The Impact of ESG Performance on Shareholder Value During Market Turmoil Caused by COVID-19

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ABSTRACT

The global economic downturn triggered by the ongoing coronavirus disease 2019 (COVID-19) has been reflected in stock markets around the world. This paper examines whether a sustainable use of resources, proxied by ESG scores, can contribute to share price resilience during the COVID-19 crisis. By also analysing the durability of earnings per share (EPS) analyst consensus forecasts during the first five months in 2020, a statement can be made on where potential differences in share price returns are originated. For the analysis I utilize a sample of S&P 500 firms in the USA, and control for industry affiliation, firm size, leverage, stock price volatility, and earnings surprises were utilized. I find that environmental activities positively affect actual and abnormal share price returns in the first period, from January 01, 2020 to March 23, 2020 . None of the other scores offer explanatory power for returns. In the recovery phase, from March to May, a negative link between ESG dimensions and stock price returns can be established. This finding, combined with the insight that generally no relationship can be determined between the ESG dimensions and EPS forecasts, leads to the conclusion that investors seem to attach greater importance to performance aspects like liquidity and short-term profitability during the turmoil.

Keywords: COVID-19, ESG, stock market

RESUMO

A queda económica global despoletada pela presente pandemia de COVID-19 tem impactuado o mercado de ações, por tudo o mundo. Esta dissertação investiga se o uso de recursos sustentáveis poderá contribuir para resiliência do preço das ações durante a crise do COVID-19, usando pontuações ESG como *proxy*. Analisando igualmente o consenso entre especialistas sobre as projeções realizadas durante os primeiros cinco meses de 2020 relativamente à durabilidade do resulto líquido por ação, é possível concluir sobre potenciais diferenças nos retornos por ação gerados. Utilizei uma amostra de empresas presentes no S&P 500 nos EUA, controlando por afiliação da indústria, dimensão da empresa, endividamento, volatilidade no preço por ação, e lucros não esperados. Deste modo, pude concluir que atividades ambientais impactam positivamente no preço atual e irregular das ações no primeiro período. Nenhuma das restantes pontuações parecem explicar os retornos. Durante a fase de recuperação, entre março e maio, existe uma tendência negativa entre dimensões ESG e o retorno das ações. A presente conclusão, em conjunto com conhecimento de que, na generalidade, não existe uma relação entre as dimensões ESG e estimativas sobre o lucro por ação, levam à conclusão de que os investidores parecem atribuir maior importância a aspetos referentes ao desempenho, como liquidez e lucratividade de curto prazo durante a crise.

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List of Abbreviations

3FF	Fama-French three-factor model
4C	Carhart four-factor model
5FF	Fama-French five-factor model
bn	billion
CBOE VIX	CBOE Volatility Index
cf.	confer
COVID-19	Coronavirus disease
CSR	Corporate Social Responsibility
EPS	Earnings per share
ESG	Environmental, Social, and Governance
FY	Fiscal year
GDP	Gross Domestic Product
IFRS	International Financial Reporting Standards
S&P 500	Standard & Poor's 500 stock index
SEC	Security and Exchange Commission
tn	trillion
US	United States
USA	United States of America
USD	US-Dollar
VIX	Volatility index

1. Introduction

For a considerable period now, there has been growing concern about how firms deal with available resources, whether natural, human, or any other kind. Evidence for this are the growing popularity of environmental, social, and governance (ESG) performance ranking of firms, the widespread implementation of these rankings in investment decision models among such as institutional investors, and the growing number of studies addressing ESG scores. One commonly used score that quantifies ESG performance, on a scale from 0 to 100, according to standardized criteria is provided by Thomson Reuters.

Academics, focusing on the relation between ESG or corporate social responsibility (CSR) respectively and other aspects of firms, have had remarkable results in recent years. For example, Cheng, Ioannou, and Serafeim (2014) find that environmental activities reduce capital constraints. Among the authors who deliver direct implications for the impact of ESG performance on a corresponding firm's stock price are Fatemi, Glaum, and Kaiser (2018) who find a positive relation between firm value and environmental activities. Another insight is presented by Bouslah, Kryzanowski, and M'Zhali (2013) who examine the relation of firm risk, systematic and idiosyncratic, and ESG performance stating that the two are positively related.

While researchers presented empirical evidence for these relationships, more and more investors, both private and public, started to actively incorporate ESG factors into their investment strategies. Private equity (PE) investors are increasingly investing in sustainability issues: one of the most reputable PE firms, Kohlberg Kravis Roberts & Co. closed a USD 1.3bn Global Impact Fund that only invests in business models providing solutions to an environmental or social challenge. On the public side, an institutional investor survey in 2018 showed that – at that time already – 80% of institutions had an ESG component as part of their investment strategies. In a more recent survey from this year, 100% of respondents state that ESG risks have become more important to them throughout the 12 months prior to the survey with climate change being the main aspect (86%).

The aforementioned indicators clearly show the growing importance of ESG performance, both for managers and investors in relatively stable times. The coronavirus disease 2019 (COVID-19) caused uncertainty all over the globe which has also been reflected in stock markets. It has put business models to the test, unsettled investors, and caused liquidity shortages. Therefore, it

provides an extraordinary opportunity to test whether the benefits of ESG performance, as introduced before, continue to exist in turbulent times. More generally, this study aims to expand existing literature by analyzing whether ESG performance has an impact on shareholder value in such stressful times and therefore provide guidance for managers and investors in their decision-making processes when they incorporate ESG components in their strategic considerations or investment strategies, respectively. To do this, I examine actual and abnormal share price returns on four different ESG dimensions controlling for a variety of covariates. Moreover, I study where potential differences originate. Specifically, I test whether ESG performance influences the cash flow of the firms themselves or whether it affects investor decisions in highly volatile times too. To that effect, I include another test where I examine the relation between analyst consensus earnings forecasts and the ESG dimensions.

With regard to share price returns, I find that none of the ESG dimensions has an impact at the peak of the turmoil. Furthermore, the results show that it is important to examine the downturn and recovery phase individually: In the first phase a positive relationship between environmental activities and share price returns can be established, while in the recovery phase high scores in all of the four ESG dimensions are related to lower returns. Finally, none of the ESG dimensions do appear to have had a positive impact on cash flow or earnings-generating aspects of the business during the crisis.

The findings of this paper can be used in several ways. Firstly, it extends existing literature that analyzes the importance of sustainable budgeting of resources for businesses and how this is perceived by the investors of the respective firm. Furthermore, investors can incorporate the outcomes for future investment decisions. Finally, managers can also use the results as a decision-making guide to determine if and how to pursue ESG activities.

The remainder of this paper is organized as follows: Section 2 discusses related literature and develops the hypotheses of this study. In Section 3, I outline the testing methodologies. Section 4 introduces data and key descriptive statistics. All relevant results are presented and discussed in Section 5. Section 6 concludes

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2. Literature Review

2.1 The Effect of CSR and ESG Performance on Risk and Other Characteristics

According to the Commission of the European Communities (2001), corporate social responsibility (CSR) is best described "[…] as a concept whereby companies integrate social and environmental concerns […] on a voluntary basis." As a result of growing publicity, CSR, and its relation with numerous firm characteristics – such as risk and agency costs – has been the subject of many academic researches in recent years.

