whaley (2000), Giot (2005) and Banerjee et al. (2007). Furthermore, when we investigate how this relationship depends on the ESG, environmental, social and governance scores in model (2), (3), (4) and (5) respectively, we find that the returns of companies with high scores across all factors are less sensitive to the market uncertainty. Companies with high scores generate higher returns, compared to those with lower scores,

when market uncertainty is abnormally high, but not when market uncertainty is abnormally low. Thus, sustainable companies seem to be associated with less risk, and investors pay a premium for these stocks in times of high market uncertainty. The lower risk of sustainable companies is consistent with the findings of Fulton et al. (2012) and De and Clayman (2015). We observe that when uncertainty is high, the differences in stock returns between high and low scored companies are greatest for the ESG and governance score.

Next, we investigate if the deviations in VIX from its one year rolling median can predict stock returns the following day. The results are presented in Table 9.

Table 9: Panel data regressions with company fixed effects predicting stock returns of companies with different ESG, environmental (E), social (S) and governance (G) score using the deviation in VIX from its one year rolling median, AbVIX.

Exogenous variable	Endogenous variable: Daily return, R_t				
	(1)	(2)	(3)	(4)	(5)
$AbVIX_{t-1}$	0.1410**	0.1245**	0.1244**	0.1291**	0.1358**
	(0.006)	(0.052)	(0.008)	(0.014)	(0.015)
$AbVIX_{t-1} * ESG_{t-1}$		0.0403			
		(0.032)			
$AbVIX_{t-1} * E_{t-1}$			0.0659**		
			(0.075)		
$AbVIX_{t-1} * S_{t-1}$				0.0280	
				(0.092)	
$AbVIX_{t-1} * G_{t-1}$					0.0103
					(0.028)
$AbVolume_{t-1}$	0.0297**	0.0296**	0.0294**	0.0296**	0.0296**
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
$BidAsk_{t-1}$	-0.0566	-0.0548	-0.0532	-0.0560	-0.0560
	(0.096)	(0.096)	(0.096)	(0.096)	(0.096)
$MCAP_{t-1}$	-0.1960**	-0.1960**	-0.1959**	-0.1960**	-0.1959**
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
R^2	0.001	0.001	0.001	0.001	0.001
No. of observations	2 564 305	2 564 305	2 564 305	2 564 305	2 564 305

*p<0.05, **p<0.01

The table shows that the relationship between stock returns and deviations in VIX from its one year rolling median the previous day is significant and positive. This is consistent with the findings of Giot (2005), who finds the same positive relationship for 20 days forward-looking returns. He suggests that high market volatility may indicate oversold markets, hence signaling an attractive buy point. Subsequently, this generates positive future market returns. Thus, following his reasoning, it may seem as investors buy stocks performing well on the environmental factor when the market is oversold. We observe that the stock returns predicted

by the abnormal VIX level only depends on the environmental score. Companies with higher environmental score generate higher returns the following day when investors are worried. The other scores are insignificant in predicting stock returns when VIX deviates from its one year median. Hence, there is little predictive power in ESG ratings in times of an abnormal high or low market uncertainty level.

3.2.2 Daily Changes in VIX

Banerjee et al. (2007) find that both the VIX and the innovations in VIX are important in explaining stock returns. We therefore investigate how changes in market uncertainty from one day to another impact stock returns of sustainable firms. This captures more sudden changes in investor fear, as oppose to the more general level of concern that is captured by the VIX relative to its one year median. The results are presented in Table 10.

Table 10: Panel data regressions with company fixed effects explaining stock returns of companies with different ESG, environmental (E), social (S) and governance (G) score using deviations in VIX from the previous day's VIX, ΔVIX.

Exogenous variable	Endogenous variable: Daily return, R_t				
	(1)	(2)	(3)	(4)	(5)
ΔVIX_t	-9.0875**	-9.4631**	-9.1133**	-9.0827**	-9.7827**
	(0.016)	(0.038)	(0.022)	(0.037)	(0.041)
$\Delta VIX_t * ESG_t$		0.9286**			
		(0.086)			
$\Delta VIX_t * E_t$			0.1059		
			(0.058)		
$\Delta VIX_t * S_t$				-0.0114	
				(0.078)	
$\Delta VIX_t * G_t$					1.3929**
					(0.075)
AbVolume$_t$	0.1271**	0.1269**	0.1270**	0.1271**	0.1269**
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
BidAsk$_t$	0.7674**	0.7645**	0.7668**	0.7674**	0.7669**
	(0.088)	(0.088)	(0.088)	(0.088)	(0.088)
MCAP$_t$	0.1632**	0.1630**	0.1631**	0.1632**	0.1630**
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
R^2	0.106	0.106	0.106	0.106	0.107
No. of observations	2 662 419	2 662 419	2 662 419	2 662 419	2 662 419

*$p<0.05$, **$p<0.01$

The daily change in VIX is in model (1) observed to be negatively related to stock returns. That is, when market uncertainty increases from one day to another, the stock returns fall. This is also found by French et al. (1987), Whaley (2000) and Sarwar (2012). As observed in model (2) and (5), the ESG and governance scores are significant and positive in explaining stock returns when market concern changes from the previous day. Accordingly, the stock returns of companies with high ESG and governance scores seem to be less sensitive to daily changes in market uncertainty. While the stock returns appear to be dependent on all scores

when the deviation in VIX from its one year median is evaluated, the stock returns are solely dependent on the ESG and governance score when sudden changes in VIX is considered. As stipulated by Giese et al. (2021), the governance factor reflect short-term risks. Accordingly, one would expect the governance factor to be important when there is sudden changes in market uncertainty, as seen in model (5). The environmental and social score, reflecting long-term risks Giese et al. (2021), seem to be less important when the market uncertainty changes from one day to another, compared to when the VIX is evaluated for one year back.

Next, we investigate if the previous day's change in VIX can predict stock returns. The results are presented in Table 11.

Table 11: Panel data regressions with company fixed effects predicting stock returns of companies with different ESG, environmental (E), social (S) and governance (G) score using deviations in VIX from the previous day's VIX, ΔVIX.

Exogenous variable	Endogenous variable: Daily return, R_t				
	(1)	(2)	(3)	(4)	(5)
ΔVIX_{t-1}	-0.0493**	-0.1129**	-0.0616**	-0.1838**	-0.0114
	(0.017)	(0.041)	(0.023)	(0.039)	(0.044)
$\Delta VIX_{t-1} * ESG_{t-1}$		0.1572			
		(0.089)			
$\Delta VIX_{t-1} * E_{t-1}$			0.0505		
			(0.063)		
$\Delta VIX_{t-1} * S_{t-1}$				0.3204**	
				(0.084)	
$\Delta VIX_{t-1} * G_{t-1}$					-0.0758
					(0.080)
Volume$_{t-1}$	0.0335**	0.0335**	0.0335**	0.0335**	0.0335**
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
BidAsk$_{t-1}$	0.3572**	0.3566*	0.3568**	0.3557**	0.3572**
	(0.095)	(0.095)	(0.095)	(0.095)	(0.090)
MCAP$_{t-1}$	-0.1907**	-0.1908**	-0.1907**	-0.1908**	-0.1907**
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
R^2	0.001	0.001	0.001	0.001	0.001
No. of observations	2 564 305	2 564 305	2 564 305	2 564 305	2 564 305

*p<0.05, **p<0.01

In Table 11 we observe in model (1) that a daily positive change in VIX is related to lower returns. We find that this relationship only depends on the social score, seen in model (4). A high social score contributes positively to the stock return one day after an increase in VIX. That is, when investor concern increases, companies with higher social scores experience higher returns one day later.

In this section, we have presented evidence for superior returns of sustainable companies when investors are concerned. Our results indicate that the overall ESG and governance scores are

the most important scores in explaining this. The environmental and social score may be more important in predictions.

3.3 The Impact of Google Search Volume on Stock Returns

In this section, we study the impact of public attention to individual companies and various sustainability topics, measured by Google search volumes. First, we investigate how the abnormal Google search volumes on company names impact weekly stock returns and how this depends on the companies' ESG scores. Second, we investigate how the ESG, environmental, social and governance scores affect daily stock returns when the public show interest in sustainability topics. The four topics on sustainability; ESG, environmental, social and governance, are evaluated with their corresponding score. The aim is to evaluate if companies with high scores generate higher returns when there is an increased level of attention to individual companies and sustainability.

3.3.1 Weekly Google Searches on Company Names

Table 12 shows how daily Google search volumes on company names relate to stock returns the same week.

Table 12: Panel data regressions with company fixed effects explaining stock returns of companies with different ESG, environmental (E), social (S) and governance (G) scores using Search Volume Index, SVI, on company names.

Exogenous variable	Endogenous variable: Weekly return, R_t				
	(1)	(2)	(3)	(4)	(5)
$AbSVI_t$	-0.0619*	-0.1225	-0.0760*	-0.0374	-0.2159
	(0.026)	(0.063)	(0.035)	(0.028)	(0.116)
$AbSVI_t * ESG_t$		0.1701			
		(0.111)			
$AbSVI_t * E_t$			0.0771		
			(0.063)		
$AbSVI_t * S_t$				-0.0657	
				(0.080)	
$AbSVI_t * G_t$					0.3301
					(0.197)
$AbVolume_t$	-0.6126*	-0.6132*	-0.6129*	-0.6125*	-0.6142*
	(0.251)	(0.251)	(0.251)	(0.251)	(0.252)
$BidAsk_t$	48.952**	48.952**	48.950**	48.951**	48.949**
	(13.612)	(13.612)	(13.612)	(13.612)	(13.612)
$MCAP_t$	0.7721**	0.7724**	0.7720**	0.7720**	0.7734**
	(0.219)	(0.219)	(0.219)	(0.219)	(0.218)
R^2	0.002	0.002	0.002	0.002	0.002
No. of observations	581 655	581 655	581 655	581 655	581 655

*$p<0.05$, **$p<0.01$

Model (1) shows that there is a negative and significant relationship between abnormal search volumes on individual companies and stock returns. That is, increased attention to companies is associated with low returns. Similar results are found by Chen (2017), who studies Google search volumes on Dow Jones Industrial Index (DJIA) and its returns. Furthermore, it can be seen in model (2), (3), (4) and (5) that weekly stock returns explained by search volumes on companies do not depend on ESG scores.

Next, we investigate if search volumes on company names can predict stock returns. The results are presented in Table 13.

Table 13: Panel data regressions with company fixed effects predicting stock returns of companies with different ESG, environmental (E), social (S) and governance (G) scores using the Search Volume Index, SVI, on company names.

Exogenous variable	Endogenous variable: Weekly return, R_t				
	(1)	(2)	(3)	(4)	(5)
$AbSVI_{t-1}$	-0.0733**	-0.1817**	-0.1047**	-0.1398**	-0.1596**
	(0.015)	(0.051)	(0.023)	(0.043)	(0.053)
$AbSVI_{t-1} * ESG_{t-1}$		0.3042**			
		(0.110)			
$AbSVI_{t-1} * E_{t-1}$			0.1720**		
			(0.054)		
$AbSVI_{t-1} * S_{t-1}$				0.1785*	
				(0.083)	
$AbSVI_{t-1} * G_{t-1}$					0.1851*
					(0.092)
$AbVolume_{t-1}$	-0.4188*	-0.4198*	-0.4195*	-0.4190*	-0.4197*
	(0.172)	(0.173)	(0.172)	(0.172)	(0.173)
$BidAsk_{t-1}$	40.266*	40.267*	40.263*	40.269*	40.264*
	(17.086)	(17.086)	(17.085)	(17.087)	(17.086)
$MCAP_{t-1}$	-1.0670**	-1.0665**	-1.0672**	-1.0668**	-1.0663**
	(0.119)	(0.119)	(0.119)	(0.119)	(0.118)
R^2	0.003	0.003	0.003	0.003	0.003
No. of observations	581 600	581 600	581 600	581 600	581 600

*$p<0.05$, **$p<0.01$

The results of model (1) indicate that search volumes for individual companies are significant in predicting stock returns. This result is consistent with the findings of Bijl et al. (2016). Model (2), (3), (4) and (5) show that the impact of Google search volumes on stock returns depend on the ESG, E, S and G scores. We find that companies with high scores across all ESG factors generate higher returns when they receive more attention. Thus, when investors pay attention to individual company information, they also seem pay attention to their sustainability level. Furthermore, we observe that stock returns explained by search volumes on companies are most

impacted by the overall ESG score.

3.3.2 Daily Google Searches on ESG Topics

We now investigate how attention to sustainability topics affect stock returns of sustainable companies the same day. The results are presented in Table 14.

Table 14: Panel data regressions with company fixed effects explaining stock returns of companies with different ESG, environmental (E), social (S) and governance (G) score using Search Volume Indices, SVIs, on ESG, social, environmental and governance topics.

Exogenous variable	Endogenous variable: Daily return, R_t							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\text{AbSVI}_{ESG,t}$	-0.0172**	-0.0697**						
	(0.005)	(0.013)						
$\text{AbSVI}_{ESG,t} * \text{ESG}_t$		0.1298**						
		(0.024)						
$\text{AbSVI}_{E,t}$			-0.0156**	-0.0261**				
			(0.003)	(0.005)				
$\text{AbSVI}_{E,t} * \text{E}_t$				0.0433**				
				(0.010)				
$\text{AbSVI}_{S,t}$					-0.0161**	-0.0274**		
					(0.005)	(0.010)		
$\text{AbSVI}_{S,t} * \text{S}_t$						0.0269		
						(0.019)		
$\text{AbSVI}_{G,t}$							0.0454**	-0.0225
							(0.005)	(0.015)
$\text{AbSVI}_{G,t} * \text{G}_t$								0.1358**
								(0.025)
AbVolume_t	0.1153**	0.1149**	0.1153**	0.1151**	0.1153**	0.1152**	0.1118**	0.1116**
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
BidAsk_t	-1.7050*	-1.6965*	-1.7015*	-1.6958*	-1.7031*	-1.7015*	-1.6989*	-1.6958*
	(0.684)	(0.685)	(0.685)	(0.685)	(0.685)	(0.685)	(0.684)	(0.684)
MCAP_t	0.1475**	0.1480**	0.1477**	0.1478**	0.1473**	0.1474**	0.1475**	0.1475**
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
R^2	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
No. of observations	2 662 419	2 662 419	2 662 419	2 662 419	2 662 419	2 662 419	2 662 419	2 662 419

*p<0.05, **p<0.01

We observe in model (1), (3), (5) and (7) that, on average, more attention on ESG, environmental, social and governance topics affect stock returns negatively. Model (2), (4), (6) and (8) show that the impact of Google search volumes on stock returns depends on ESG, environmental and governance scores. When the attention on Google is high, companies with high scores generate higher returns. Conversely, when investor pay little attention to ESG, environmental and governance topics, companies with the lowest scores generate higher returns. Attention to social topics, however, does not seem to affect stock returns differently for companies with high or low social scores. Thus, increased attention to sustainability topics on Google is related to higher returns for the companies ranked highest on overall ESG, environmental and governance factors.

Next, we investigate if daily Google search volumes on ESG, environmental, social and governance topics predict stock returns. The results are presented in Table 15.

Table 15: Panel data regressions with company fixed effects predicting stock returns of companies with different ESG, environmental (E), social (S) and governance (G) score using Search Volume Indices, SVIs, for ESG, environmental, social and governance topics.

Exogenous variable	Endogenous variable: Daily return, R_t							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\text{AbSVI}_{ESG,\ t-1}$	0.0296**	0.0326*						
	(0.005)	(0.013)						
$\text{AbSVI}_{ESG,\ t-1} * \text{ESG}_{t-1}$		-0.0074						
		(0.025)						
$\text{AbSVI}_{E,\ t-1}$			0.0311**	0.0286**				
			(0.003)	(0.005)				
$\text{AbSVI}_{E,\ t-1} * \text{E}_{t-1}$				0.0104				
				(0.011)				
$\text{AbSVI}_{S,\ t-1}$					0.0431**	0.0450**		
					(0.004)	(0.010)		
$\text{AbSVI}_{S,\ t-1} * \text{S}_{t-1}$						-0.0045		
						(0.020)		
$\text{AbSVI}_{G,\ t-1}$							0.0820**	0.0950**
							(0.005)	(0.016)
$\text{AbSVI}_{G,\ t-1} * \text{G}_{t-1}$								-0.0260
								(0.026)
AbVolume_{t-1}	0.0321**	0.0321**	0.0318**	0.0318**	0.0313**	0.0313**	0.0302**	0.0302**
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
BidAsk_{t-1}	0.3443	0.3439	0.3368	0.3379	0.3391	0.3389	0.3514	0.3510
	(0.260)	(0.260)	(0.260)	(0.260)	(0.260)	(0.260)	(0.260)	(0.260)
MCAP_{t-1}	-0.1908**	-0.1908**	-0.1913**	-0.1913**	-0.1904**	-0.1905**	-0.1909**	-0.1909**
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
R^2	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
No. of observations	2 564 305	2 564 305	2 564 305	2 564 305	2 564 305	2 564 305	2 564 305	2 564 305

$*p<0.05, **p<0.01$

The results show that increased attention to ESG, environmental, social and governance topics, observed in model (1), (3), (5) and (7) respectively, predicts higher returns following a day with high search volumes on these topics. As observed in model (2), (4), (6) and (8), stock returns predicted by search volumes on sustainability topics do not depend on ESG scores.

In this section, we have shown that sustainable companies generate higher returns when there is an increased level of attention to individual companies and ESG topics. Attention to social

topics seems to be the least important for explaining stock returns.

3.4 The Impact of Twitter Volume and Sentiment on Stock Returns

We now investigate if engagement on Twitter about ESG topics is related to stock returns. We study tweets containing «climate change», «corporate governance», «ESG», «social responsibility» and «sustainability», and use them as measures of engagement on ESG topics. These keywords are related to different factors of ESG, and are thus studied in relation to their appropriate score(s). We use «climate change» as a measure of engagement on the environmental factor and «social responsibility» as a measure of engagement on the social factor. Both «corporate governance» and «social responsibility» are used as measures of engagement on the governance factor, as the latter word may also contain tweets on «corporate social responsibility». Additionally, all five keywords are used as measures of engagement on overall ESG. As observed in the data section, there is low correlation between the volume of tweets containing the different words. We therefore study all five keywords separately.

First, we evaluate whether the volume of tweets containing either of the five keywords explain stock returns of companies depending on their ESG scores. The aim of doing so, is to find out if companies with high scores generate higher returns when there is more buzz related to sustainability on Twitter. Second, we perform sentiment analysis on the content of each tweet to determine if positive or negative utterance is more important in explaining stock returns. We also combine the positive and negative volume of tweets to establish the overall mood. The mood related to ESG topics is used to explain and predict stock returns of companies, and to investigate how these relationships depend on companies' ESG scores.

3.4.1 Twitter Volume

Table 16 shows how the daily volume of tweets for each keyword are related to stock return and how this depends on companies' ESG scores.

Model (1) for each keyword indicate that there is no conclusive relationship between the amount of tweets and stock returns. More tweets about «sustainability», «climate change» and «corporate governance» affect stock returns negatively, while more tweets about «social

Table 16: Panel data regressions with company fixed effects explaining stock returns of companies with different ESG, environmental (E), social (S) and governance (G) score using abnormal Twitter volume, AbTV, for the five keywords.

	Endogenous variable: Daily return, R_t													
	Keyword:													
	ESG		Sustainability		Climate change			Social responsibility				Corporate governance		
Exogenous Variable	(1)	(2)	(1)	(2)	(1)	(2)	(3)	(1)	(2)	(3)	(4)	(1)	(2)	(3)
$AbTV_t$	-0.0061	-0.0248*	-0.0298**	-0.0407**	-0.0272**	-0.0146	-0.0214**	0.0350**	0.0520**	0.0228**	0.0825**	-0.0362**	-0.0322**	-0.0485**
	(0.005)	(0.012)	(0.005)	(0.014)	(0.004)	(0.009)	(0.005)	(0.004)	(0.009)	(0.008)	(0.011)	(0.004)	(0.011)	(0.011)
$AbTV_t * ESG_t$		0.0450		0.0267**									0.0098	
		(0.024)		(0.027)									(0.021)	
$AbTV_t * E_t$						-0.0313	-0.0239*							
						(0.018)	(0.012)							
$AbTV_t * S_t$									-0.0420*	0.0291				
									(0.019)	(0.016)				
$AbTV_t * G_t$											-0.0952**			0.0245
											(0.018)			(0.019)
$Volume_t$	0.1144**	0.1144**	0.1151**	0.1151**	0.1148**	0.1149**	0.1149**	0.1129**	0.1129**	0.1129**	0.1129**	0.1152**	0.1152**	0.1151**
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
$BidAsk_t$	-1.7047*	-1.7059*	-1.7063*	-1.7065*	-1.7095*	-1.7093*	-1.7098*	-1.6911*	-1.6550*	-1.6915*	-1.6906*	-1.7115*	-1.7114*	-1.7113*
	(0.684)	(0.684)	(0.684)	(0.684)	(0.684)	(0.684)	(0.684)	(0.684)	(0.684)	(0.684)	(0.684)	(0.684)	(0.684)	(0.684)
$MCAP_t$	0.1471**	0.1469**	0.1463**	0.1469**	0.1488**	0.1489**	0.1488**	0.1489**	0.1490**	0.1489**	0.1491**	0.1455**	0.1455**	0.1455**
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
R^2	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
No. of observations	2 662 419	2 662 419	2 662 419	2 662 419	2 662 419	2 662 419	2 662 419	2 662 419	2 662 419	2 662 419	2 662 419	2 662 419	2 662 419	2 662 419

*p<0.05, **p<0.01

responsibility» is positively related to stock returns. We find that the impact on stock returns of Twitter volume on «climate change» and «social responsibility» depend on the environmental score, and the ESG and governance score, respectively. More engagement on Twitter related to «climate change» seems to affect the stock returns of companies with high environmental score negatively, observed in model (3) of «climate change». In addition, companies with high ESG and governance score are slightly negatively affected by increased buzz related to «social responsibility» on Twitter, seen in model (2) and (4) of «social responsibility». In general, we observe that there are few significant relationships. Engagement itself seems to affect stock returns of companies with different ESG scores similarly. We therefore investigate if the sentiment of each tweet is important in explaining stock returns.

3.4.2 Twitter Sentiment Analysis

We study the content of each tweet by performing a sentiment analysis. This allows us to determine whether the content is positive, neutral or negative. When the sentiments are studied together, an overall mood may be established. We evaluate if the daily mood can explain stock returns. Additionally, we study the amount of positive and negative tweets separately to gain insight into which sentiment that impacts stock returns the most. For the keywords «social responsibility» and «sustainability», the mood on Twitter is positive for the studied period. For «corporate governance» and «ESG» more than 98 % of the days have a positive mood.

The subtables of Table 17 show the relationships between the daily sentiment on Twitter of each keyword and the stock returns of companies with different ESG, environmental, social and governance scores. As previously mentioned, each keyword is only studied in relation to the appropriate scores.

Table 17: Panel data regressions with company fixed effects explaining stock returns of companies with different ESG, environmental (E), social (S) and governance (G) scores using the abnormal positive Twitter volume, $AbTV^+$, abnormal negative Twitter volume, $AbTV^-$, and the MOOD. The MOOD is the overall Twitter sentiment.

Keyword: ESG

Exogenous variable	Endogenous variable: Daily return, R_t					
	(1)	(2)	(3)	(4)	(5)	(6)
$MOOD_t$	-0.3877**	-0.1994**				
	(0.019)	(0.033)				
$MOOD_t * ESG_t$		-0.3856**				
		(0.053)				
$AbTV_t^+$			-0.0329**	-0.0458**		
			(0.004)	(0.011)		
$AbTV_t^+ * ESG_t$				0.0310		
				(0.021)		
$AbTV_t^-$					-0.0397**	-0.0497**
					(0.004)	(0.004)
$AbTV_t^- * ESG_t$						0.0644**
						(0.007)
$AbVolume_t$	0.1148**	0.1145**	0.1156**	0.1156**	0.1154**	0.1144**
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
$BidAsk_t$	-1.6214*	-1.6063*	-1.7095*	-1.7104*	-1.7027*	-1.6907*
	(0.686)	(0.686)	(0.684)	(0.684)	(0.684)	(0.684)
$MCAP_t$	0.1672**	0.1721**	0.1459**	0.1457**	0.1459**	0.1469**
	(0.008)	(0.008)	(0.007)	(0.007)	(0.007)	(0.007)
R^2	0.001	0.001	0.001	0.001	0.001	0.001
No. of observations	2 662 419	2 662 419	2 662 419	2 662 419	2 662 419	2 662 419

*p<0.05, **p<0.01

Exogenous variable	Endogenous variable: Daily return, R_t					
	(1)	(2)	(3)	(4)	(5)	(6)
MOOD_t	-0.6204**	-0.4945**				
	(0.028)	(0.037)				
$\text{MOOD}_t * ESG_t$		-0.2023**				
		(0.039)				
AbTV_t^+			-0.0224**	-0.0306*		
			(0.005)	(0.013)		
$\text{AbTV}_t^+ * ESG_t$				0.0200		
				(0.025)		
AbTV_t^-					-0.0711**	-0.0702**
					(0.005)	(0.013)
$\text{AbTV}_t^- * ESG_t$						-0.0020
						(0.024)
AbVolume_t	0.1119**	0.1118**	0.1149**	0.1149**	0.1162**	0.1162**
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
BidAsk_t	-1.5536*	-1.5474*	-1.7053*	-1.7056*	-1.6971*	-1.6970*
	(0.687)	(0.687)	(0.684)	(0.684)	(0.684)	(0.684)
MCAP_t	0.1818**	0.1847**	0.1470**	0.1470**	0.1469**	0.1469**
	(0.008)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
R^2	0.002	0.002	0.001	0.001	0.001	0.001
No. of observations	2 662 419	2 662 419	2 662 419	2 662 419	2 662 419	2 662 419

*$p<0.05$, **$p<0.01$

Keyword: Climate change

Exogenous variable	Endogenous variable: Return								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$MOOD_t$	-0.4572** (0.021)	-0.4232** (0.051)	-0.4566** (0.030)						
$MOOD_t * ESG_t$		-0.0829 (0.099)							
$MOOD_t * E_t$			-0.0023 (0.064)						
$AbTV_t^+$				-0.0473** (0.004)	-0.0413** (0.010)	-0.0436** (0.006)			
$AbTV_t^+ * ESG_t$					-0.0150 (0.019)				
$AbTV_t^+ * E_t$						-0.0153 (0.012)			
$AbTV_t^-$							-0.0119** (0.003)	-0.0141** (0.003)	-0.0141** (0.003)
$AbTV_t^- * ESG_t$								0.0465** (0.006)	
$AbTV_t^- * E_t$									0.0465** (0.006)
$AbVolume_t$	0.1156** (0.007)	0.1156** (0.007)	0.1156** (0.007)	0.1155** (0.007)	0.1156** (0.007)	0.1156** (0.007)	0.1144** (0.007)	0.1135** (0.007)	0.1135** (0.007)
$BidAsk_t$	-1.6544* (0.685)	-1.6540* (0.685)	-1.6544** (0.685)	-1.7083* (0.684)	-1.7083* (0.684)	-1.7085** (0.684)	-1.7033** (0.684)	-1.6947** (0.684)	-1.6647** (0.684)
$MCAP_t$	0.1486** (0.007)	0.1488** (0.007)	0.1486** (0.007)	0.1497** (0.007)	0.1498** (0.007)	0.1498** (0.007)	0.1482** (0.007)	0.1492** (0.007)	0.1492** (0.007)
R^2	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
No. of observations	2 662 419	2 662 419	2 662 419	2 662 419	2 662 419	2 662 419	2 662 419	2 662 419	2 662 419

*p<0.05, **p<0.01

Keyword: Social responsibility

Exogenous variable	Endogenous variable: Daily return, R_t											
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
$MOOD_t$	-0.0682**	0.1027**	0.0612**	0.0083								
	(0.016)	(0.020)	(0.019)	(0.019)								
$MOOD_t * ESG_t$		-0.4282**										
		(0.030)										
$MOOD_t * S_t$			-0.3132**									
			(0.026)									
$MOOD_t * G_t$				-0.1550**								
				(0.018)								
$AbTV_t^+$					0.0373**	0.0520**	0.0254**	0.0801**				
					(0.004)	(0.009)	(0.008)	(0.010)				
$AbTV_t^+ * ESG_t$						-0.0363*						
						(0.018)						
$AbTV_t^+ * S_t$							0.0282					
							(0.015)					
$AbTV_t^+ * G_t$								-0.0858**				
								(0.017)				
$AbTV_t^-$									0.0407**	0.0663**	0.0604**	0.0614**
									(0.003)	(0.008)	(0.008)	(0.009)
$AbTV_t^- * ESG_t$										-0.0617**		
										(0.017)		
$AbTV_t^- * S_t$											-0.0460**	
											(0.015)	
$AbTV_t^- * G_t$												-0.0410**
												(0.016)
$AbVolume_t$	0.1144**	0.1137**	0.1139**	0.1142**	0.1127**	0.1127**	0.1127**	0.1127**	0.1131**	0.1131**	0.1131**	0.1130**
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
$BidAsk_t$	-1.7111*	-1.6744*	-1.6823*	-1.7025*	-1.6877*	-1.6873*	-1.6881*	-1.6871*	-1.7021*	-1.7005*	-1.7011*	-1.7014**
	(0.685)	(0.685)	(0.685)	(0.685)	(0.684)	(0.684)	(0.684)	(0.684)	(0.684)	(0.684)	(0.684)	(0.684)
$MCAP_t$	0.1471**	0.1610**	0.1581**	0.1510**	0.1491**	0.1491**	0.1491**	0.1492**	0.1477**	0.1478**	0.1478**	0.1478**
	(0.007)	(0.008)	(0.008)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
R^2	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
No. of observations	2 662 419	2 662 419	2 662 419	2 662 419	2 662 419	2 662 419	2 662 419	2 662 419	2 662 419	2 662 419	2 662 419	2 662 419