In one of the earlier papers, McGuire, Sundgren and Schneeweis (1988) address the benefits of reduced firm risk due to CSR strategies and already differentiate between prior and subsequent financial performance. They find a stronger relation between CSR strategy and prior performance and conclude that not only CSR affects financial performance, but also that financial performance determines a firm's capability to being socially responsible.

More recent literature provides more differentiated findings of the relation between CSR and risk. Elliott, Jackson, Peecher, and White (2014) find that it makes a difference whether CSR performance is valued explicitly or implicitly stating that implicit valuation of CSR strategies reduces firm risk, and thereby cost of capital whereas an explicit valuation diminishes the positive effect of lower risk due to increased CSR activities. This is consistent with Fatemi, Glaum, and Kaiser (2018), who state that disclosure of environmental, social and governance (ESG) dimensions diminish the positive effects of the corresponding activity. For a detailed consideration, it is possible to divide the concept of risk once again into systematic and idiosyncratic risk. Earlier studies also do justice to this division. Albuquerque, Koskinen, and Zhang (2019) find that CSR can increase firm value by reducing systematic risk. Examining the same question from a different view, Heinkel, Kraus, and Zechner (2001) create an equilibrium model focused on the environmental impact of firms and conclude that stocks of firms with high environmental impact are held by fewer investors, which increases the corresponding firm's cost of capital. The increased cost of capital is to be allocated to systematic risk. Lee and Faff (2009) – by looking at stock returns and including an idiosyncratic risk factor – provide the insight that idiosyncratic risk is reduced by CSR strategies.

Complementary to studies that elaborate on which type of risk CSR strategies are associated with, other researchers have looked at which dimensions of CSR strategies have more or less impact on

firm characteristics and value. Fatemi, Glaum, and Kaiser (2018) – by examining the ESG dimensions individually – find that environmental activities have the most significant and positive impact on firm value, while social and governance activities are not as essential. Slightly different results are obtained by Ghoul, Guedhami, Kwok, and Mishra (2011) who look on the effect of CSR strategies on the cost of equity for US firms: Although they stress the positive effect for environmental activities, the same is true for employee relations which can be allocated to social activities. This is largely consistent with Bird, Hall, Momentè, and Reggiani (2008) who elaborate on the relation between corporate social activities and shareholder value. Their findings suggest that employee relations, as well as the fulfillment of minimum requirements in diversity and environmental protection, are valued by shareholders. In a recent paper, Hartzmark and Sussman (2019) recognize that investors value sustainability when it comes to net cash inflows, but also state that they do not find evidence that sustainability has an impact on mutual fund performance. Jo and Na (2012) stress that the magnitude of the effect of CSR on firm risk varies across industries: Firms in more controversial industries, for example, the tobacco industry, benefit more from corporate social strategies than other firms do. In the same vein, Bouslah, Kryzanowski, and M'Zhali (2013) show the importance of distinguishing between the ESG dimensions and types of firms, as they find a negative relation between environmental activities and firm risk for non-S&P 500 firms but a positive relation for S&P 500 firms.

Apart from the direct effect of CSR strategies or ESG performance on firm risk and therefore shareholder value, recent literature provides insights also to the effects on other corporate outcomes. For a sample of Australian firms, Limkriangkrai, Koh, and Durand (2017) find that ESG performance is positively related to leverage, which can be interpreted as a consequence of lower capital constraints, with the social dimension having the smallest impact. Apart from slightly different insights when it comes to individual dimensions, their result is mostly in line with Cheng, Ioannou, and Serafeim (2014) who look at the relation between CSR – proxied by ESG performance – and access to capital. Their findings are consistent with environmental and social dimensions, but especially the environmental dimension, reducing capital constraints which leads them to conclude that ESG performance can mitigate agency costs and information asymmetry. Besides that, several studies link CSR to access to other crucial resources. For example, Greening and Turban (2000) find that prospective job applicants are more attracted to socially responsible firms. In line with that, Hillman and Keim (2001) find that active stakeholder management –

employees are stakeholders – can increase shareholder value even though it comes with opportunity costs. However, social issue participation is negatively associated with shareholder value in their study. They justify this result by stating that social issue participation is easily copied by competitors and therefore does not provide a competitive advantage. Nevertheless, one other potentially arising competitive advantage that comes with CSR strategies is provided by Hull and Rothenberg (2008). The authors study the size of the impact of CSR strategies on financial performance conditioned on industries. Their finding – a negative relation between differentiation in the industry and the effect of CSR on financial performance – suggests that CSR strategies also serve as a way for a firm to differentiate itself from its competitors. Lastly, another aspect that has been examined in relation to CSR by Kim, Park, and Wier (2012) is earnings quality. The authors find that socially responsible firms are linked to higher transparency and less frequently investigated by the Securities and Exchange Commission (SEC).

2.2 Market Reaction to Crises

In times of market turmoil or crises, the stock market and the behavior of its participants is – due to several reasons – different from that in 'normal' times. Academics have found several explanations of why stock prices decline and to which extent.

One stream of research focuses on Knightian uncertainty to asset pricing and market freezes (Knight, 1921) and overcautious behavior of market participants to such uncertainty. In the case of Knightian uncertainty, which is defined as a lack of any quantifiable knowledge about some potential outcomes, Gilboa and Schmeidler (1989) state that market participants are uncertainty averse. Projecting that on the topic of this paper means that investors would invest in risk-free assets during the turmoil. Consistent with that, Easley and O'Hara (2010) find widening bid-ask spreads and a resulting market freeze as a consequence of uncertainty. Caballero and Krishnamurty (2008) put this theory into the context of the financial crisis and state that stock prices fall because of investors hoarding liquidity in uncertain times. Adding to that, Acharya, Gale, and Yorulmazer (2011) find that already a small decline of an asset's fundamental value is related to an immense drop in the corresponding firm's debt capacity.

Explicitly looking at market turmoil, Cella, Ellull, and Gianetti (2013) find ownership structure to influence the extent of the fall in stock prices. According to them, shares that are mostly held by short-term investors suffer more. Consequently, they conclude that short investor horizons increase

the effect of market-wide negative shocks. Also examining the shareholder structure, Hotchkiss and Strickland (2003) establish a relation between the level of momentum or aggressive growth investors and stock prices responses to bad earnings reports, which can be projected to the COVID-19 market environment because all market participants knew that earnings of many firms would decline.

Kim, Li, and Li (2014) establish a theoretical relationship between a firm's CSR and the crash risk of the corresponding share, which they define as the conditional skewness of return distribution. Their findings suggest CSR is most effective in mitigating crash risk for firms with ineffective corporate governance and / or low level of institutional ownership. Furthermore, they stress an exception to that rule; they predict that managers who use CSR to cover up bad news will see an increased crash risk for their firms. The authors control for other determinants of crash risk including industry fixed effects, the control for the change in trading volume, past returns, market-to-book ratio, firm size, market value of equity, financial leverage, stock volatility, and earnings management.

Table I summarizes the key findings and statements of several prior studies addressing the effect of crises or market turmoil on asset prices. Investors hoard liquidity in uncertain times (Cabellero, 2008), short-term investors amplify market shocks (Cella et al., 2003), and debt capacity can determine a valuation in uncertain times (Acharya et al., 2011).