*p<0.05, **p<0.01

Exogenous variable	Endogenous variable: Daily return, R_t								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$MOOD_t$	-0.0384**	0.0784**	0.0350						
	(0.011)	(0.024)	(0.022)						
$MOOD_t * ESG_t$		-0.2803**							
		(0.047)							
$MOOD_t * G_t$			-0.1448**						
			(0.034)						
$AbTV_t^+$				-0.0415**	-0.0546**	-0.0620**			
				(0.004)	(0.009)	(0.010)			
$AbTV_t^+ * ESG_t$					0.0319				
					(0.018)				
$AbTV_t^+ * G_t$						0.0410*			
						(0.017)			
$AbTV_t^-$							-0.0284**	-0.0061	-0.0253**
							(0.003)	(0.006)	(0.007)
$AbTV_t^- * ESG_t$								-0.0538**	
								(0.013)	
$AbTV_t^- * G_t$									-0.0063
									(0.012)
$AbVolume_t$	0.1141**	0.1139**	0.1140**	0.1153**	0.1153**	0.1153**	0.1152**	0.1152**	0.1152**
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
$BidAsk_t$	-1.6990*	-1.6870*	-1.6956*	-1.7037*	-1.7042*	-1.7039*	-1.7098*	-1.7089*	-1.7098*
	(0.685)	(0.685)	(0.685)	(0.684)	(0.684)	(0.684)	(0.684)	(0.684)	(0.684)
$MCAP_t$	0.1479**	0.1516**	0.1494**	0.1458**	0.1457**	0.1457*	0.1469**	0.1472**	0.1469**
	(0.007)	(0.008)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
R^2	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
No. of observations	2 662 419	2 662 419	2 662 419	2 662 419	2 662 419	2 662 419	2 662 419	2 662 419	2 662 419

*$p<0.05$, **$p<0.01$

Model (1) in all five subtables of Table 17 show that a negative mood on Twitter, on average, is related to higher stock returns. The impact of Twitter mood on stock returns is dependent on ESG, social and governance scores for the keywords «corporate governance», «ESG», «social responsibility» and «sustainability». Companies with high scores generate higher returns when the mood related to these words is more negative. The impact on stock returns for the Twitter mood related to «climate change», however, is not affected by ESG scores, shown by model (2) and (3) in the «climate change» table. A possible reason for this is that the usage of «climate

change» on Twitter to a greater extent reflects public engagement rather than investor interest. The high volume of tweets containing the word «climate change» and the low correlation with the other keywords that deal with more finance-related topics, as presented in the data section, may support this presumption. Groß-Klußmann et al. (2019) find that the sentiment of experts tweeting about financial topics is more important than the public sentiment in explaining stock returns. Hence, the studied words' relation to finance and investments may be important for explaining stock returns of sustainable companies.

When investigating the mood it is not clear if the amount of positive or negative tweets has the most influence on stock returns. Our results in the subtables of Table 17 indicate that the impact of the amount of negative tweets on stock returns is more often dependent on ESG scores compared to the amount of positive tweets. Nevertheless, no general conclusion can be drawn on the direction of this dependency. On one hand, a high amount of negative tweets related to «ESG» contributes positively to the returns of companies with high ESG score, presented in model (6) of the «ESG» subtable. On the other hand, a low amount of negative tweets related to «social responsibility» is associated with lower stock returns for high-ranked companies, as seen in model (10), (11) and (12) in the «social responsibility» subtable. Due to the lack of consistency between the separate Twitter sentiments and stock returns, we use the mood as the overall indicator of investor sentiment on Twitter.

3.4.3   Twitter Mood in Stock Return Prediction

We now use the Twitter mood related to each keyword to evaluate if the mood can predict stock returns, and whether this depends on the ESG, environmental, social and governance scores. The results are presented in Table 18.

We observe in Table 18 that the mood on Twitter for all keywords are significant in predicting stock returns. This is observed in model (1) for all keywords. However, the mood might predict both positive and negative returns, depending on the keyword studied. A positive mood related to «ESG» and «sustainability» predicts higher stock returns, while a negative mood related to «climate change», «social responsibility» and «corporate governance» predicts higher returns. When we investigate the impact of the mood on stock returns of companies with high and low scores, we find that a positive mood for all keywords predicts higher returns the following

Table 18: Panel data regressions with company fixed effects predicting stock returns of companies with different ESG, environmental (E), social (S) and governance (G) scores using Twitter mood for the selected keywords.

	ESG		Sustainability		Climate change			Social responsibility				Corporate governance		
Endogenous variable: Daily return, R_t														
Keyword:														
Exogenous Variable	(1)	(2)	(1)	(2)	(1)	(2)	(3)	(1)	(2)	(3)	(4)	(1)	(2)	(3)
$MOOD_{t-1}$	0.0744**	-0.2024**	0.2499**	-0.0082	-0.4220**	-0.7153**	-0.5170**	-0.1767**	-0.3201**	-0.3252**	-0.2185**	-0.0250*	-0.2323**	-0.1068**
	(0.018)	(0.033)	(0.025)	(0.036)	(0.021)	(0.049)	(0.028)	(0.016)	(0.020)	(0.020)	(0.019)	(0.012)	(0.023)	(0.021)
$MOOD_{t-1}*ESG_{t-1}$		0.5649**		0.4151**		0.7155**			0.3602**				0.4964**	
		(0.055)		(0.041)		(0.107)			(0.031)				(0.047)	
$MOOD_{t-1}*E_{t-1}$							0.3713**							
							(0.073)							
$MOOD_{t-1}*S_{t-1}$										0.3605**				
										(0.027)				
$MOOD_{t-1}*G_{t-1}$											0.0849**			0.1611**
											(0.019)			(0.035)
$AbVolume_{t-1}$	0.0335**	0.0338**	0.0345**	0.0346**	0.0344**	0.0343**	0.0343**	0.0338**	0.0345**	0.0344**	0.0340**	0.0333**	0.0337**	0.0334**
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
$BidAsk_{t-1}$	0.3280**	0.3073**	0.2825**	0.2711**	0.3931**	0.3887**	0.3908**	0.3310**	0.3007**	0.2986	0.3263**	0.2516**	0.3327**	0.3327**
	(0.095)	(0.095)	(0.095)	(0.095)	(0.095)	(0.095)	(0.095)	(0.095)	(0.095)	(0.095)	(0.095)	(0.095)	(0.095)	(0.095)
$MCAP_{t-1}$	-0.1946**	-0.2018**	-0.2046**	-0.2106**	-0.1899**	-0.1918**	-0.1908**	-0.1918**	-0.2034**	-0.2045**	-0.1939**	-0.1905**	-0.1972**	-0.1922**
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
R^2	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
No. of observations	2 564 305	2 564 305	2 564 305	2 564 305	2 564 305	2 564 305	2 564 305	2 564 305	2 564 305	2 564 305	2 564 305	2 564 305	2 564 305	2 564 305

*p<0.05, **p<0.01

day for high-ranked companies. This relationship is opposite of what we found for the mood and stock returns of sustainable companies the same day. Presumably, this may occur as the behaviour of investors are different for positive and negative sentiments. A positive sentiment increases the adoption of future goals, while a negative sentiment triggers a focus on immediate concerns (Liberman and Trope, 1998; Eyal et al., 2004; Bar-Anan et al., 2006; Fujita et al., 2006; Labroo and Patrick, 2009). Thus, an investor might be likely to invest in sustainable companies immediately when there is more public concern about sustainability. However, in the long run, the positive sentiment may influence investor to invest in sustainable companies due to a belief in long-term profitability. Accordingly, sustainable companies may generate higher daily returns when there is more negativity on Twitter related to sustainability, but on a longer term generate higher returns when there is more positivity.

In this section we have shown that companies with higher ESG scores generate higher returns on days where the mood on Twitter is negative. One day after, however, this is reversed, and companies with lower ESG scores achieve higher returns.

4 Conclusion

In this thesis, we evaluate if sustainable companies generate higher returns when investors are concerned. We use ESG, environmental, social and governance scores, provided by Refinitiv, to assess the sustainability level of a company. Investor concerns related to these companies, the general stock market and ESG topics are measured using VIX, Google search volumes and Twitter. Our dataset consists of 2030 companies trading on NYSE or NASDAQ for the period 01.01.2010-31.12.2019.

First, we establish that the stocks of companies with high ESG, environmental, social and governance scores on average underperform. However, when VIX is high, companies with high ESG scores generate higher returns.

Second, we investigate how public attention to ESG topics and companies, measured by Google search volumes, affect stock returns. We find that high search volumes on ESG topics are related to higher stock returns for companies with high ESG, environmental and governance scores. Furthermore, in accordance with existing literature, increased attention to companies (measured by Google search volume) predicts negative returns the following week. However, we find that this relationship strongly depends on ESG scores. Increased attention to companies with high ESG scores predicts positive returns, while increased attention to companies with negative scores predicts negative returns.

Finally, we use 42 million tweets that contain either of the words «climate change», «corporate governance», «ESG», «social responsibility» and «sustainability» to evaluate if stock returns are affected by public engagement on ESG topics, and how this may depend on companies' ESG scores. In general, we find that the impact of the amount of tweets related to ESG topics on stock returns shows little dependence on ESG scores. On each tweet we perform sentiment analysis and construct variables capturing the overall Twitter mood related to these topics. The impact of the mood related to ESG topics on stock returns is highly affected by the ESG scores. A more negative mood on Twitter is associated with higher stock returns for companies with high ESG scores. However, a more positive sentiment predicts higher returns the day after for these companies.

We conclude that sustainable companies generate inferior returns on average, but they generate

superior returns when investors are concerned about these companies, the general stock market or ESG topics. Overall, the impact of investor sentiment on stock returns seems to be most dependent on the ESG and governance scores.

To test the validity of our results, future research could apply ESG scores from other providers to evaluate if the presented relationships hold. Furthermore, other sentiment indicators, such as tweets about individual companies, or news on companies, major events or sustainability can be studied. These, and our studied sentiment proxies, can be assessed for different regions and industries.

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Appendices

A Companies in Dataset and Company Search Terms on Google

Below follows a complete list of the search terms used for each company in our sample with corresponding CRSP permanent company identifier, denoted by No. The majority of permanent company identifiers are associated with one search term, however some of them have multiple as a direct consequence of names changes.

No.	Company	No.	Company	No.	Company
7	Apple	1425	Flowserve	2615	La Z Boy
90	American Express	1451	Eaton Vance	2636	Leggett & Platt
92	Aflac	1467	Ecolab	2664	Limited Brands
137	American International	1557	Enzo Biochem	2664	L Brands
153	Alico	1582	Escalade	2706	Range Resources
157	Alexander & Baldwin	1620	Regions Financial	2709	Lowes
157	Matson	1629	First American Corp	2736	Lydall
176	Ceco Environmental	1629	Corelogic	2767	Manitowoc
194	Applied Materials	1632	Farmer Brothers	2784	Maui Land & Pineapple
211	Advanced Micro Devices	1645	Us Bancorp	2801	Mccormick
216	Amgen	1658	Trustmark	2809	Gencor Industries
250	Natures Sunshine Products	1685	Fedex Corp	2847	Mge Energy
261	American National Insurance	1688	Franklin Electric	2850	Medtronic
282	Analog Devices	1689	M&T Bank	2881	Methode Electronics
317	Apogee Enterprises	1741	Fifth Third Bancorp	2913	Siebert Financial
352	Arabian American Development	1768	Flexsteel Industries	2949	Miller Herman
352	Trecora Resources	1852	Lb Foster	2971	Mine Safety Appliances
362	Associated Banc	1856	First Horizon National	2971	Msa Safety
392	Atrion	1868	Hb Fuller	3021	Magellan Petroleum
397	Astronics	1892	Gap	3021	Tellurian
430	Azz	1908	Gray Television	3031	Marcus Corp
469	Robert Half International	1940	Arrow Financial	3048	Middlesex Water
475	Banco Popular	2002	Graco	3083	Mts Systems
511	Black Hills Energy	2004	Graham Corp	3102	Myers
544	Wr Berkley	2075	Haemonetics	3104	Mylan
589	Bank Of Hawaii	2088	Allied Motion Technologies	3133	Nabi Biopharmaceuticals
676	Bassett Furniture	2089	Haverty Furniture	3133	Biota Pharmaceuticals
678	Mastec	2093	Huntington Bancshares	3133	Aviragen Therapeutics
737	Cal Maine Foods	2130	Hexcel	3133	Vaxart
779	Commerce Bancshares	2191	Hni	3151	Bank Of America
781	Synovus Financial	2235	Hurco Company	3160	Nordson
840	Cullen Frost Bankers	2238	Hawkins Inc	3178	Newell Brands
892	Chesapeake Utilities	2253	Westamerica Bancorporation	3200	New Jersey Resources
900	Chubb	2293	Igi Laboratories	3217	Nordstrom
904	Cantel Medical	2293	Teligent	3219	Noble Energy
912	Cincinnati Financial	2366	Insituform Technologies	3236	Gp Strategies
1033	Coherent Inc	2366	Aegion	3275	Northern Trust
1035	Coca Cola Bottling	2367	Intel	3302	Terex
1035	Coca Cola Consolidated	2488	Kaman	3306	Northwest Natural Gas
1071	Coeur Mining	2535	Keycorp	3309	Northwestern
1103	Church & Dwight	2545	Hallador Energy	3321	Owens & Minor
1222	California Water Service	2551	Kla	3326	Oceaneering
1261	Comerica	2552	Kulicke & Soffa	3333	Iteris
1285	Deluxe Corp	2572	Korn Ferry	3348	Oil Dri
1344	Donaldson	2577	Primeenergy	3363	Old Republic International
1367	Omnicom	2600	Lancaster Colony	3418	Otter Tail
1418	Ducommun	2612	Lawson Products	3466	Patrick Industries

No.	Company	No.	Company	No.	Company
3487	Paccar	5230	Telephone & Data Systems	7506	Best Buy
3500	Pure Cycle Corp	5242	Gentex	7518	Insteel Industries
3526	Petroleum Development Oman	5253	Napco Security Technologies	7556	Cadiz
3526	Pdc Energy	5342	Ihc Group	7557	Drew Industries
3580	Agilysys	5440	Fulton Financial	7557	Lci Industries
3588	Park Ohio	5653	Vse	7623	Autodesk
3622	Pentair	5679	Washington Federal	7676	Bryn Mawr Bank
3624	Brown & Brown	5703	Quality Systems	7684	Ross Stores
3642	Powell Industries	5703	Nextgen Healthcare	7720	Independent Bank
3682	Progressive Insurance	5705	Utah Medical Products	7765	Oshkosh Corp
3685	Pnc Financial Services	5708	Par Technology	7784	Bancorpsouth
3741	Quaker Chemical	5780	Cooper Companies	7788	Peoples Bank
3772	United States Lime Minerals	5849	Mr Cooper	7850	Conseco
3781	Raven Industries	5856	Cvb Financial	7850	Cno Financial
3840	Regal Beloit	5908	First Midwest Bancorp	7863	Mercury General
3860	Rli Corp	5925	Interface Inc	7864	Henry Jack
3911	Rpm International	5926	Trustco Bank	7871	Community Bank System
3914	Royal Gold	5974	Value Line Inc	7882	Costco
4040	Sei Investments	6051	Unifirst	7902	Hansen Natural
4120	Stewart Information Services	6137	Raymond James Financial	7902	Monster Beverage
4162	Snap On	6144	Staar Surgical	7976	J&J Snack Foods
4163	Bb&T	6149	Williams Sonoma	7980	Plexus
4163	Truist Financial	6185	Stifel Financial	8045	Oracle
4181	Southwest Airlines	6262	Cardinal Health	8048	Microsoft
4196	Sonoco Products	6281	1St Source	8087	T Rowe Price
4230	Standard Register	6304	Cintas	8135	Repligen
4234	Selective Insurance	6333	Paychex	8179	Independent Bank
4255	Biglari	6342	Culp	8186	Celldex Therapeutics
4255	Steak N Shake	6391	Avis Budget	8237	Balchem
4260	State Street	6407	Franklin Resources	8254	Xoma
4293	Travelers Companies	6412	Slm Corp	8278	Daily Journal
4295	Sturm Ruger	6515	Caseys General Stores	8284	Amag Pharmaceuticals
4298	Stryker	6560	Immunomedics	8292	Tcf Financial
4338	Southwestern Energy	6606	Hunt Jb Transport Services	8299	Astec Industries
4342	Southwest Gas	6616	Healthcare Services	8317	Werner Enterprises
4350	American States Water	6689	Calamp Corp	8340	Skywest
4375	Tennant Co	6702	Acxiom	8360	Patriot Transportation
4402	Team Inc	6702	Liveramp	8372	Toll Brothers
4516	Toro	6736	First Financial Bankshares	8377	Research Frontiers
4557	Thermo Fisher Scientific	6748	Atmos Energy	8418	American Woodmark
4560	Transcat	6760	Brinker	8441	Meridian Bioscience
4589	Tetra Tech	6765	Thor Industries	8458	Clearfield
4604	Twin Disc	6827	Seacoast Banking	8476	Adobe
4643	United Fire	6883	Mesa Laboratories	8526	World Fuel Services
4673	Umb Financial	6944	Glacier Bancorp	8534	First National Bank
4684	Sensient Technologies	7013	Lam Research	8549	Lakeland Industries
4685	Unifi	7019	American Ecology	8551	Pam Transportation
4761	Valmont Industries	7019	Us Ecology	8596	Healthsouth
4818	Valley Bancorp	7029	Invacare	8596	Encompass Health
4879	Western Digital	7062	Dycom Industries	8598	Fiserv
4881	Wd 40	7065	Micron Technology	8600	Marten Transport
4905	Weyco	7067	Old National Bancorp	8702	Heartland Express
4980	Alliant Energy	7093	Modine Manufacturing	8743	Orasure Technologies
4998	West Pharmaceutical Services	7094	Gallagher Arthur J	8766	Wsfs Financial
5009	Worthington Industries	7135	Rex American Resources	8778	Investors Title
5037	Yrc Worldwide	7195	Scientific Games	8786	Cerner Corp
5057	Zions Bancorporation	7232	Expeditors	8810	Webster Financial
5085	Home Depot	7267	Unitedhealth	8811	Markel
5130	Argan	7301	Mcgrath Rentcorp	8839	Axogen
5132	International Game Technology	7317	Nanometrics	8879	First Long Island
5152	Fonar	7317	Onto Innovation	8889	First Bancorp Pr
5169	Cracker Barrel Old Country Store	7343	Icad	9002	American Vanguard
5184	Interdigital	7459	Lsi Industries		

No.	Company	No.	Company	No.	Company
9010	Photronics	10421	Great Southern Bancorp	11371	First Financial Corp In
9023	Americas Car Mart	10486	Cisco	11403	Nbt Bancorp
9028	Dmc Global	10504	Hologic	11440	Icu Medical
9058	Oriental Financial	10512	Merit Medical Systems	11446	Mohawk Industries
9141	First Bancorp Nc	10544	Tetra Technologies	11454	Nci Building Systems
9147	Wesbanco	10545	Vicor Corporation	11454	Cornerstone Building Brands
9188	Sanderson Farms	10561	Granite Construction	11455	Asure Software
9213	United Bankshares	10563	Kemper Corp	11473	Agco
9239	Washington Trust Bancorp	10594	Autonation	11479	Renasant Bank
9245	Cadence Design Systems	10634	Xilinx	11480	S & T Bancorp
9280	City Holding	10684	Veru	11506	Buckle
9312	Ebix	10691	Trimble	11512	Arcbest
9360	Fair Isaac	10724	Exponent Inc	11522	Universal Display
9370	Conmed	10758	Matrix Service	11542	Us Physical Therapy
9375	Middleby	10805	Cathay General Bancorp	11558	Bed Bath & Beyond
9389	Horizon Bancorp	10817	Aaon	11559	Dr Horton
9424	Dentsply	10827	Quidel	11561	Credit Acceptance
9438	Northeast Bank	10855	Dorman Products	11576	Columbia Banking System
9440	Fastenal Company	10867	Pico	11591	Fuelcell Energy
9449	Central Pacific Financial	10876	Regeneron Pharmaceuticals	11592	Starbucks
9457	Ap Pharma	10905	Firstcash	11600	Stratus Properties
9457	Heron Therapeutics	10924	Abraxas Petroleum	11606	Superior Energy Services
9465	Comstock Resources	10937	Isis Pharmaceuticals	11617	Central Garden & Pet
9558	Ii Vi	10937	Ionis Pharmaceuticals	11621	Encore Wire
9576	Johnson Outdoors	10954	Hancock Whitney Bank	11691	First United
9588	Svb Financial	10959	Lifetime Brands	11706	Cheesecake Factory
9604	Mitek Systems	10989	Idexx	11709	Littelfuse
9616	Clean Harbors	10992	Devry Education	11713	On Assignment
9632	Cyberoptics	10992	Adtalem Global Education	11713	Asgn
9645	Community Trust Bancorp	10996	Aes Corp	11778	Patterson Companies
9654	Comtech Telecommunications	11001	State Auto Financial	11857	St Mary Land & Exploration
9677	Intermediate Parfums	11003	Corvel	11857	Sm Energy
9698	Maxim Integrated Products	11011	Sterling Construction	11862	Universal Insurance
9764	Mgm Resorts	11018	Dineequity	11865	Seacor
9798	Office Depot	11018	Dine Brands Global	11871	Hms Corp
9804	Waste Management	11042	Vertex Pharmaceuticals	11879	Ultralife
9847	Peoples United Financial	11050	Progress Software	11901	Iac
9848	Labcorp	11052	Monro	11934	Rocky Brands
9868	Mercer International	11083	Healthways	11946	Cree
9882	Chemical Financial	11083	Tivity Health	11950	Peoples Bancorp
9882	Tcf Financial	11103	Proassurance Corp	11958	Cryolife
9899	Avid Bioservices	11106	Bok Financial	11960	Universal Electronics
9899	Peregrine Pharmaceuticals	11111	National Beverage	11980	Nathans Famous
9971	Lindsay Corp	11112	Biogen Idec	12009	Avid Technology
9977	Mgp Ingredients	11112	Biogen	12011	Intuit
9999	Republic First Bancorp	11161	Old Dominion Freight Line	12015	Shoe Carnival
10020	Champions Oncology	11204	Atlantic Tele Network	12025	Alamo
10039	Hingham Institution	11204	Atn International	12027	Microchip Technology
10107	Bio Techne	11206	Biospecifics Technologies	12036	Chicos Fashion
10110	Trimas	11225	World Acceptance Corp	12038	Stock Yards Bancorp
10210	Cirrus Logic	11235	Wisdomtree Investments	12058	Bancfirst
10218	First Merchants	11238	Sanfilippo John B & Son	12074	Fossil
10256	Cognex	11248	American Superconductor	12083	Sanmina
10288	Neogen	11253	Qualcomm	12086	Trico Bancshares
10299	Hallmark Financial Services	11257	Perrigo	12097	O Reilly Automotive
10303	Electronic Arts	11300	Gilead Sciences	12108	Jabil Circuit
10323	Digi	11304	Misonix	12108	Jabil
10358	Zix	11316	Pdl Biopharma	12119	Anika Therapeutics
10359	Lattice Semiconductor	11324	Scotts Miracle Gro	12139	German American Bancorp
10380	Immunogen	11344	Roper Industries	12147	Titan International
10390	Biolife Solutions	11344	Roper Technologies	12185	Papa Johns
10408	Ptc	11358	Scholastic Corp	12194	Amerigon
10419	G Iii Apparel	11361	Synopsys		

No.	Company	No.	Company	No.	Company
12194	Gentherm	13539	Brooks Automation	14863	Teletech
12197	Barrett Business Services	13587	Aci Worldwide	14863	Ttec
12204	Arrowhead Pharmaceuticals	13603	Dollar Tree	14888	Carriage Services
12214	Flir Systems	13617	National Instruments	14915	E Trade
12339	Monarch Casino & Resort	13695	Cbiz	14927	Stericycle
12378	Winmark	13739	Harmonic	14958	Willis Lease
12412	Meta Financial	13753	Resmed	14969	Ocwen
12457	Gartner	13927	Atlas Air Worldwide	14977	Spectrum Pharmaceuticals
12461	Union Bankshares	13938	Kforce	15025	Bjs Restaurants
12461	Union First Bankshares	13943	Integra Lifesciences	15037	Hibbett Sports
12461	Atlantic Union Bankshares	13945	Craft Brewers Alliance	15108	United Natural Foods
12462	Qcr	13945	Craft Brew Alliance	15114	Seachange
12484	Deckers Outdoor	13966	Auburn National Bancorp	15147	Eplus
12499	Activision Blizzard	13978	Smith Micro Software	15158	Accelr8 Technology Corp
12503	Riverview Bancorp	13979	Mednax	15158	Accelerate Diagnostics
12525	First Financial Bankshares	14031	Myriad Genetics	15171	Steel Dynamics
12530	Patterson Uti Energy	14046	Pool Corp	15190	Forrester Research
12539	Itron	14049	Ricks Cabaret International	15199	Viasat
12541	Gibraltar Industries	14049	Rci Hospitality	15243	Lithia Motors
12546	Urban Outfitters	14091	Banner Corp	15267	Sun Hydraulics
12553	Universal Forest Products	14092	Opko Health	15267	Helios Technologies
12557	Century Casinos	14098	Schein Henry	15306	Cerus Corporation
12561	Old Second Bancorp	14143	Advanced Energy Industries	15307	Capital City Bank
12569	Hain Celestial	14152	Netapp	15314	Aastrom Biosciences
12577	Forward Air	14157	Flushing Financial Corp	15314	Vericel
12583	Jds Uniphase	14161	Intevac	15321	Ciena
12583	Viavi Solutions	14175	Northwest Pipe Co	15339	Silgan
12608	New York Community Bancorp	14201	Citrix Systems	15370	Td Ameritrade
12669	Madden Steven	14205	Nuance Communications	15376	Euronet Worldwide
12706	Ufp Technologies	14232	Tg Therapeutics	15385	Wintrust Bank
12740	Medifast	14268	Emcor	15436	Take Two Interactive
12843	Daktronics	14330	Iron Mountain	15450	Codorus Valley Bancorp
12846	Dsp	14355	Ohio Valley Bank	15454	Flagstar Bancorp
12848	Boston Private	14374	Landec	15471	Rambus
12863	Tractor Supply	14382	Andersons	15473	Amazon Com
12902	Biocryst Pharmaceuticals	14387	Columbus Mckinnon	15506	Rf Micro Devices
12908	Olympic Steel	14393	Csg Systems	15506	Qorvo
12917	Nn Inc	14394	Alexion Pharmaceuticals	15507	Avi Biopharma
12926	Copart	14427	Hub	15507	Sarepta Therapeutics
12933	Scansource	14470	Prgx	15534	Simulations Plus
12938	Motorcar Parts Of America	14479	Century Aluminum	15547	Pacific Premier Bancorp
12951	Landmark Bancorp	14494	Kvh Industries	15560	Heska
12994	Southern Missouri Bancorp	14531	Sandy Spring Bancorp	15563	Helix Energy Solutions
13001	American Eagle Outfitters	14572	Sykes Enterprises	15567	8X8
13036	Nektar Therapeutics	14602	Fti Consulting	15568	Dxp Enterprises
13092	Ameris Bancorp	14633	Premier Financial Bancorp	15596	Bank Of The Ozarks
13114	Simpson Manufacturing	14659	Neurocrine Biosciences	15596	Bank Ozk
13115	Penn National Gaming	14715	Entremed	15657	Lakeland Bancorp
13125	La Jolla Pharmaceutical	14715	Casi Pharmaceuticals	15678	Pricesmart
13240	Miller Industries	14722	Trueblue	15692	Faro Technologies
13252	Adtran	14744	Ansys	15697	Childrens Place
13269	Amedisys	14751	Center Bancorp	15739	Osi Systems
13300	Darling International	14751	Connectone Bancorp	15758	Ch Robinson
13300	Darling Ingredients	14762	Dime Community Bancshares	15783	Casella Waste Systems
13304	Sirius Xm Radio	14778	Provident Financial	15802	Depomed
13304	Sirius Xm	14781	Cass Information Systems	15802	Assertio Therapeutics
13311	Callon Petroleum	14795	Oceanfirst Bank	15841	Oyo Geospace
13394	Knight Transportation	14801	Acacia Research	15841	Geospace Technologies
13398	Aspen Technology	14828	Pegasystems	15890	Power Integrations
13413	Northwest Bancshares	14838	Strayer Education	15916	Dennys
13447	Veeco Instruments	14838	Strategic Education	15918	Heritage Bank
13521	Insight Enterprises	14845	Usana Health Sciences	15921	Timberland Bank
13524	Rent A Center	14859	Geron		