2.3 CSR/ESG and Stock Prices during COVID-19

COVID-19 is an infectious disease that was first identified in Wuhan, China in 2019. It was declared a pandemic by the World Health Organization (WHO) on March 11, 2020. As the disease is highly contagious, the governments of almost all countries took harsh measures, i.e. lockdowns and quarantine, with serious consequences for economies around the world. At the beginning of the COVID-19 crisis, there was great uncertainty about the length of this state of emergency: companies in certain sectors, such as hospitality, saw their sales collapse completely. The Gross Domestic Product (GDP) of the United States of America decreased at an annual rate of 32.9% in the second quarter of 2020 (cf. Bureau of Economic Analysis, 2020). A specific example, illustrative for many firms, is American Airlines: the second-quarter operating profit declined from USD 1.15bn in 2019 to USD -2.49bn in 2020.

Although many governments put together the largest stimulus packages ever for their economies – the US adopted a USD 2tn stimulus package in April – uncertainty and liquidity shortages caused severe stock market turmoil. The general fear in the market was best illustrated looking at the CBOE Volatility Index, which soared from 14.02 at the beginning of this year and reached its highest value of 82.69 in mid-March.

The stock market reaction following COVID-19 offers a unique opportunity to combine theoretical insights about market reaction to crises and the effect of ESG on corporate outcomes, summarized in Table I, from the past and put them into to a practical test.

As mentioned above, CSR- and ESG-related studies find that, in normal times, CSR reduces firm risk (Albuquerque et al., 2019), lowers capital constraints (Cheng et al., 2014), and in theory reduces crash risk (Kim et al., 2014). The continuing trend for CSR and ESG to become more important for investors and society makes it necessary to use current examples to avoid outdated results. Therefore, the main hypothesis of this paper is:

H1: The market price of firms with good ESG performance have suffered less severely during the COVID-19 crisis.

In order to get an indication of whether potential differences in the extent of stock price declines during turmoil arise from the firm's earnings, i.e. whether stronger ESG is related to more stability with regard to the business model, as suggested e.g. by Hull et al. (2008), or they arise from investment decisions of shareholders (Bird et al., 2008), the following hypothesis will also be tested:

H2: Firms with good ESG performance have more stable EPS forecasts during the COVID-19 crisis.

Table I
Key findings in related studies
This table summarizes key findings and statements of selected studies discussed in this section

Authors	Keywords	Statement
Acharya et al. (2011)	Market freeze, valuation	Small changes in fundamental asset values can trigger huge drops in debt capacity in uncertain times
Albuquerque et al. (2019)	CSR, firm risk	By reducing systematic firm risk, CSR can increase a corresponding firm's value
Bird et al. (2008)	Environmental activities	Social and environmental activities are valued by shareholders
Bouslah et al. (2013)	ESG, firm risk	Positive relation between environmental activities and firm risk for S&P 500 firms
Caballero et al. (2008)	Uncertainty, liquidity	In case of uncertainty and market turmoil, investors hoard liquidity as a result of minmax strategies
Cella et al. (2013)	Ownership structure	Stocks owned by short-term investors suffer more when it comes to shocks
Cheng et al. (2014)	Environment, capital constraints	The environmental dimension reduces capital constraints by mitigating agency costs and information asymmetry
Easley et al. (2010)	Uncertainty, asset prices	Uncertainty triggers market freezes by widening bid-ask spreads for many assets
Elliott et al. (2014)	CSR, valuation	Explicit CSR valuation diminishes positive valuation effects that come with good CSR strategies
Fatemi et al. (2018)	ESG disclosure, firm value	Environmental activities have the strongest positive effect on firm value
Ghoul et al. (2011)	Cost of equity, ESG	Environmental activities have a positive effect on, i.e. reduce, cost of equity
Greening et al. (2000)	CSR, employees	Job applicants are more attracted to socially responsible firms, giving them competitive advantages
Heinkel et al. (2001)	ESG, ownership structure	High environmental impact leads to fewer investors holding a firm's shares
Hull et al. (2008)	CSR, differentiation	CSR can serve as a differentiation strategy in industries with little differentiation
Jo et al. (2012)	ESG, industries	ESG and CSR performance have a greater impact in controversial industries
Kim et al. (2012)	CSR, transparency	Socially responsible firms are more transparent and investigated less often
Kim et al. (2014)	CSR, crash risk	CSR reduces crash risk, especially for firms with low level of institutional ownership
Lee et al. (2009)	CSR, idiosyncratic risk	CSR strategies can reduce idiosyncratic risk
Limkriangkrai et al. (2017)	ESG, leverage	ESG performance is positively related to financial leverage, potentially due to lower capital constraints
McGuire et al. (1988)	Profitability, CSR	Prior financial performance determines a firm's CSR capability

3. Methodology

To obtain detailed and complete results and to be able to make meaningful statements to investors and managers, I have conducted a series of tests using S&P 500 firms as a data sample.

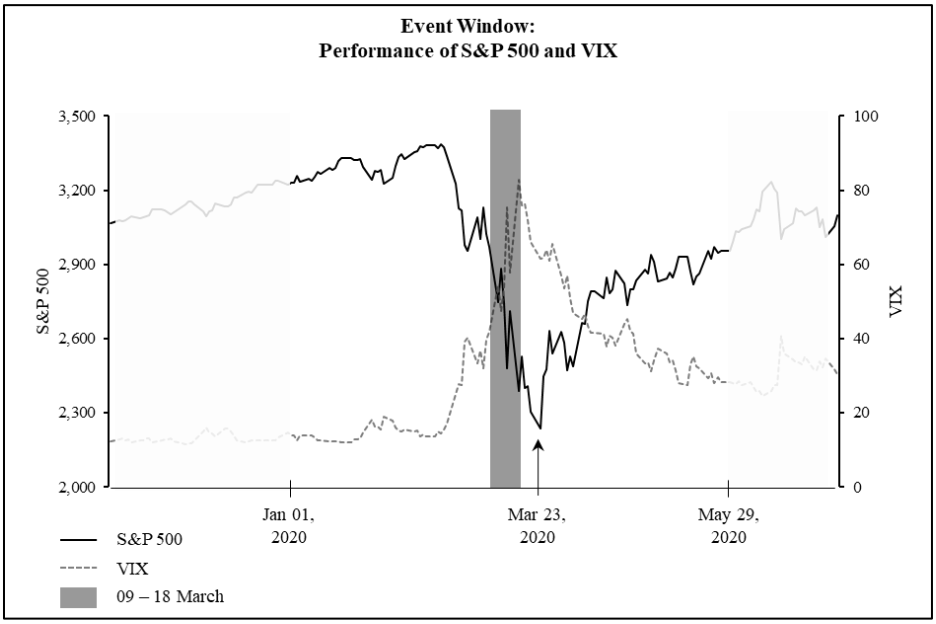

Figure 1. Performance of the S&P 500 and VIX during the event window

Because COVID-19 has spread uncertainty over a long time and still does, the event window will be defined first to test the hypotheses developed in section 2. Even though I will not only look at share price returns but also at analyst revisions, I will use the S&P 500 and the VIX as a quantitative guideline to define the event window of this study. Figure 1 shows the performance of both indices, thereby illustrating the turmoil caused by the uncertainty. January 01, 2020, and May 29, 2020 mark the first and last day of the event window, respectively.

Following a period of days with sharp declines, mainly between and March 09 and March 18, as highlighted in grey, the S&P 500 reached its lowest point on March 23. At the same time, this is the phase in which the VIX, which serves as an indicator of uncertainty, had its peak. This figure serves as a basis for the course of this section and will further be referred to.