No.	Company	No.	Company	No.	Company
15926	C&F Bank	5037	Yrc Worldwide	7195	Scientific Games
15928	Rockwell Medical	5057	Zions Bancorporation	7232	Expeditors
15933	Nara Bancorp	5085	Home Depot	7267	Unitedhealth
15933	Bbcn Bancorp	5130	Argan	7301	Mcgrath Rentcorp
15933	Hope Bancorp	5132	International Game Technology	7317	Nanometrics
15939	Mercury Computer Systems	5152	Fonar	7317	Onto Innovation
15939	Mercury Systems	5169	Cracker Barrel Old Country Store	7343	Icad
15940	Verisign	5184	Interdigital	7459	Lsi Industries
15993	Norwood Bank	5230	Telephone & Data Systems	7506	Best Buy
15994	Pc Connection	5242	Gentex	7518	Insteel Industries
15995	Surmodics	5253	Napco Security Technologies	7556	Cadiz
16026	Brookline Bancorp	5342	Ihc Group	7557	Drew Industries
16029	Columbia Sportswear	5440	Fulton Financial	7557	Lci Industries
16035	Umpqua	5653	Vse	7623	Autodesk
16037	Colony Bank	5679	Washington Federal	7676	Bryn Mawr Bank
16065	Manhattan Associates	5703	Quality Systems	7684	Ross Stores
16066	Cra International	5703	Nextgen Healthcare	7720	Independent Bank
16075	Griffin Land And Nurseries	5705	Utah Medical Products	7765	Oshkosh Corp
16075	Griffin Industrial Realty	5708	Par Technology	7784	Bancorpsouth
16080	Amkor Technology	5780	Cooper Companies	7788	Peoples Bank
16107	Southside Bancshares	5849	Mr Cooper	7850	Conseco
16121	Axt	5856	Cvb Financial	7850	Cno Financial
16127	Clarus	5908	First Midwest Bancorp	7863	Mercury General
16127	Black Diamond	5925	Interface Inc	7864	Henry Jack
16130	Hackett	5926	Trustco Bank	7871	Community Bank System
16149	Microstrategy	5974	Value Line Inc	7882	Costco
16188	Costar	6051	Unifirst	7902	Hansen Natural
16268	Crown Castle	6137	Raymond James Financial	7902	Monster Beverage
16285	Ebay	6144	Staar Surgical	7976	J&J Snack Foods
16290	First Busey	6149	Williams Sonoma	7980	Plexus
16300	Cnb Bank	6185	Stifel Financial	8045	Oracle
16310	21St Century Holding	6262	Cardinal Health	8048	Microsoft
16310	Federated National Holding	6281	1St Source	8087	T Rowe Price
16310	Fednat Holding	6304	Cintas	8135	Repligen
16313	Prosperity Bancshares	6333	Paychex	8179	Independent Bank
16332	Select Comfort Corp	6342	Culp	8186	Celldex Therapeutics
16332	Sleep Number	6391	Avis Budget	8237	Balchem
16347	Infospace	6407	Franklin Resources	8254	Xoma
16347	Blucora	6412	Slm Corp	8278	Daily Journal
16367	First Capital	6515	Caseys General Stores	8284	Amag Pharmaceuticals
16368	Lakes Entertainment	6560	Immunomedics	8292	Tcf Financial
16368	Golden Entertainment	6606	Hunt Jb Transport Services	8299	Astec Industries
16374	Provident Bancorp	6616	Healthcare Services	8317	Werner Enterprises
16374	Sterling Bancorp	6689	Calamp Corp	8340	Skywest
16382	Nvidia	6702	Acxiom	8360	Patriot Transportation
16402	East West Bancorp	6702	Liveramp	8372	Toll Brothers
16410	Bottomline Technologies	6736	First Financial Bankshares	8377	Research Frontiers
16454	Priceline Com	6748	Atmos Energy	8418	American Woodmark
16454	Priceline	6760	Brinker	8441	Meridian Bioscience
4589	Tetra Tech	6765	Thor Industries	8458	Clearfield
4604	Twin Disc	6827	Seacoast Banking	8476	Adobe
4643	United Fire	6883	Mesa Laboratories	8526	World Fuel Services
4673	Umb Financial	6944	Glacier Bancorp	8534	First National Bank
4684	Sensient Technologies	7013	Lam Research	8549	Lakeland Industries
4685	Unifi	7019	American Ecology	8551	Pam Transportation
4761	Valmont Industries	7019	Us Ecology	8596	Healthsouth
4818	Valley Bancorp	7029	Invacare	8596	Encompass Health
4879	Western Digital	7062	Dycom Industries	8598	Fiserv
4881	Wd 40	7065	Micron Technology	8600	Marten Transport
4905	Weyco	7067	Old National Bancorp	8702	Heartland Express
4980	Alliant Energy	7093	Modine Manufacturing	8743	Orasure Technologies
4998	West Pharmaceutical Services	7094	Gallagher Arthur J	8766	Wsfs Financial
5009	Worthington Industries	7135	Rex American Resources		

No.	Company	No.	Company	No.	Company
8778	Investors Title	10303	Electronic Arts	11300	Gilead Sciences
8786	Cerner Corp	10323	Digi	11304	Misonix
8810	Webster Financial	10358	Zix	11316	Pdl Biopharma
8811	Markel	10359	Lattice Semiconductor	11324	Scotts Miracle Gro
8839	Axogen	10380	Immunogen	11344	Roper Industries
8879	First Long Island	10390	Biolife Solutions	11344	Roper Technologies
8889	First Bancorp Pr	10408	Ptc	11358	Scholastic Corp
9002	American Vanguard	10419	G Iii Apparel	11361	Synopsys
9010	Photronics	10421	Great Southern Bancorp	11371	First Financial Corp In
9023	Americas Car Mart	10486	Cisco	11403	Nbt Bancorp
9028	Dmc Global	10504	Hologic	11440	Icu Medical
9058	Oriental Financial	10512	Merit Medical Systems	11446	Mohawk Industries
9141	First Bancorp Nc	10544	Tetra Technologies	11454	Nci Building Systems
9147	Wesbanco	10545	Vicor Corporation	11454	Cornerstone Building Brands
9188	Sanderson Farms	10561	Granite Construction	11455	Asure Software
9213	United Bankshares	10563	Kemper Corp	11473	Agco
9239	Washington Trust Bancorp	10594	Autonation	11479	Renasant Bank
9245	Cadence Design Systems	10634	Xilinx	11480	S & T Bancorp
9280	City Holding	10684	Veru	11506	Buckle
9312	Ebix	10691	Trimble	11512	Arcbest
9360	Fair Isaac	10724	Exponent Inc	11522	Universal Display
9370	Conmed	10758	Matrix Service	11542	Us Physical Therapy
9375	Middleby	10805	Cathay General Bancorp	11558	Bed Bath & Beyond
9389	Horizon Bancorp	10817	Aaon	11559	Dr Horton
9424	Dentsply	10827	Quidel	11561	Credit Acceptance
9438	Northeast Bank	10855	Dorman Products	11576	Columbia Banking System
9440	Fastenal Company	10867	Pico	11591	Fuelcell Energy
9449	Central Pacific Financial	10876	Regeneron Pharmaceuticals	11592	Starbucks
9457	Ap Pharma	10905	Firstcash	11600	Stratus Properties
9457	Heron Therapeutics	10924	Abraxas Petroleum	11606	Superior Energy Services
9465	Comstock Resources	10937	Isis Pharmaceuticals	11617	Central Garden & Pet
9558	Ii Vi	10937	Ionis Pharmaceuticals	11621	Encore Wire
9576	Johnson Outdoors	10954	Hancock Whitney Bank	11691	First United
9588	Svb Financial	10959	Lifetime Brands	11706	Cheesecake Factory
9604	Mitek Systems	10989	Idexx	11709	Littelfuse
9616	Clean Harbors	10992	Devry Education	11713	On Assignment
9632	Cyberoptics	10992	Adtalem Global Education	11713	Asgn
9645	Community Trust Bancorp	10996	Aes Corp	11778	Patterson Companies
9654	Comtech Telecommunications	11001	State Auto Financial	11857	St Mary Land & Exploration
9677	Intermediate Parfums	11003	Corvel	11857	Sm Energy
9698	Maxim Integrated Products	11011	Sterling Construction	11862	Universal Insurance
9764	Mgm Resorts	11018	Dineequity	11865	Seacor
9798	Office Depot	11018	Dine Brands Global	11871	Hms Corp
9804	Waste Management	11042	Vertex Pharmaceuticals	11879	Ultralife
9847	Peoples United Financial	11050	Progress Software	11901	Iac
9848	Labcorp	11052	Monro	11934	Rocky Brands
9868	Mercer International	11083	Healthways	11946	Cree
9882	Chemical Financial	11083	Tivity Health	11950	Peoples Bancorp
9882	Tcf Financial	11103	Proassurance Corp	11958	Cryolife
9899	Peregrine Pharmaceuticals	11106	Bok Financial	11960	Universal Electronics
9899	Avid Bioservices	11111	National Beverage	11980	Nathans Famous
9971	Lindsay Corp	11112	Biogen Idec	12009	Avid Technology
9977	Mgp Ingredients	11112	Biogen	12011	Intuit
9999	Republic First Bancorp	11161	Old Dominion Freight Line	12015	Shoe Carnival
10020	Champions Oncology	11204	Atlantic Tele Network	12025	Alamo
10039	Hingham Institution	11204	Atn International	12027	Microchip Technology
10107	Bio Techne	11206	Biospecifics Technologies	12036	Chicos Fashion
10110	Trimas	11225	World Acceptance Corp	12038	Stock Yards Bancorp
10210	Cirrus Logic	11235	Wisdomtree Investments	12058	Bancfirst
10218	First Merchants	11238	Sanfilippo John B & Son	12074	Fossil
10256	Cognex	11248	American Superconductor	12083	Sanmina
10288	Neogen	11253	Qualcomm	12086	Trico Bancshares
10299	Hallmark Financial Services	11257	Perrigo		

No.	Company	No.	Company	No.	Company
12097	O Reilly Automotive	13304	Sirius Xm	14781	Cass Information Systems
12108	Jabil Circuit	13311	Callon Petroleum	14795	Oceanfirst Bank
12108	Jabil	13394	Knight Transportation	14801	Acacia Research
12119	Anika Therapeutics	13398	Aspen Technology	14828	Pegasystems
12139	German American Bancorp	13413	Northwest Bancshares	14838	Strayer Education
12147	Titan International	13447	Veeco Instruments	14838	Strategic Education
12185	Papa Johns	13521	Insight Enterprises	14845	Usana Health Sciences
12194	Amerigon	13524	Rent A Center	14859	Geron
12194	Gentherm	13539	Brooks Automation	14863	Teletech
12197	Barrett Business Services	13587	Aci Worldwide	14863	Ttec
12204	Arrowhead Pharmaceuticals	13603	Dollar Tree	14888	Carriage Services
12214	Flir Systems	13617	National Instruments	14915	E Trade
12339	Monarch Casino & Resort	13695	Cbiz	14927	Stericycle
12378	Winmark	13739	Harmonic	14958	Willis Lease
12412	Meta Financial	13753	Resmed	14969	Ocwen
12457	Gartner	13927	Atlas Air Worldwide	14977	Spectrum Pharmaceuticals
12461	Union Bankshares	13938	Kforce	15025	Bjs Restaurants
12461	Union First Bankshares	13943	Integra Lifesciences	15037	Hibbett Sports
12461	Atlantic Union Bankshares	13945	Craft Brewers Alliance	15108	United Natural Foods
12462	Qcr	13945	Craft Brew Alliance	15114	Seachange
12484	Deckers Outdoor	13966	Auburn National Bancorp	15147	Eplus
12499	Activision Blizzard	13978	Smith Micro Software	15158	Accelr8 Technology Corp
12503	Riverview Bancorp	13979	Mednax	15158	Accelerate Diagnostics
12525	First Financial Bankshares	14031	Myriad Genetics	15171	Steel Dynamics
12530	Patterson Uti Energy	14046	Pool Corp	15190	Forrester Research
12539	Itron	14049	Ricks Cabaret International	15199	Viasat
12541	Gibraltar Industries	14049	Rci Hospitality	15243	Lithia Motors
12546	Urban Outfitters	14091	Banner Corp	15267	Sun Hydraulics
12553	Universal Forest Products	14092	Opko Health	15267	Helios Technologies
12557	Century Casinos	14098	Schein Henry	15306	Cerus Corporation
12561	Old Second Bancorp	14143	Advanced Energy Industries	15307	Capital City Bank
12569	Hain Celestial	14152	Netapp	15314	Aastrom Biosciences
12577	Forward Air	14157	Flushing Financial Corp	15314	Vericel
12583	Jds Uniphase	14161	Intevac	15321	Ciena
12583	Viavi Solutions	14175	Northwest Pipe Co	15339	Silgan
12608	New York Community Bancorp	14201	Citrix Systems	15370	Td Ameritrade
12669	Madden Steven	14205	Nuance Communications	15376	Euronet Worldwide
12706	Ufp Technologies	14232	Tg Therapeutics	15385	Wintrust Bank
12740	Medifast	14268	Emcor	15436	Take Two Interactive
12843	Daktronics	14330	Iron Mountain	15450	Codorus Valley Bancorp
12846	Dsp	14355	Ohio Valley Bank	15454	Flagstar Bancorp
12848	Boston Private	14374	Landec	15471	Rambus
12863	Tractor Supply	14382	Andersons	15473	Amazon Com
12902	Biocryst Pharmaceuticals	14387	Columbus Mckinnon	15506	Rf Micro Devices
12908	Olympic Steel	14393	Csg Systems	15506	Qorvo
12917	Nn Inc	14394	Alexion Pharmaceuticals	15507	Avi Biopharma
12926	Copart	14427	Hub	15507	Sarepta Therapeutics
12933	Scansource	14470	Prgx	15534	Simulations Plus
12938	Motorcar Parts Of America	14479	Century Aluminum	15547	Pacific Premier Bancorp
12951	Landmark Bancorp	14494	Kvh Industries	15560	Heska
12994	Southern Missouri Bancorp	14531	Sandy Spring Bancorp	15563	Helix Energy Solutions
13001	American Eagle Outfitters	14572	Sykes Enterprises	15567	8X8
13036	Nektar Therapeutics	14602	Fti Consulting	15568	Dxp Enterprises
13092	Ameris Bancorp	14633	Premier Financial Bancorp	15596	Bank Of The Ozarks
13114	Simpson Manufacturing	14659	Neurocrine Biosciences	15596	Bank Ozk
13115	Penn National Gaming	14715	Entremed	15657	Lakeland Bancorp
13125	La Jolla Pharmaceutical	14715	Casi Pharmaceuticals	15678	Pricesmart
13240	Miller Industries	14722	Trueblue	15692	Faro Technologies
13252	Adtran	14744	Ansys	15697	Childrens Place
13269	Amedisys	14751	Center Bancorp	15739	Osi Systems
13300	Darling International	14751	Connectone Bancorp	15758	Ch Robinson
13300	Darling Ingredients	14762	Dime Community Bancshares	15783	Casella Waste Systems
13304	Sirius Xm Radio	14778	Provident Financial		

No.	Company	No.	Company	No.	Company
15802	Depomed	16488	Compucredit	20222	Ashland
15802	Assertio Therapeutics	16488	Atlanticus	20235	Automatic Data Processing
15841	Oyo Geospace	16492	Heidrick & Struggles	20238	Avery Dennison
15841	Geospace Technologies	16506	Nautilus	20239	Avnet
15890	Power Integrations	16549	Us Concrete	20250	Badger Meter
15916	Dennys	16561	F5 Networks	20257	Ball Corp
15918	Heritage Bank	16578	Sierra Bancorp	20265	Bny Mellon
15921	Timberland Bank	16587	United Therapeutics	20270	Barnes
15926	C&F Bank	16609	Financial Institutions Inc	20277	Baxter International
15928	Rockwell Medical	16612	Stamps Com	20283	Applied Industrial Technologies
15933	Nara Bancorp	16614	Juniper Networks	20284	Becton Dickinson
15933	Bbcn Bancorp	16622	Idsystems	20288	Verizon Communications
15933	Hope Bancorp	16622	Powerfleet	20309	Block H&R
15939	Mercury Computer Systems	16636	American Technology	20312	Manpower
15939	Mercury Systems	16636	Lrad Corp	20315	Boeing
15940	Verisign	16640	Greene County Bank	20325	Abitibibowater
15993	Norwood Bank	16641	Encore Capital	20325	Resolute Forest Products
15994	Pc Connection	16649	First Bancorp	20331	Bristol Myers Squibb
15995	Surmodics	16650	Nic Inc	20342	Brown Shoe Co
16026	Brookline Bancorp	16665	J2 Global	20342	Caleres
16029	Columbia Sportswear	16666	Allscripts	20344	Brunswick
16035	Umpqua	16668	Biomarin Pharmaceutical	20345	Brush Engineered Materials
16037	Colony Bank	16678	Perficient	20345	Materion Corp
16065	Manhattan Associates	16695	1 800 Flowers Com	20357	Cigna
16066	Cra International	16758	Netscout Systems	20361	Cms Energy
16075	Griffin Land And Nurseries	17135	Egain Communications	20363	Cna Financial
16075	Griffin Industrial Realty	17135	Egain	20370	Csx
16080	Amkor Technology	17183	Eagle Bancorp	20371	Cts Corp
16107	Southside Bancshares	17208	Pc Tel	20374	Cabot Corp
16121	Axt	17300	Akamai Technologies	20384	Campbell Soup
16127	Clarus	17303	Plug Power	20392	Carlisle Companies
16127	Black Diamond	17314	Kratos Defense & Security Solutions	20398	Carpenter Technology
16130	Hackett	17317	Collectors Universe	20408	Caterpillar
16149	Microstrategy	17346	Immersion	20421	Centurytel
16188	Costar	17395	Alaska Communications	20421	Centurylink
16268	Crown Castle	17469	National Bankshares	20435	Chemed
16285	Ebay	17473	Pfsweb	20436	Jpmorgan Chase
16290	First Busey	17665	Macatawa Bank	20440	Chevron Corp
16300	Cnb Bank	17669	Bank Of Marin	20448	Cincinnati Bell
16310	21St Century Holding	17936	Antigenics	20462	Cliffs Natural Resources
16310	Federated National Holding	17936	Agenus	20462	Cleveland Cliffs
16310	Fednat Holding	18304	Lakeland Bancorp	20463	Clorox
16313	Prosperity Bancshares	18455	Silicon Laboratories	20468	Coca Cola
16332	Select Comfort Corp	18709	Luminex	20470	Cohu
16332	Sleep Number	20000	Aar Corp	20473	Colgate Palmolive
16347	Infospace	20010	Amr Corp	20483	Citigroup
16347	Blucora	20010	American Airlines	20484	Commercial Metals
16367	First Capital	20017	Abbott Laboratories	20493	Computer Sciences Corp
16368	Lakes Entertainment	20018	Abiomed	20493	Dxc Technology Co
16368	Golden Entertainment	20030	Air Products & Chemicals	20495	Conagra
16374	Provident Bancorp	20035	Alaska Air	20499	Consolidated Edison
16374	Sterling Bancorp	20043	Alleghany	20505	Big Lots
16382	Nvidia	20058	Skyworks Solutions	20518	Cooper Tire & Rubber
16402	East West Bancorp	20060	Alcoa	20523	Corning
16410	Bottomline Technologies	20060	Arconic	20531	Crane Co
16454	Priceline Com	20064	Hess Corp	20537	Crown
16454	Priceline	20068	Abm Industries	20541	Cubic Corp
16454	Booking Holdings	20077	American Electric Power	20543	Cummins
16455	Mks Instruments	20098	American Realty Investors	20546	Curtiss Wright
16457	Capitol Federal	20203	Aon	20550	Wendys Arbys
16466	Extreme Networks	20204	Apache	20550	Wendys Co
16470	Diamond Hill Investment	20207	Archer Daniels Midland	20557	Danaher Corp
16487	American National Bankshares	20217	Arrow Electronics		

No.	Company	No.	Company	No.	Company
20561	Target Corp	20939	Centerpoint Energy	21299	Northeast Utilities
20566	Deere & Co	20945	Hubbell	21299	Eversource Energy
20569	Delta Air Lines	20950	Humana	21300	Xcel Energy
20574	Dte Energy Co	20964	Itt Corp	21303	Northrop Grumman
20582	Diebold	20965	Idacorp	21305	Wells Fargo
20582	Diebold Nixdorf	20968	Illinois Tool Works	21308	Nucor
20585	Diodes	20981	Griffon Corp	21322	Occidental Petroleum
20587	Disney Walt	20990	Ibm	21326	Firstenergy
20592	Dominion Resources	20991	International Flavors & Frag	21328	Oge Energy
20592	Dominion Energy	20994	International Paper	21329	Olin
20594	Donnelley Rr & Sons	20997	Interpublic	21332	Oneok
20596	Dover Corp	21018	Johnson & Johnson	21346	Overseas Shipholding
20608	Duke Energy	21019	Johnson Controls	21348	Oxford Industries
20610	Moodys	21022	Transcontinental Realty Investors	21349	Pulte Homes
20616	Perkinelmer	21033	Kansas City Southern	21349	Pulte
20622	Eastern Co	21035	Westar Energy	21351	Ppg Industries
20626	Eastman Kodak	21035	Evergy	21356	Pg&E
20627	Eaton Corp	21037	Kb Home	21365	Park Electrochemical
20642	Meritage Homes	21041	Kellogg	21365	Park Aerospace
20643	Emerson Electric	21045	Kennametal	21366	Pioneer Natural Resources
20653	Ennis	21055	Kimberly Clark	21367	Parker Hannifin
20659	Equifax	21057	Kirby	21372	American Financial
20662	Eqt	21068	Kroger Company	21376	Ppl Corp
20672	Newmarket	21072	Lsb Industries	21384	Pepsico
20678	Exxon Mobil	21080	Laclede	21385	Tutor Perini
20681	Fmc Corp	21080	Spire	21394	Pfizer
20684	Fpl Inc	21097	Leucadia National	21396	Exelon
20684	Nextera Energy	21097	Jefferies Financial	21398	Altria
20698	Federal Signal	21100	Vector Ltd	21401	Conocophillips
20699	Ferro Corp	21102	Lilly Eli & Co	21402	Phillips Van Heusen
20750	Ford Motor	21105	Lincoln National	21402	Pvh
20763	Freeport Mcmoran	21110	Lockheed Martin	21409	Pinnacle West Capital
20773	Gatx Corp	21111	Loews	21411	Pitney Bowes
20782	Gannett	21121	Louisiana Pacific	21414	Brinks
20782	Tegna	21128	Mbia	21425	Polaris
20786	Gencorp	21130	Mdc Holdings	21430	Portland General Electric
20786	Aerojet Rocketdyne	21132	Mdu Resources	21446	Procter & Gamble
20791	General Dynamics	21158	Marsh & Mclennan	21457	Pnm Resources
20792	General Electric	21161	Masco	21458	Public Service Enterprise
20798	General Mills	21168	Mattel	21482	Rpc
20805	Genesco	21177	Mcdonalds	21515	Rite Aid
20807	Genuine Parts Co	21179	Mcgraw Hill	21526	Rogers Corp
20819	Glatfelter Ph	21179	S&P Global	21530	Rollins
20834	Goodyear Tire & Rubber	21185	Cvs Caremark	21541	Ryder Systems
20841	Grainger Ww	21185	Cvs Health	21543	Edison International
20851	Viad	21188	Merck & Co	21545	Sjw Corp
20868	Halliburton Company	21189	Meredith Corp	21548	Spx Corp
20881	Harley Davidson	21201	Entergy	21551	Safeguard Scientifics
20883	Harris Corp	21205	3M	21578	Schwab Charles
20883	L3Harris Technologies	21206	Allete	21594	Intricon
20884	Harsco	21224	Morgan Stanley	21596	Semtech
20887	Hasbro	21230	Motorola	21599	Service Corp International
20890	Hawaiian Electric Industries	21236	Murphy Oil	21609	Sherwin Williams
20897	Hecla Mining	21242	Nvr Inc	21625	Smith Ao
20898	Heico	21244	Nisource	21629	Smucker Jm
20902	Helmerich & Payne	21245	Nl Industries	21637	South Jersey Industries
20906	Hershey Co	21255	National Fuel Gas	21640	Southern Co
20908	Hewlett Packard	21258	Tenet Healthcare	21645	At&T
20908	Hp	21259	National Presto Industries	21658	Standard Motor Products
20913	Hill Rom	21265	Navistar	21662	Standex International
20922	Holly Corp	21286	Newmont Mining	21664	Stanley Works
20922	Hollyfrontier	21286	Newmont Goldcorp	21664	Stanley Black & Decker
20932	Hormel Foods	21294	Norfolk Southern		

No.	Company	No.	Company	No.	Company
21669	Stepan Company	23511	Packaging Corp America	30913	Wabtec
21693	Superior Industries	24025	Newpark Resources	30958	Hanover Insurance
21694	Superior Uniform	25268	Magellan Health	30975	Davita
21694	Superior Of Companies	25865	Jack In The Box	31205	Schweitzer Mauduit
21698	Sysco	26024	Cabot Oil & Gas	31208	Waters Corp
21718	Tejon Ranch	26048	St Joe Company	31386	Hartford Financial
21722	Allegheny Technologies	26080	Tyler Technologies	31389	Novavax
21723	Teleflex	26087	Benchmark Electronics	31574	Southern Copper
21731	Teradyne	26113	Esco Technologies	31647	Tupperware Brands
21737	Texas Instruments	26127	3D Systems Corp	31661	Factset Research Systems
21743	Textron	26503	Rgc Resources	31710	Guess
21752	Tidewater	27454	Lincoln Electric	31714	Mma Capital
21753	Tiffany & Co	27497	Woodward	31769	Nov
21758	Timken Company	27610	York Water Company	31779	Triumph
21763	Tootsie Roll	27626	Movado	31780	Penske Automotive
21764	Torchmark	27836	Radnet	31832	Ncr
21764	Globe Life	27849	Churchill Downs	31838	Quest Diagnostics
21783	Trinity Industries	28858	Landstar System	31841	Tenneco
21793	Ual Corp	28924	Covanta Holding	31847	Rockwell Automation
21793	United Continental	28947	Northrim Bancorp	31854	International Bancshares Corp
21793	United Airlines	29009	Autozone	31890	Administaff
21794	Ugi Corp	29028	United States Steel	31890	Insperity
21795	Marathon Oil	29052	Ambac Financial	31896	Scbt Financial
21798	Unum	29067	Mgic Investment	31896	First Financial
21808	Ameren	29231	Haynes International	31896	South State Bank
21810	Union Pacific	29327	Wabash National	31907	Unity Bancorp
21814	Unisys	29347	Horace Mann Educators	31933	Vail Resorts
21826	United States Cellular	29432	Callaway Golf	31946	Autoliv
21835	Unitil	29489	Boston Scientific	31979	Knoll
21838	Universal Corporation	29494	Kohls	31994	Comfort Systems Usa
21849	Vf Corp	29505	First Commonwealth Bank	32004	Maximus
21854	Valhi	29506	Franklin Covey	32014	Startek
21859	Varian Medical Systems	29602	Radian	32025	Corrections Corp America
21869	Vishay Intertechnology	29610	Minerals Technologies	32025	Corecivic
21876	Vulcan Materials	29710	Kadant	32039	Jones Lang Lasalle
21880	Wal Mart Stores	29717	Chart Industries	32054	Ametek
21880	Walmart	29780	Ethan Allen Interiors	32066	Valero Energy
21881	Walgreen	29805	Aptargroup	32092	Arvinmeritor
21890	Avista	29863	Reinsurance Of America	32092	Meritor
21900	Weis Markets	29870	Allstate	32093	Yum Brands
21913	Meadwestvaco	29930	Stone Energy	32101	Camden National
21913	Westrock	29930	Talos Energy	32102	Capital Senior Living
21916	Whirlpool	29936	Borgwarner	32108	Dril Quip
21923	Williams Cos	29956	Belden	32111	Group 1 Automotive
21927	Winnebago Industries	29992	Boyd Gaming	32122	Stoneridge
21931	Wisconsin Energy	30020	Amerco	32132	Choice Hotels
21931	Wec Energy	30033	Incyte	32136	Affiliated Managers
21935	Wolverine World Wide	30036	Mi Homes	32158	Mettler Toledo
21936	Foot Locker	30070	Eastman Chemical	32162	Spectrum Brands
21945	Xerox	30106	Plantronics	32164	Sonic Automotive
21948	Harbinger	30249	Albemarle	32174	Corn Products International
21948	Hrg	30251	Beazer Homes	32174	Ingredion
21948	Spectrum Brands	30260	Martin Marietta Materials	32185	Mid Penn Bancorp
21949	Tjx Companies	30381	Eagle Materials	32191	United Rentals
22075	Idex	30388	Lear Corp	33945	Rurban Financial
22095	Tredegar	30446	Greenbrier Companies	33945	Sb Financial
22113	Eog Resources	30474	Reliance Steel & Aluminum	34633	Integrated Electrical Services
22168	Honeywell	30513	Capital One Financial	34633	Ies Holdings
22462	Owens Ill	30521	Mckesson	34660	Quanta Services
22462	Oi Glass	30829	Itt Educational Services	34684	Wr Grace & Co
22807	Mueller Industries	30886	Darden Restaurants	34702	Sealed Air
22856	Macys	30897	Systemax	34715	Red Lion Hotels
23285	Kaiser Aluminum	30898	Hawaiian		