3.1 Share Returns

To examine the main hypothesis of this paper, I regressed actual ($r_{i, act}$) and abnormal ($r_{i, abn}$) share returns for the event window on E, S, G, and ESG scores to check for a significant impact of a firm's score on the corresponding share price return during the market turmoil caused by COVID-19.

$$r_{i, act} \text{ or } r_{i, abn} = \beta_0 + \boldsymbol{\beta_1 Score_i} + \beta_2 Size_i + \beta_3 Leverage_i + \beta_4 Volatility_i + \beta_5 EPSSurprise + \varepsilon_i. \quad (1)$$

As a basis for actual returns, I use the "Return Index" from Thomson Reuters Datastream, which adjusts for stock splits and dividends. Furthermore, and in order to take into account different types of systematic risk profiles, I conduct tests with abnormal returns as independent variables following Campbell, Lo, and MacKinlay's (1997) event-study research design, which is also used by Armstrong, Barth, Jagolinzer, and Riedl (2010) in their event study about IFRS adoption of European firms. The models used in this study are the Fama-French three-factor model (3FF; Fama and French, 1993) and five-factor model (5FF; Fama and French, 2015), as well as the four-factor (4C) developed by Carhart (1997) - please refer to Appendix A for the details on calculating abnormal returns. Every test is performed four times to check for the impact of each *Score*: environmental, social, governance, and ESG compound. I obtain all scores from Refinitiv, which is a replacement and enhancement to ASSET4 scores, and aims to "transparently and objectively measure a company's relative ESG performance". ASSET4 scores have served as reliable indicators in earlier studies and were – amongst others – used by Cheng, Ioannou, and Serafeim (2014). To allocate scores to firms, 150 analysts collect 400+ individual measures per firm and transforms them into consistent units to allow quantitative analysis. All other independent variables are control variables for which previous studies have established that it is important to consider them (e.g. Kim et al., 2014). *Size* is the natural logarithm of total assets at the most recent annual report, obtained from Compustat. *Leverage* is computed by dividing each firm's book value of debt as of the most recent annual report, obtained from Compustat, by the market value of equity as of 31 December 2019, obtained from CRSP. *Volatility* is the annualized volatility of monthly holding period returns from January 2015 to December 2019. Furthermore, I add *EPSSurprise* for firms that reported their earnings within the event window. This variable describes the deviation in percentage of actual earnings for the fiscal year ended from a priori analyst estimates. I have obtained *EPSSurprise* and the report date from Eikon. Based on the report date, I assign, whether

and into which regressions for periodic returns the respective *EPSSurprise* must be included, i.e. when a firm reported EPS deviated from estimates and the report date was within the event window. Finally, I have included industry dummy variables using Kenneth French 12 industries, which serve the purpose to only compare firms with similar business models exposure to potential external influences. For this purpose, firms are allocated to industries according to their SIC codes.

It should be emphasized at this point that the outlined research design assumes that basically there have been, apart from earnings surprises which I control for, no other significant firm-specific or market-wide events that have caused such big shocks in the same time window that the returns in the event window are distorted. Furthermore, it is implicitly assumed that the selected estimation window ensures a representative estimation of the coefficients. Including actual returns in the analysis is supposed to minimize the latter risk.

To test whether ESG scores and stock returns in the event window are related, I have developed two test scenarios. The purpose of this is to gain insights into whether and how ESG performance affects returns when immediate shocks occur (refer to 3.1.1), but also whether ESG performance can be valuable to investors over a longer period of ongoing turmoil (refer to 3.1.2).

3.1.1 Worst Five Days

The first series of tests addresses immediate shocks to the stock market. Table III presents the five trading days with the largest intraday decline within the event window, i.e. from January to May, and potential reasons for that.

For each firm of the data sample, I computed abnormal daily returns as described in section 3.1 for all five days.

The arithmetic means of actual returns, 3FF abnormal returns, 4C abnormal returns, and 5FF abnormal returns of these five days per firm have then separately been used as independent variables and regressed on E, S, G, and ESG scores. This was again done with Stata. The results can be seen as a stress test for previous findings of the positive effects of ESG on firm risk as they show whether the various ESG dimensions are in some way taken into account by investors even in the event of major shocks. Alternatively, the negative impact of ESG scores on returns could indicate a preference of investors for other aspects such as short-term liquidity at high uncertainty levels. Since none of the firms in the dataset of this paper had one of the five worst days as the

report date, the *EPSSurprise* variable is not part of this test series.

Table II
Five worst days during COVID-19 crisis
This table summarizes the five worst trading days during the event window in chronological order and suggests potential reasons for the declines

Date	Return	Reason
March 09	-7.60%	First trading day after New York declares state of emergency
March 11	-4.89%	The day on which WHO declares COVID-19 a global pandemic
March 12	-9.51%	First full trading day after WHO declares COVID-19 a global pandemic
March 16	-11.98%	President Trump states that COVID-19 will stay in the US longer than assumed (at least August 2020)
March 18	-5.18%	First trading day after President Trump told reporters: "This is a pandemic."

3.1.2 Periodic Returns

In addition to the tests concerning immediate market shocks, I conduct a series of tests that address periodic returns during the turmoil. In this test series, the interpretation of the results can on the one hand show possible action alternatives for investors, but also help managers to understand the behavior of investors in crises and use this understanding for their firms.

I divide the event window for this test series into two. Hereby, the first period ranges from January 01 to March 23, when the stock markets crashed and uncertainty was at a peak (for illustration, please refer to Figure 1). The following period, from March 23 to May 29, marks the phase of recovery. This enables me to make detailed assessments and differentiate the actions and potential relations between crash and recovery. Finally, I conduct a series of tests for the whole event window, from January 01 to March 29. All returns, actual and abnormal, have been annualized on an actual-actual-basis in order to compare the results.

3.2 Earnings Forecasts

For testing of hypothesis 2, I use analyst consensus 1-year-ahead earnings forecasts (EPSFY1), and 2-year-ahead earnings forecasts (EPSFY2) from the Institutional Brokers' Estimate System (IBES) database, retrieved from Datastream. These numbers are supposed to indicate differences in the

consistency of profitability in relation to the ESG dimensions. I obtain EPSFY1 and EPSFY2, for all firms where estimates are available, at the beginning and end of the event window. After eliminating all observations where one of the forecasts was negative or zero, I calculate the difference in percent (as in equation 7) and use the result, *ΔEPSFY1*, as the dependent variable of this test series. The regression equation is the same as for share returns (equation 1) except for the dependent variable.

$$\Delta EPSFY1 = \frac{EPSFY1\,(on\ January\ 01) - EPSFY1\,(on\ May\ 29)}{EPSFY1\,(on\ January\ 01)} \qquad (2)$$

The rationale for adding hypothesis 2 of this paper is to indicate whether potential relations between ESG performance and share price returns can be attributed to internal factors, such as more stable business models or better customer relationships. For example, if a high ESG score reduces the extent of stock price decline for a firm, and also reduces the decline in forecasted EPS, this could be interpreted as the firm being more stable itself. Furthermore, the relation between ESG and forecasted EPS indicates how well the ESG activities are embedded in the business model so that they support the firm in uncertain times.