No.	Company	No.	Company	No.	Company
34751	Innospec	38418	Mandalay Digital	42651	Synaptics
34788	Marinemax	38418	Digital Turbine	42769	Cogent Communications
34798	Sempra Energy	38419	Equinix	42784	Mantech
34838	Republic Services	38463	Spartan Stores	42912	United Community Banks
34846	Heritage Commerce	38463	Spartannash	42915	Asbury Automotive
34857	Salisbury Bancorp	39150	Greatbatch	42997	Jetblue Airways
34949	Inovio Biomedical	39150	Integer Corp	43014	Lannett
34949	Inovio Pharmaceuticals	39159	Durect	43140	Computer Programs & Systems
34964	American Axle	39177	Ttm Technologies	43145	Netflix
34977	Entercom Communications	40143	Coach	43146	Overstock Com
35026	Consol Energy	40143	Tapestry	43147	Pinnacle Financial Partners
35026	Cnx Resources	40213	Shenandoah Telecom Company	43149	Verint Systems
35031	Jefferies	40996	Novatel Wireless	43159	Enpro Industries
35037	Trex Company	40996	Inseego	43249	Biodelivery Sciences
35048	Goldman Sachs	40998	Rigel Pharmaceuticals	43253	Hooker Furniture
35057	Wesco	41007	Peapack Gladstone Bank	43261	West Bank
35177	Lennox International	41060	Harvard Bioscience	43281	Westwood
35205	Mercantile Bank	41080	Fluor Corp	43326	Calavo Growers
35222	Devon Energy	41154	Align Technology	43328	Kirklands
36336	Blackrock	41157	Exact Sciences	43332	Red Robin Gourmet Burgers
36337	Circor	41159	Hanmi Bank	43340	Cit Bank
36338	Citizens Holding	41168	Global Payments	43449	First Pactrust Bancorp
36364	Agilent Technologies	41257	Marine Products Corp	43449	Bank Of California
36380	Teledyne Technologies	41259	Oil States International	43508	Saia
36949	Plasmatech Biopharmaceuticals	41265	Antares Pharma	43519	Carmax
36949	Abeona Therapeutics	41367	Flowers Foods	43520	Cimarex Energy
36952	Edwards Lifesciences	41388	First Community Bancshares	43620	Wynn Resorts
36954	Energizer	41391	Seattle Genetics	43626	Dicks Sporting Goods
36954	Edgewell Personal Care	41460	First Citizens Bank	43631	Natural Gas Services
37138	Metlife	41460	Civista Bancshares	43633	Newcastle Investment
37148	Cabot Microelectronics	41464	Shore Bancshares	43633	Drive Shack
37154	Exelixis	41562	Taser International	43688	Ceva
37161	Healthstream	41562	Axon Enterprise	43689	Parke Bancorp
37167	Lexicon Pharmaceuticals	41564	United Security Bankshares	43690	Portfolio Recovery Associates
37168	Liveperson	41580	Peabody Energy	43690	Pra
37176	On Semiconductor	41671	Alliance Data Systems	43691	Safety Insurance
37188	Sangamo	41673	Fidelity National Information Services	43845	First Community Corp
37195	Vasco Data Security	41678	Fmc Technologies	43857	Provident Financial Services
37195	Onespan	41813	Natus Medical	43861	Nve Corp
37472	Regis	41820	Pdf Solutions	44055	Heartland Financial
37496	Nrg Energy	41822	Wright Medical	44115	Formfactor
37524	Pixelworks	41870	Zimmer	44168	Cavco Industries
37528	Sonus Networks	41870	Zimmer Biomet	44176	Netgear
37528	Ribbon Communications	41979	Mackinac Financial Corp	44184	Molina Healthcare
37659	Berkshire Hills Bancorp	41980	Omnicell	44272	Graphic Packaging Holding
37660	Charles River Laboratories	42114	Preformed Line Products	44290	Providence Service
37664	Community Health Systems	42265	Cross Country Healthcare	44292	Texas Capital Bancshares
37682	Visteon	42273	Wellpoint	44293	Univest
37716	Hawthorn Bancshares	42273	Anthem	44497	Lkq Corp
37718	Pacwest Bancorp	42285	Principal Financial	44505	Biosante Pharmaceuticals
37726	Insmed	42396	Penns Woods Bancorp	44505	Ani Pharmaceuticals
37727	Intuitive Surgical	42400	Amn Healthcare	44506	Carters
37737	Pacific Mercantile Bancorp	42401	Acuity Brands	44612	Synnex
37913	Axcelis Technologies	42402	Advance Auto Parts	44613	Whiting Petroleum
37917	Arena Pharmaceuticals	42430	Weight Watchers	44619	Conns
37931	Endo Pharmaceuticals	42430	Ww International	44623	Marlin Business Services
37931	Endo Health Solutions	42517	Five Star Quality Care	44631	Tessera Technologies
37931	Endo International	42517	Five Star Senior Living	44631	Tessera Holding
37932	Entegris	42524	Prudential Financial	44631	Xperi
37938	Illumina	42533	Westfield Financial	44633	Zhone Technologies
37952	Pain Therapeutics	42533	Western New England Bancorp	44633	Dasan Zhone Solutions
37952	Cassava Sciences	42540	Centene Corp	44689	Marshall Edwards
38406	Bruker	42541	1St Constitution Bancorp		

No.	Company	No.	Company	No.	Company
44689	Mei Pharma	46112	Summit Financial	50323	Gulfport Energy
44699	American Equity Investment Life	46156	Huntsman	50481	Transdigm
44705	Compass Minerals	46162	Prestige Brands	50489	Green Plains
44712	Kronos Worldwide	46162	Prestige Consumer Healthcare	50600	Targacept
44726	Tempur Pedic	46169	Wright Express	50600	Catalyst Biosciences
44726	Tempur Sealy	46169	Wex Inc	50601	Vanda Pharmaceuticals
44727	Universal Technical Institute	46272	Enterprise Bancorp	50609	General Finance
44816	Petmed Express	46273	Enterprise Financial Services	50694	Delek U S
44885	Dynavax Technologies	46281	Kearny	50706	Vonage
44891	Bancorp	46282	Nasdaq Omx	50731	First Bancshares
44892	Hilltop	46282	Nasdaq	50732	Transcept Pharmaceuticals
44893	Assurant	46284	Preferred Bank	50732	Paratek Pharmaceuticals
44994	Cutera	46285	Threshold Pharmaceuticals	50830	Community Bankers Trust
44995	Central Valley Community Bancorp	46285	Molecular Templates	50854	Alphatec
44999	Signature Bank	46287	Universal Truckload Services	50861	Home Bancshares
45004	Ultra Clean	46287	Universal Logistics	50864	Luna Innovations
45081	Corcept Therapeutics	46441	B Of I Holding	50865	New Century Bancorp
45082	Cytokinetics	46441	Axos Financial	50865	Select Bancorp
45176	Greenhill & Co	46444	Prudential Bank	50867	Pgt Innovations
45186	Express 1 Expedited Solution	46559	Dexcom	50869	Cardiovascular Systems
45186	Xpo Logistics	46691	Citi Trends	50870	Synchronoss Technologies
45190	Acadia Pharmaceuticals	46692	Morningstar	50965	Wyndham
45191	Alnylam Pharmaceuticals	46694	Plumas Bancorp	51096	Hanesbrands
45192	Angiodynamics	46697	Zumiez	51110	Innerworkings
45197	Nuvasive	46701	Air Transport Services	51196	Western Union
45203	Standard Parking	46844	Bankfinacial	51198	Commvault Systems
45203	Sp Plus	46846	Builders Firstsource	51205	Icf International
45286	Moneygram	46857	Lhc Group	51209	Porter Bancorp
45288	Salesforce Com	46889	Treehouse Foods	51209	Limestone Bancorp
45295	Bank Of Commerce	46890	Western Alliance Bank	51213	Ziopharm Oncology
45305	Momenta Pharmaceuticals	46992	Flotek Industries	51306	Ehealth
45379	Dominos Pizza	47009	Consolidated Communcations	51308	Exlservice
45380	Enersys	47013	Expedia	51311	Lemaitre Vascular
45417	Blackbaud	47018	Genco Shipping & Trading	51321	Armstrong World Industries
45425	Mannkind	47179	Acco Brands	51337	Owens Corning
45467	Cohen & Steers	47183	Cf Industries	51338	Saic
45475	Westlake Chemical	47203	Atricure	51338	Leidos
45478	Commercial Vehicle	47214	Omega Flex	51421	Emergent Biosolutions
45555	Beacon Roofing Supply	47216	Rbc Bearings	51423	Hertz
45559	Southern First Bancshares	47217	Ruths Hospitality	51423	Herc Holdings
45679	B&G Foods	47422	Ameriprise Financial	51426	Kbr
45695	Mosaic Company	47428	Global Cash Access	51442	Catalyst Pharmaceutical
45708	Ada Es	47428	Everi	51447	First Solar
45708	Advanced Emissions Solutions	47864	Fidelity National	51454	Orbcomm
45716	Huron Consulting	47869	Tal International	51457	Southern National Bancorp
45728	Theravance	47877	First Business Bank	51459	Willdan
45732	Texas Roadhouse	47880	Investors Bancorp	51546	Altra
45865	Halozyme Therapeutics	47887	Waterstone Financial	51547	Allegiant Travel
45869	Neenah Paper	48766	Amerisafe	51552	Great Lakes Dredge & Dock
45871	Ormat Technologies	48773	Irobot	51555	Ipg Photonics
45878	Marketaxess	48778	Sunpower	51559	Medicinova
45879	Monolithic Power Systems	48786	Brookdale Senior Living	51565	Carrols Restaurant
45886	Usa Mobility	48793	Intercontinentalexchange	51568	Sally Beauty
45886	Spok	49991	Bcb Bancorp	51635	Employers
45993	Ames National	49994	Core Mark	51651	Aerovironment
46014	Bill Barrett	50000	Loral Space & Communications	51792	Information Services
46014	Highpoint Resources	50016	Live Nation Entertainment	51803	Accuray
46024	Las Vegas Sands	50184	Chipotle Mexican Grill	51811	National Cinemedia
46026	Macquarie Infrastructure	50199	H & E Equipment Services	51815	Us Auto Parts Network
46102	W & T Offshore	50290	Acorda Therapeutics	51819	Synta Pharmaceuticals
46103	Citizens & Northern	50293	Crocs	51819	Madrigal Pharmaceuticals
46107	Majesco Entertainment	50297	Liquidity Services	51962	Broadridge
46107	Polarityte	50314	Koppers		

No.	Company	No.	Company	No.	Company
51966	Domtar	52967	Cardionet	53453	Tesla
51992	Glu Mobile	52967	Biotelemetry	53456	Babcock & Wilcox
51993	Gsi Technology	52968	Heritage Crystal Clean	53456	Bwx Technologies
51998	Super Micro Computer	52970	Midwestone Financial	53461	Envestnet
52115	Cinemark	52975	Hillenbrand	53497	Realpage
52120	Metropcs Communications	52978	Philip Morris	53510	Amyris
52120	T Mobile	52985	American Water Works	53544	Pacific Biosciences
52134	Essa Bancorp	52993	Intrepid Potash	53546	Vera Bradley
52142	Tfs Financial	53000	Quanex Building Products	53554	General Motors
52247	Aecom	53008	Colfax	53556	Howard Hughes
52251	Cai International	53043	Bridge Bancorp	53557	Inphi Corp
52253	Continental Resources	53050	John Bean Technologies	53561	Park City
52284	Biodel	53059	Energy Recovery	53576	Lpl Investment
52284	Albireo Pharma	53060	Homeowners Choice	53576	Lpl Financial
52287	Clean Energy Fuels	53060	Hci Group	53585	Zogenix
52292	Amicus Therapeutics	53076	Primoris Services	53609	First Republic Bank
52301	Insulet	53077	Tree Com	53610	Fleetcor Technologies
52303	Techtarget	53077	Lendingtree	53621	Targa Resources Corp
52369	Biofuel Energy	53082	Myr Group	53622	Walker & Dunlop
52369	Green Brick Partners	53096	Digimarc	53624	Acnb
52376	Infinera Corp	53097	First Savings Financial	53632	Rignet
52378	Limelight Networks	53098	Home Bancorp	53635	Ventrus Biosciences
52381	Comscore	53106	Grand Canyon Education	53635	Assembly Biosciences
52396	Discover Financial Services	53108	Clearwater Paper	53639	Oconee Federal
52408	Pros Holdings	53113	Virtus Investment Partners	53647	Bankunited
52520	Dice	53116	Oak Valley Bancorp	53649	Demand Media
52520	Dhi	53137	Rosetta Stone	53649	Leaf Ltd
52547	Lululemon	53141	Orrstown Financial Services	53668	Neophotonics
52669	Masimo	53155	Sharps Compliance	53673	Acelrx Pharmaceuticals
52670	Mercadolibre	53184	Globe Specialty Metals	53677	Fluidigm
52677	Virtusa	53187	Territorial Bancorp	53682	Pacira Pharmaceuticals
52684	Concho Resources	53214	Select Medical	53682	Pacira Biosciences
52690	Exterran	53234	Mistras	53687	Ally Financial
52690	Archrock	53242	Addus Homecare	53694	Futurefuel
52762	Teradata	53247	Echo Global Logistics	53696	Hca Healthcare
52773	First Financial Northwest	53252	Omeros	53697	Huntington Ingalls
52785	Townebank	53256	Verisk Analytics	53702	Cornerstone Ondemand
52788	Ulta Salon Cosmetics	53264	Dollar General	53704	Servicesource
52788	Ulta Beauty	53286	Fortinet	53763	Thermon
52793	Cvr Energy	53293	Zagg	53776	Spirit Airlines
52830	Energysolutions	53300	Kar Auction Services	53779	Boingo Wireless
52838	Searchmedia	53301	Kraton Performance Polymers	53810	Marathon Petroleum
52838	Tiger Media	53301	Kraton	53836	Suncoke Energy
52838	Idi Inc	53305	Pilgrims Pride	53842	Chefs Warehouse
52838	Cogint	53339	Generac	53843	Dunkin Brands
52838	Fluent	53349	Quinstreet	53876	Fortune Brands Home & Security
52839	Lumber Liquidators	53353	Calix	53882	Farmers National Bank
52840	Msci	53366	Aveo Pharmaceuticals	53883	Lcnb
52845	Kennedy Wilson	53374	Ss & C Tech	53896	Xylem
52847	Sandridge Energy	53383	Primerica	53923	Marriott Vacations
52854	American Public Education	53389	Codexis	53929	Acadia Healthcare
52858	Ensign	53399	Sps Commerce	53930	Angies List
52863	Northfield Bancorp	53402	Eagle Bancorp Montana	53931	Clovis Oncology
52874	Athersys	53405	Douglas Dynamics	53932	Groupon
52875	Cardtronics	53406	Express	53938	Bonanza Creek Energy
52884	Orion Energy Systems	53407	First American Financial	53941	Laredo Petroleum
52889	Titan Machinery	53419	Genmark Diagnostics	53947	Wpx Energy
52892	Forestar	53423	Limoneira	53958	Coronado Biosciences
52898	K12	53428	Telenav	53958	Fortress Biotech
52920	Meridian Bancorp	53438	Oasis Petroleum	53964	Tripadvisor
52956	Dana Holding	53439	Qep Resources	53970	Guidewire Software
52956	Dana Incorporated	53440	Six Flags Entertainment	53972	Post Holdings
52958	Iridium Communications	53443	Vishay Precision		