4. Data and Descriptive Statistics

4.1 Sample and Selection

The initial sample of firms contained all constituents of the S&P 500 as of December 2019. The S&P 500 is an index that lists around 500 US-based large companies. Using a large number of firms allows drawing conclusions on *share price returns* or *change in forecasted EPS* – for hypothesis 1 and hypothesis 2, respectively – as a function of ESG scores.

To measure the potential effect of ESG scores on actual returns, firms were required to have share price returns throughout the whole event window. Since I estimate abnormal returns using the factors of the described models, firms also had to have share price returns for the entire duration of the estimation window, January 2015 to December 2019 (for a detailed description of computation of abnormal returns, please refer to Appendix 1).

For the second series of tests, the independent variable is the difference of forecasted EPS (refer to equation 7) for the next two years in percentage. I obtain forecasted EPS for FY1 and FY2 from IBES as of January 01, 2020 (beginning of the event window), and May 29, 2020 (end of the event

window). Firms had to have positive forecasted EPS on both dates to be in the sample for the second test series because ΔEPSFY1 and ΔEPSFY2 are calculated in percent and therefore negative estimates are not technically implementable.

Firm data from CRSP, Compustat, IBES, and Thomson Reuters Datastream was matched using the following identifiers: Ticker, PERMNO, and ISIN codes.

Finally, there was complete data for 490 firms for hypothesis 1, while for hypothesis 2 the sample consists of 444 and 467 firms for FY1 and FY2 forecasts, respectively.

4.2 Descriptive Statistics

Tables IV and V present descriptive statistics for dependent or independent variables, respectively. For a better comparison, the most important indicators for all companies are shown at the top, followed by a breakdown by industry.

Looking at the different types of dependent variables in Table III, several remarks can be made. Firstly, it is clear to see that the actual share prices of companies have suffered greatly: on average 9.16% on the worst five days, per day, and an annualized 167% in the period from January 01 to March 23. Secondly, in the period from March 23 to May 29, the shares of the average firm's stock price had a strong recovery. However, it has to be said that although 226% is more than 167% in relative terms, this is somewhat different in absolute terms due to the different starting levels. Furthermore, EPSFY1 and EPSFY2 have decreased significantly during the event window, which shows a high level of pessimism across the market. Looking at abnormal returns, this table illustratively displays 5FF abnormal return statistics, the model seems to work rather well as it relativizes actual returns quite satisfactory.

Next, some of the differences between the various industries will be highlighted. Firstly, looking at columns one and three of Table III, it becomes apparent that some industries suffered more than others: *Energy* firms' shares suffer the most on average between January and March, whereas – as expected – *Healthcare* firms were the ones that suffered the least. The last two columns address the EPS forecasts, where different levels of uncertainty can be identified by only looking at the number of observations: for *Chemicals*, there are positive estimates for all firms, while many *Energy* firms have no or negative estimated earnings.

Table III

Descriptive statistics: dependent variables

This table presents descriptive statistics for independent variables. The periodic returns (columns Jan-Mar, Mar-May, and Jan-May) are annualized. For detailed descriptions, please refer to Section 3.

	Worst 5 Days		Jan-Mar		Mar-May		Jan-May		ΔEPS	
	ACT	**5FF**	**ACT**	**5FF**	**ACT**	**5FF**	**ACT**	**5FF**	**FY1**	**FY2**
All Firms										
Mean	-9.16	-1.18	-1.67	-0.34	2.26	0.20	-0.32	-0.17	-0.15	-0.10
Std Dev	3.85	4.83	0.78	0.85	1.20	1.34	0.56	0.50	0.29	0.25
Min	-24.08	-21.13	-3.72	-3.37	-1.61	-6.79	-1.80	-1.83	-0.99	-0.99
0.25	-11.22	-4.12	-1.65	-0.32	2.11	0.17	-0.28	-0.19	-0.10	-0.06
Median	-8.59	-0.63	-1.17	0.24	2.82	0.99	0.06	0.15	0.02	0.03
0.75	-5.39	5.83	-2.16	-0.94	1.50	-0.60	-0.70	-0.48	-0.29	-0.20
Max	-1.26	13.72	0.98	2.13	8.23	4.52	1.57	1.50	1.29	2.13
1 - Consumer Nondurables										
Mean	-7.63	-2.04	-1.56	-0.48	1.68	0.12	-0.40	-0.28	-0.14	-0.15
Std Dev	3.67	3.91	0.82	0.78	0.91	0.90	0.55	0.49	0.23	0.23
Obs	28	28	28	28	28	28	28	28	27	28
2 - Consumer Durables										
Mean	-11.97	-3.49	-2.44	-0.75	1.97	-0.45	-0.94	-0.69	-0.52	-0.24
Std Dev	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Obs	1	1	1	1	1	1	1	1	1	1
3 - Manufacturing										
Mean	-9.32	1.1	-1.85	-0.02	2.37	-0.28	-0.41	-0.08	-0.21	-0.19
Std Dev	3.22	3.35	0.48	0.56	0.91	0.99	0.36	0.40	0.22	0.16
Obs	36	36	36	36	36	36	36	36	34	35
4 - Energy										
Mean	-15.07	-1.86	-2.92	-0.49	3.99	1.46	-1.04	-0.18	-0.73	-0.66
Std Dev	4.88	5.4	0.60	0.58	1.77	1.76	0.44	0.43	0.19	0.27
Obs	24	24	24	24	24	24	24	24	10	16
5 - Chemicals										
Mean	-9.32	-0.86	-1.57	-0.07	2.17	0.05	-0.24	0.00	-0.21	-0.13
Std Dev	4.08	4.06	0.80	0.64	1.27	1.28	0.61	0.54	0.23	0.17
Obs	17	17	17	17	17	17	17	17	17	17
6 - Business Equipment										
Mean	-7.88	1.11	-1.28	0.06	2.16	-0.45	-0.01	-0.05	-0.03	0.00
Std Dev	2.76	3.75	0.60	0.79	0.82	1.29	0.50	0.53	0.19	0.14
Obs	70	70	70	70	70	70	70	70	69	69
7 - Telecommunications										
Mean	-7.65	-0.31	-1.49	-0.13	1.92	-0.16	-0.32	-0.19	-0.17	-0.13
Std Dev	2.6	2.76	0.86	0.53	1.37	1.37	0.53	0.34	0.38	0.25
Obs	10	10	10	10	10	10	10	10	10	10

Table III - *continued*

8 - Utilities										
Mean	-8.64	-7.05	-1.45	-1.23	2.02	1.28	-0.23	-0.40	0.02	0.02
Std Dev	3.78	2.3	0.56	0.31	0.95	0.55	0.29	0.23	0.08	0.07
Obs	30	30	30	30	30	30	30	30	30	30
9 - Shops										
Mean	-8.01	-1.7	-1.55	-0.33	2.47	0.58	-0.20	-0.13	-0.21	-0.09
Std Dev	3.6	4.52	0.90	0.91	1.39	1.46	0.55	0.47	0.24	0.18
Obs	40	40	40	40	40	40	40	40	37	40
10 - Healthcare										
Mean	-6.51	-0.27	-1.20	-0.44	2.28	0.28	0.05	-0.23	-0.06	0.10
Std Dev	2.33	4.04	0.68	1.05	1.00	1.31	0.42	0.52	0.24	0.37
Obs	41	41	41	41	41	41	41	41	37	38
11 - Finance										
Mean	-10.3	-2.27	-1.84	-0.50	2.07	0.39	-0.48	-0.20	-0.17	-0.10
Std Dev	3.21	5.67	0.62	0.92	1.09	1.14	0.51	0.53	0.33	0.18
Obs	103	103	103	103	103	103	103	103	97	98
12 - Other										
Mean	-9.52	-0.46	-1.77	-0.23	2.27	-0.13	-0.39	-0.18	-0.20	-0.14
Std Dev	4.02	4.73	0.79	0.78	1.24	1.37	0.59	0.56	0.33	0.27
Obs	90	90	90	90	90	90	90	90	75	85

Significant differences can also be seen in the abnormal returns; companies whose business is in business equipment have even achieved positive figures, possibly in connection with home office equipment. In contrast, *Utilities* companies were the ones that suffered the most. However, if you look at Table IV, this may also be related to the size and the otherwise low volatility.