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No.	Company	No.	Company	No.	Company
53977	Renewable Energy	54366	Seaworld Entertainment	54656	Del Taco Restaurants
53978	Verastem	54373	Chimerix	54657	Lgi Homes
53983	Epam Systems	54377	Independent Bank	54662	Tandem Diabetes Care
53987	Matador Resources	54388	Channeladvisor	54666	Aramark
53988	Proto Labs	54396	Ing Us	54672	Hilton Worldwide
53989	Us Silica	54396	Voya Financial	54680	Kindred Biosciences
53992	Brightcove	54401	Quintiles	54685	Xencor
53993	Bazaarvoice	54401	Iqvia	54702	One Gas
53994	Chemocentryx	54407	Capitol Acquisition Corp Ii	54703	Platform Specialty Products
53998	Caesars Entertainment	54407	Lindblad Expeditions	54703	Element Solutions
54001	Homestreet	54408	Customers Bancorp	54706	Santander Consumer Usa
54006	Allison Transmission	54410	Epizyme	54713	Cara Therapeutics
54013	Regional Management Corp	54422	Tristate Capital	54714	Celladon
54014	Rexnord	54424	Bluebird Bio	54714	Eiger Biopharmaceuticals
54018	Vocera Communications	54426	Cdw	54717	Dicerna Pharmaceuticals
54026	Enphase Energy	54427	Esperion Therapeutics	54718	Glycomimetics
54027	Galectin Therapeutics	54428	Gogo	54719	Hennessy Capital Acquisitn
54029	Macom Technology Solutions	54429	Hd Supply	54719	Blue Bird
54031	Parametric Sound	54432	Nanostring Technologies	54720	Intra Cellular Therapies
54031	Turtle Beach	54434	Ohr Pharmaceutical	54723	Ultragenyx Pharmaceuticals
54037	Forum Energy Technologies	54434	Neubase Therapeutics	54724	Retrophin
54041	Mrc Global	54436	Ptc Therapeutics	54731	Boulevard Acquisition
54048	Phillips 66	54448	Global Telecom & Technology	54731	Agrofresh Solutions
54061	Fiesta Restaurant	54448	Gtt Communications	54733	Concert Pharmaceuticals
54063	Proofpoint	54476	Agios Pharmaceuticals	54736	Eagle Pharmaceuticals
54064	Splunk	54484	Mirati Therapeutics	54737	Flexion Therapeutics
54087	Supernus Pharmaceuticals	54499	Murphy Usa	54739	Inogen
54099	Alexander & Baldwin	54509	Fox Factory	54740	National General Corp
54109	Servicenow	54510	Marrone Bio Innovations	54743	Revance Therapeutics
54113	Chembio Diagnostics	54513	Sprouts Farmers Market	54748	Varonis Systems
54136	Natural Grocers	54515	Stock Building Supply Holdings	54750	Installed Building Products
54139	Palo Alto Networks	54515	Bmc Stock Holdings	54752	Knowles
54141	Chuys	54544	Science Applications International Corp	54754	New Media Investment
54146	Five Below	54548	Applied Optoelectronics	54754	Gannett
54147	Fs Bancorp	54550	Benefitfocus	54756	A10 Networks
54149	Howard Bancorp	54556	Fireeye	54762	Cbs Outdoor Americas
54151	Hometrust Bancshares	54558	Five Prime Therapeutics	54762	Outfront Media
54162	Bloomin Brands	54561	Ophthotech	54763	Coupons Com
54194	Lifevantage	54561	Iveric Bio	54763	Quotient Technology
54195	Qualys	54567	Tri County Financial	54764	Enlink Midstream
54198	Berry Plastics	54567	Community Financial	54769	Q2 Holdings
54198	Berry Global	54568	Acceleron Pharma	54772	Trinet
54207	Puma Biotechnology	54570	Antero Resources	54777	Applied Genetic Technologies
54208	Realogy	54574	Burlington Stores	54779	Akebia Therapeutics
54209	Shutterstock	54577	Cooper Standard	54780	A Mark Precious Metals
54222	Diamondback Energy	54584	Marcus & Millichap	54781	Aquinox Pharmaceuticals
54224	Intercept Pharmaceuticals	54593	Springleaf	54781	Neoleukin Therapeutics
54265	Restoration Hardware	54593	Onemain	54786	Lands End
54270	Chemung Financial	54601	Aerie Pharmaceuticals	54790	Paylocity Holding
54278	Neogenomics	54602	Commscope Holding	54792	Recro Pharma
54284	United Insurance	54604	Endurance International	54796	2U
54287	Abbvie	54605	Fate Therapeutics	54797	Versartis
54297	Bright Horizons Family Solutions	54614	Macrogenics	54797	Aravive
54303	Tri Pointe	54615	Potbelly	54798	Energous
54318	Boise Cascade	54619	Sorrento Therapeutics	54805	Grubhub
54331	Imprimis Pharmaceuticals	54620	Veracyte	54812	Paycom Software
54331	Harrow Health	54627	Chegg	54816	Adamas Pharmaceuticals
54332	First Internet Bancorp	54628	Container Store	54820	Five 9
54334	Exone	54638	Twitter	54824	Navient
54344	Model N	54651	First Bank	54827	Peoples Financial Services
54351	Enanta Pharmaceuticals	54653	Houghton Mifflin Harcourt	54830	Sabre
54355	Nv5	54655	Karyopharm Therapeutics	54831	Sportsmans Warehouse
54361	Evertec	54656	Levy Acquisition		

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No.	Company	No.	Company	No.	Company
54835	Vital Therapies	55050	Great Western Bancorp	55296	Kraft Heinz
54835	Immunic	55051	Hubspot	55297	Alarm Com
54841	Heritage Insurance	55059	Vivint Solar	55302	Catabasis Pharmaceuticals
54844	Now Inc	55066	Atara Biotherapeutics	55313	Lantheus
54851	Zendesk	55070	Calithera Biosciences	55315	Seres Therapeutics
54855	Agile Therapeutics	55082	Dave & Busters Entertainment	55317	Pieris Pharmaceuticals
54857	Aldeyra Therapeutics	55084	Sientra	55321	Wingstop
54858	Bankwell Financial	55085	Veritex	55327	Glaukos
54861	First Mid Bancshares	55095	Nevro	55335	Transunion
54867	Resonant	55102	Adma Biologics	55337	Univar
54870	Servisfirst Bancshares	55104	Capnia	55341	Paypal
54875	Truecar	55104	Soleno Therapeutics	55342	Barnes & Noble Education
54876	Rayonier Advanced Materials	55105	Coherus Biosciences	55343	Lumentum
54878	Timkensteel	55109	First Foundation	55348	Chiasma
54881	Amphastar Pharmaceuticals	55110	Fibrogen	55349	Commerce Union Bancshares
54883	Ardelyx	55111	Freshpet	55349	Reliant Bancorp
54884	Cymabay Therapeutics	55114	Joint Corp	55350	Cryoport
54886	Cellular Biomedicine	55117	Neothetics	55358	Global Partner Acquisition
54891	Michaels Companies	55117	Evofem Biosciences	55358	Purple Innovation
54892	Mobileiron	55119	Pra Health Sciences	55359	Hennessy Capital Acqn Corp Ii
54898	Radius Health	55123	Triumph Bancorp	55359	Daseke
54907	Arista Networks	55124	Upland Software	55361	Live Oak Bancshares
54908	Aspen Aerogels	55129	Lendingclub	55362	Mcbc Holdings
54909	Century Communities	55133	New Relic	55362	Mastercraft Boat
54912	Eclipse Resources	55135	On Deck Capital	55364	Nantkwest
54912	Montage Resources	55143	Bellicum Pharmaceuticals	55365	Natera
54920	Servicemaster	55146	Cytosorbents	55366	Ollies Bargain Outlet
54923	Veritiv	55163	Vista Outdoor	55368	Provident Bancorp
54929	Advanced Drainage Systems	55170	First Northwest Bancorp	55369	B Riley Financial
54931	Catalent	55171	County Bancorp	55370	Rapid7
54936	Synchrony Financial	55174	Quinpario Acquisition Corp 2	55377	Ooma
54939	Tribune Publishing	55174	Exela Technologies	55379	Teladoc
54939	Tronc	55184	Invitae	55389	Aimmune Therapeutics
54940	Trupanion	55191	Bellerophon Therapeutics	55393	Global Blood Therapeutics
54946	Avalanche Biotechnologies	55196	Inotek Pharmaceuticals	55396	Sunrun
54946	Adverum Biotechnologies	55196	Rocket Pharmaceuticals	55400	Spx Flow
54951	Caredx	55197	Lion Biotechnologies	55401	J Alexanders
54953	Contrafect	55197	Iovance Biotherapeutics	55404	Csw Industrial
54955	Healthequity	55200	Pacific Datavision	55410	Regenxbio
54958	Iradimed	55200	Pdvwireless	55417	Penumbra
54959	Investar Holding	55200	Anterix	55421	Hewlett Packard
54960	El Pollo Loco	55212	Harmony Merger	55423	Atlantic Capital Bancshares
54963	Marinus Pharmaceuticals	55212	Nextdecade	55424	Exterran
54967	Minerva Neurosciences	55214	Solaredge Technologies	55428	Performance Food Group
54968	Ocular Therapeutix	55222	Aduro Biotech	55451	Allegiance Bancshares
54971	Sage Therapeutics	55224	Blueprint Medicines	55452	Aclaris Therapeutics
54973	Spark Enercy	55225	Carbylan Therapeutics	55453	Anavex Life Sciences
54980	Intersect Ent	55225	Kalvista Pharmaceuticals	55454	Cerecor
54985	Ryerson Holding	55226	Cidara Therapeutics	55456	Cytomx Therapeutics
54996	Otonomy	55227	Corbus Pharmaceuticals	55458	Edge Therapeutics
55001	Vectrus	55229	Etsy	55458	Pds Biotechnology
55006	Citizens Financial	55236	Viking Therapeutics	55461	Mirna Therapeutics
55022	Brainstorm Cell Therapeutics	55238	Xbiotech	55461	Synlogic
55023	Cdk Global	55244	Party City Holdco	55462	Myokardia
55026	Gwg Holdings	55270	Collegium Pharmaceutical	55468	Surgery Partners
55027	Middlefield Bank	55285	Gannett	55477	Axsome Therapeutics
55033	Keysight Technologies	55287	Cable One	55481	First Guaranty Bancshares
55034	Halyard Health	55288	Babcock & Wilcox Enterprises	55484	Kura Oncology
55034	Avanos Medical	55289	Topbuild	55487	Match
55035	Kimball Electronics	55290	Chemours	55490	Voyager Therapeutics
55036	Cb Financial Services	55291	Horizon Global	55493	Avangrid
55042	Boot Barn	55292	Energizer Holdings	55508	Smartfinancial
55047	Enova	55295	Seaspine		

No.	Company	No.	Company
55512	Workhorse	55806	Hilton Grand Vacations
55513	Gcp Applied Technologies	55807	Park Hotels & Resorts
55517	Manitowoc Foodservice	55825	Penn Virginia
55517	Welbilt		
55521	Editas Medicine		
55525	Nicolet Bankshares		
55529	Armstrong Flooring		
55537	Syndax Pharmaceuticals		
55538	Viewray		
55543	Aeglea Biotherapeutics		
55544	Chromadex		
55545	Global Water Resources		
55547	Pavmed		
55551	American Renal Associates		
55557	Ingevity		
55562	Acacia Communications		
55567	Midland States Bancorp		
55568	Intellia Therapeutics		
55570	Pulse Biosciences		
55577	Gms Inc		
55580	Siteone Landscape Supply		
55581	Turning Point Brands		
55582	Us Foods		
55584	Hertz		
55585	Fortive Corp		
55587	Harborone Bancorp		
55589	Nanthealth		
55591	Selecta Biosciences		
55593	Syros Pharmaceuticals		
55595	Atkore		
55608	Kadmon		
55617	Kinsale Capital		
55623	Impinj		
55625	Tactile Systems Technology		
55627	Tpi Composites		
55668	Atomeraorporated		
55668	Atomera		
55670	First Hawaiian		
55672	Medpace		
55673	Protagonist Therapeutics		
55677	At Home		
55684	Advansix		
55685	Donnelley Financial Sol		
55691	Capstar Financial		
55692	Everbridge		
55694	Fulgent Genetics		
55700	Tabula Rasa Healthcare		
55704	Elf Beauty		
55705	Fb Financial Corp		
55711	Valvoline		
55716	Yum China		
55718	Alcoa		
55746	Blackline		
55747	Coupa Software		
55749	Forterra		
55752	Irhythm Technologies		
55760	Mammoth Energy Services		
55775	Acushnet		
55776	Advanced Disposal Services		
55778	Lamb Weston		
55795	Tapimmune		
55795	Marker Therapeutics		
55805	Conduent		

B Search Terms on ESG Topics on Google

The search terms used to construct the search volume indices on ESG, environmental (E), social (S) and governance (G) topics are shown below.

Notably, search queries from Google comprise all searches whereby the search term(s) has/have been passed, including searches in combination with other words. The queries are case-insensitive.

Search terms with two words or more include searches containing the words in any order. More information on how Google Trends derives the search index can be found on Google (2021).

ESG	Environmental	Social	Governance
CSR	Acid rain	Animal testing	Board composition
ESG	Biodiversity	Business disabilities	Board members
ESG investing	Carbon footprint	Business ethnicity	Board of directors
ESG screening	Climate change	Career development	Code of business conduct
Ethical investing	Conservation	Child labor	Company polices
Green investments	Deforestation	Customer complaints	Company transparency
Impact investing	Endangered species	Data privacy	Corporate compliance
Responsible investing	Environment	Equal rights	Corporate fraud
Responsible investments	Global warming	Equality	Corporate governance
Socially responsible investing	Globalization	Fair trade	CSR strategy
Sustainability	Greenhouse gas	Gender equality	Executive compensation
Sustainable	Ozone layer	Health and safety	Litigation risk
Sustainable investments	Pollution	Human rights	Management structure
	Renewable energy	Inequality	Public disclosure
		Labor practices	Risk management
		LGBT business	Shareholder rights
		Product quality	Shareholders interest
		Salary gap	Sustainable governance
		Social impact	Sustainable growth
		Social responsibility	Takeover defenses
		Social rights	Tax reporting
		Staff turnover	Whistleblower
		Work life balance	
		Working conditions	