Looking at statistics of the whole data sample of Table IV, some interesting differences can be identified with regards to the ESG scores: While almost all statistics are very similar when it comes to social and governance score, the environmental score differs: firms have a much lower average score and the differences, i.e. standard deviation, are higher.

Moving to Table IV, the fact that EPS surprises are, on average, positive seems surprising in the beginning but is a result of the reported EPS being for the last fiscal year. Furthermore, even when the last fiscal year ended sometime during the crisis, that was already incorporated in the analyst estimates about earnings.

Table IV
Descriptive statistics: independent variables

This table presents descriptive statistics for independent variables. For detailed descriptions, please refer to Section 3.

	ESG Factors				Control Variables				
								EPS Surprise	
	Env	Soc	Gov	ESG	Size	Lev	Vol (%)	1	2
All Firms									
Mean	52.06	62.15	60.93	53.71	23.90	0.31	24.48	1.72	2.13
Std Dev	26.69	19.33	19.12	16.53	1.31	0.47	7.71	61.51	4.74
Min	0.00	4.17	4.08	2.58	20.68	0.00	10.17	-870.66	-8.89
0.25	57.30	64.36	63.81	53.83	23.72	0.19	22.93	0.85	2.20
Median	74.85	77.80	75.45	65.46	24.69	0.38	28.15	2.38	3.76
0.75	31.53	48.58	47.16	41.22	22.97	0.07	18.87	-0.08	-0.76
Max	97.04	97.83	97.96	88.22	28.62	4.37	67.31	802.97	12.52
1 - Consumer Nondurables									
Mean	60.62	68.19	60.67	58.07	23.57	0.41	24.19	1.37	-1.66
Std Dev	22.40	20.09	19.41	16.26	0.96	0.53	7.26	2.47	5.39
Obs	28	28	28	28	28	28	28	16	4
2 - Consumer Durables									
Mean	47.03	44.21	61.67	49.74	22.30	0.34	24.88	0.38	n.a.
Std Dev	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Obs	1	1	1	1	1	1	1	1	0
3 - Manufacturing									
Mean	57.84	62.18	59.09	56.97	23.44	0.26	23.72	-1.54	n.a.
Std Dev	20.82	16.49	18.11	14.15	0.94	0.20	4.02	232.28	n.a.
Obs	36	36	36	36	36	36	36	27	0
4 - Energy									
Mean	53.16	57.46	67.30	52.94	24.17	0.40	32.53	2.14	n.a.
Std Dev	23.23	25.18	14.82	17.76	1.08	0.26	7.87	25.75	n.a.
Obs	24	24	24	24	24	24	24	23	0
5 - Chemicals									
Mean	66.05	70.38	70.89	65.70	23.50	0.30	24.34	-4.80	n.a.
Std Dev	19.78	15.51	19.02	16.12	0.60	0.22	8.54	18.76	n.a.
Obs	17	17	17	17	17	17	17	13	0
6 - Business Equipment									
Mean	48.30	62.96	59.02	52.81	23.33	0.19	26.81	1.09	5.35
Std Dev	27.31	19.96	19.38	16.99	1.16	0.53	8.60	4.54	4.03
Obs	70	70	70	70	70	70	70	40	7
7 - Telecommunications									
Mean	37.06	56.50	45.30	35.29	25.46	1.14	23.74	1.77	n.a.
Std Dev	26.70	19.16	22.90	12.41	0.97	0.98	5.84	3.98	n.a.
Obs	10	10	10	10	10	10	10	9	0

Table IV - *continued*

8 - Utilities									
Mean	64.58	56.43	67.13	58.77	24.49	0.03	17.62	0.83	n.a.
Std Dev	16.33	14.14	14.82	11.12	0.68	0.14	6.49	3.48	n.a.
Obs	30	30	30	30	30	30	30	27	0
9 - Shops									
Mean	54.31	63.28	62.96	51.53	23.57	0.28	25.03	1.60	1.82
Std Dev	29.14	19.80	17.70	17.92	1.11	0.28	6.65	3.07	1.60
Obs	40	40	40	40	40	40	40	28	2
10 - Healthcare									
Mean	52.29	70.47	55.47	52.76	23.62	0.23	25.07	1.52	-0.78
Std Dev	24.48	20.06	18.16	12.71	1.27	0.28	7.51	3.31	2.55
Obs	41	41	41	41	41	41	41	33	3
11 - Finance									
Mean	45.91	61.70	61.96	54.62	24.73	0.35	21.43	4.64	n.a.
Std Dev	30.74	17.27	18.21	15.98	1.56	0.47	5.19	15.70	n.a.
Obs	103	103	103	103	103	103	103	99	0
12 - Other									
Mean	50.53	58.30	59.73	50.45	23.61	0.39	26.26	0.89	4.05
Std Dev	26.63	20.35	21.66	18.13	1.12	0.55	8.56	18.81	n.a.
Obs	90	90	90	90	90	90	90	75	1

That means that an EPS surprise can be positive with a USD 3.00 loss per share in case the analysts have expected the firm to lose USD 4.00 per share. Since for many firms, the fiscal year is the same as the calendar year, i.e. it ends on December 31, considerably more reports can be observed in the period from January 01 to March 23 than in the period from March 23 to May 29.

The information on Tables IV and V further demonstrate the importance of including industry dummies as part of the regression: Telecommunications firms on average have rather low ESG scores, and yet have not suffered as much as other industries. Comparing firms across industries would, therefore, have led to distortions.

5. Results

5.1 Returns

5.1.1 Worst Five Days

Table V represents regression results for the five trading days of immediate externally triggered market crashes. The key variables that this study is mainly concerned with are highlighted in bold:

Table V

Regression results: five worst days

This table represents regression results for the worst five trading days in the event window. A detailed description of variables, including dummy variables for industries, can be found in section 3. The standard error in parentheses. *, **, *** represent a 1%, 5%, or 10% significance level, respectively.

	ACT	3FF	4C	5FF
	Panel A: Environmental Score			
Env	**0.0001**	**0.0001**	**-0.0000**	**0.0001**
	(0.0001)	**(0.0001)**	**(0.0001)**	**(0.0001)**
Size	-0.0029**	0.0065***	0.0072***	0.0068***
	(0.0014)	(0.0017)	(0.0019)	(0.0018)
Leverage	-0.0149***	-0.0123***	-0.0170***	-0.0128***
	(0.0034)	(0.0044)	(0.0047)	(0.0044)
Volatility	-0.1493***	0.2186***	0.1452***	0.2235***
	(0.0209)	(0.0271)	(0.0291)	(0.0273)
R^2	33.92%	27.77%	21.92%	28.28%
	Panel B: Social Score			
Soc	**0.0001**	**0.0000**	**-0.0000**	**0.0000**
	(0.0001)	**(0.0001)**	**(0.0001)**	**(0.0001)**
Size	-0.0029**	0.0070***	0.0074***	0.0073***
	(0.0013)	(0.0017)	(0.0019)	(0.0017)
Leverage	-0.0149***	-0.0122***	-0.0170***	-0.0127***
	(0.0034)	(0.0044)	(0.0047)	(0.0044)
Volatility	-0.1494***	0.2171***	0.1448***	0.2222***
	(0.0209)	(0.0271)	(0.0291)	(0.0273)
R^2	33.97%	27.61%	21.93%	28.18%
	Panel C: Governance Score			
Gov	**-0.0001**	**0.0001**	**-0.0000**	**0.0001**
	(0.0001)	**(0.0001)**	**(0.0001)**	**(0.0001)**
Size	-0.0021*	0.0070***	0.0072***	0.0071***
	(0.0013)	(0.0016)	(0.0018)	(0.0017)
Leverage	-0.0146***	-0.0124***	-0.0170***	-0.0129***
	(0.0034)	(0.0044)	(0.0047)	(0.0044)
Volatility	-0.1506***	0.2164***	0.1453***	0.2219***
	(0.0208)	(0.0270)	(0.0290)	(0.0273)
R^2	34.25%	27.60%	22.03%	28.18%
	Panel D: Compound Score			
ESG	**-0.0002***	**0.0000**	**-0.0001**	**0.0000**
	(0.0001)	**(0.0001)**	**(0.0001)**	**(0.0001)**
Size	-0.0023*	0.0072***	0.0072***	0.0073***
	(0.0013)	(0.0016)	(0.0017)	(0.0016)
Leverage	-0.0148***	-0.0122***	-0.0170***	-0.0127***
	(0.0034)	(0.0044)	(0.0047)	(0.0044)
Volatility	-0.1533***	0.2172***	0.1436***	0.2221***
	(0.0209)	(0.0271)	(0.0291)	(0.0273)
R^2	34.06%	27.71%	21.92%	28.26%

environmental, social, governance, and compound as the dimensions of ESG performance in Panel A, B, C, or D, respectively.

When looking at the table, it quickly becomes clear that there is no significant impact of the respective ESG dimension on either actual or abnormal returns, except for compound score on actual returns on the 10% significance level. One can understand this by noting that apparently when uncertainty is at a peak, investors do not have time and capacity to give priority to ESG performance. This can be due to several reasons: if no one knows how long turnover will break down and whether or not firms have enough liquidity for the short term, it can be argued that ESG performance, which symbolizes sustainability, is not a decisive factor for investors to take into account when making their decisions.

As expected, the coefficients of the control variables vary little throughout Panels A to D. Furthermore, the vast majority of them are significant on the 1% level justifying the decision to incorporate these variables. Looking at the numbers, the following assessments can be made: larger firms were more severely affected when it comes to actual returns. In contrast to that, larger companies earn higher abnormal returns, which is a result of the incorporation of firm size in all factor models. The same tendency can be observed for volatility. Furthermore, stock prices of firms with higher leverage levels suffered more than those with lower leverage levels. This can be explained e.g. by interest payment commitments, short-term as well as long-term, which causes a higher immediate probability of default and therefore trigger higher price declines.

On average, the 5FF model explained most of the variation - around 28% - which can potentially be attributed to the profitability factor. Contrary, the momentum factor in 4C appears to be counterproductive in terms of R^2.

5.1.2 Periodic Returns

January 01 – March 23, 2020

Table VI potentially displays the most interesting insights as it presents the impact of the ESG dimensions on actual and abnormal holding period returns during the peak of the turmoil.

Significant positive coefficients, although being rather small, are to be noted when looking at the environmental dimension (Panel A). This means that a high environmental score has a positive impact on the holding period return during this period. It is noteworthy that this is true for both

Table VI

Regression results: Jan 01 - Mar 23

This table represents regression results for Jan 01 until March 23. A detailed description of variables, including dummy variables for industries, can be found in section 3. Standard errors in parentheses. *, **, *** represent a 1%, 5%, or 10% significance level, respectively.

	ACT	3FF	4C	5FF
	Panel A: Environmental Score			
Env	**0.0023***	**0.0032****	**0.0018**	**0.0031****
	(0.0012)	**(0.0014)**	**(0.0015)**	**(0.0014)**
Size	-0.0510*	0.1646***	0.1604***	0.1386***
	(0.0276)	(0.0319)	(0.0333)	(0.0316)
Leverage	-0.3587***	-0.2223***	-0.2788***	-0.1994**
	(0.0692)	(0.0799)	(0.0834)	(0.0790)
Volatility	-2.2816***	3.8781***	3.0765***	3.7909***
	(0.4263)	(0.4925)	(0.5136)	(0.4870)
EPS Sur.	0.0355	0.1065*	0.0853	0.0993
	(0.0536)	(0.0619)	(0.0645)	(0.0612)
R^2	33.2%	27.3%	23.8%	26.4%
	Panel B: Social Score			
Soc	**0.0032***	**0.0017**	**0.0004**	**0.0015**
	(0.0017)	**(0.0019)**	**(0.0020)**	**(0.0019)**
Size	-0.0495*	0.1840***	0.1735***	0.1563***
	(0.0272)	(0.0301)	(0.0328)	(0.0312)
Leverage	-0.3575***	-0.2244***	-0.2771***	-0.1968**
	(0.0692)	(0.0803)	(0.0835)	(0.0794)
Volatility	-2.2909***	3.7991***	3.0381***	3.7377***
	(0.4258)	(0.4929)	(0.5140)	(0.4887)
EPS Sur.	0.0413	0.1110*	0.0863	0.1025*
	(0.0536)	(0.0621)	(0.0647)	(0.0615)
R^2	33.3%	27.3%	23.6%	25.8%
	Panel C: Governance Score			
Gov	**-0.0022**	**0.0026**	**0.0009**	**0.0023**
	(0.0016)	**(0.0019)**	**(0.0019)**	**(0.0018)**
Size	-0.0259	0.1840***	0.1731***	0.1583***
	(0.0260)	(0.0301)	(0.0314)	(0.0298)
Leverage	-0.3518***	-0.2244***	-0.2788***	-0.2010**
	(0.0694)	(0.0803)	(0.0836)	(0.0794)
Volatility	-2.3343***	3.7991***	3.0317***	3.7136***
	(0.4260)	(0.4929)	(0.5131)	(0.4875)
EPS Sur.	0.0329	0.1110*	0.0870	0.1034*
	(0.0537)	(0.0621)	(0.0647)	(0.0615)
R^2	33.0%	27.5%	23.6%	25.9%

Table VI – *continued*

	Panel D: Compound Score			
ESG	**-0.0020**	**0.0027**	**0.0006**	**0.0021**
	(0.0018)	**(0.0021)**	**(0.0022)**	**(0.0021)**
Size	-0.0309	0.1898***	0.1753***	0.1637***
	(0.0257)	(0.0297)	(0.0310)	(0.0294)
Leverage	-0.3562***	-0.2191***	-0.2769***	-0.1963**
	(0.0693)	(0.0802)	(0.0835)	(0.0793)
Volatility	-2.3694***	3.8459***	3.0426***	3.7502***
	(0.4273)	(0.4942)	(0.5144)	(0.4890)
EPS Sur.	0.0370	0.1061*	0.0854	0.0991
	(0.0537)	(0.0621)	(0.0646)	(0.0615)
R^2	32.9%	27.4%	23.6%	25.8%

actual as well as 3FF and 5FF abnormal returns because it implies that also investors who base their investment decisions on factor models can benefit from this. Ceteris paribus, all other variables kept constant, a firm with an environmental score of 70 had an actual holding period return, which was 2.10% higher than that of a firm with a score of 40.

The social score, on the other hand, appears to have a bigger positive impact on actual holding period returns on the 10% level but is not significant for abnormal returns.

A different picture emerges for governance and compound score (please refer to Panel C or D, respectively) which appear to not have any impact on holding period returns during the period from January 01 to March 23. For the governance dimension which comprises management and shareholders aspects, one could argue that because all sample firms are listed in the S&P 500, differences between the firms of the sample are limited and it, therefore, has no impact in this study.

Two potential explanations for the significance of environmental as opposed to the other dimensions are, firstly, the climate crisis, which is an increasingly important issue for society as a whole, and, secondly, larger differences in the environmental score, as discussed in section 4.

Comparing the results for abnormal returns, it is noticeable that the regressions that 4C abnormal returns as independent variables have lower R^2 as well as the less pronounced impact of the ESG dimensions, which potentially is the case because momentum does not do a good job explaining returns during the turmoil. When it comes to other firm aspects, i.e. control variables, the picture

is similar to the one for the worst five trading days, meaning that bigger and highly levered firms with higher original volatility suffered the most on actual terms. However, for size and volatility, that pattern changes as soon as market factors are incorporated. Although surprising EPS reports, i.e. *EPS Sur.*, seemed to have had a positive impact on the actual holding period returns of the respective firm, they are not significant and therefore are not allowing to state that their impact is different from zero. However, the 3FF abnormal return is significantly increased.

March 23 – May 29, 2020

Table VII presents the results with the actual and abnormal returns in the period from March 23 to May 29, a phase when global stock markets including the S&P 500 recovered from the crashes prior to that. These results are partly counterintuitive after having analyzed the results of the previous period.

In general, the quality of the regressions, measured in R^2, is not as high as for actual returns than the quality of the tables seen before. Furthermore, the 4C factor model explains slightly more of the variation, around 29% on average, than the other two models for this period, which possibly indicates the increasing importance of the momentum factor as this period represents a phase of regeneration.

For the environmental score, which had a stabilizing impact from January to March, that impact was roughly equalized in the countermovement. The fact that the coefficients are roughly the opposite of those in the previous period means that altogether, the environmental score does not have a decisive impact for investors that held their stocks throughout the whole period.

The results for the other two individual scores, the social score and the governance score (please refer to Table VII; Panel B or C, respectively), are analyzed and interpreted together below due to their similarity. From January to March, abnormal returns have positive coefficients for social and governance. However, the high standard errors detain from interpreting this as an actual impact as it can't be said for sure that the coefficient is different from zero. In contrast to that, all coefficients both for actual and abnormal returns were significant and negative in the period from March to May. In other words: regardless of whether the various factors are taken into account or not, the share returns of firms with high scores were smaller on average than those of firms with low scores. Conversely, this could mean, for example, that investors fear that too much short-term liquidity

Table VII

Regression Results: Mar 23 - May 29

This table represents regression results for March 23 until May 29. A detailed description of variables, including dummies for industries, can be found in section 3. Standard errors in parentheses. *, **, *** represent a 1%, 5%, or 10% significance level, respectively.

	ACT	3FF	4C	5FF
	Panel A: Environmental Score			
Env	**-0.0049****	**-0.0059*****	**-0.0060*****	**-0.0076*****
	(0.0021)	**(0.0022)**	**(0.0022)**	**(0.0022)**
Size	-0.0334	-0.1614***	-0.1567***	-0.1005**
	(0.0475)	(0.0495)	(0.0494)	(0.0497)
Leverage	-0.0286	0.1045	0.0947	0.0303
	(0.1194)	(0.1243)	(0.1241)	(0.1250)
Volatility	1.8939**	-6.0035***	-6.0967***	-5.4717***
	(0.7366)	(0.7672)	(0.7662)	(0.7715)
EPS Sur.	-0.9603	3.8937	3.9966	3.9570
	(5.5245)	(5.7539)	(5.7459)	(5.7857)
R^2	15.9%	29.4%	29.8%	26.0%
	Panel B: Social Score			
Soc	**-0.0060****	**-0.0056***	**-0.0057***	**-0.0073****
	(0.0029)	**(0.0030)**	**(0.0030)**	**(0.0030)**
Size	-0.0409	-0.1793***	-0.1755***	-0.1231**
	(0.0469)	(0.0490)	(0.0489)	(0.0493)
Leverage	-0.0326	0.0992	0.0892	0.0234
	(0.1195)	(0.1248)	(0.1246)	(0.1257)
Volatility	1.9216***	-5.9480***	-6.0389***	-5.4014***
	(0.7368)	(0.7696)	(0.7687)	(0.7755)
EPS Sur.	-0.4056	4.6190	4.7419	4.8889
	(5.5206)	(5.7657)	(5.7593)	(5.8104)
R^2	0.1577	0.2892	0.2919	0.2507
	Panel C: Governance Score			
Gov	**-0.0047***	**-0.0078*****	**-0.0078*****	**-0.0086*****
	(0.0028)	**(0.0029)**	**(0.0029)**	**(0.0029)**
Size	-0.0612	-0.1893***	-0.1858***	-0.1403***
	(0.0448)	(0.0465)	(0.0465)	(0.0470)
Leverage	-0.0248	0.1136	0.1035	0.0389
	(0.1198)	(0.1244)	(0.1243)	(0.1255)
Volatility	2.0144***	-5.8534***	-5.9433***	-5.2815***
	(0.7370)	(0.7654)	(0.7646)	(0.7721)
EPS Sur.	-0.6698	4.0296	4.1531	4.2786
	(5.5353)	(5.7492)	(5.7431)	(5.7995)
R^2	15.5%	29.5%	29.8%	25.5%

Table VII - *continued*

	Panel D: Compound Score			
ESG	**-0.0007** **(0.0032)**	**-0.0023** **(0.0033)**	**-0.0024** **(0.0033)**	**-0.0041** **(0.0034)**
Size	-0.0737* (0.0443)	-0.2095*** (0.0462)	-0.2059*** (0.0462)	-0.1620*** (0.0467)
Leverage	-0.0345 (0.1200)	0.0977 (0.1252)	0.0877 (0.1250)	0.0217 (0.1263)
Volatility	1.9938*** (0.7407)	-5.9048*** (0.7726)	-5.9974*** (0.7717)	-5.3625*** (0.7796)
EPS Sur.	-0.2647 (5.5548)	4.5810 (5.7937)	4.6876 (5.7874)	4.7186 (5.8469)
R^2	15.0%	28.5%	28.7%	24.4%

will be spent for such purposes, thereby limiting more profitable investments and activities. This is even more striking when considering that the governance score contains the CSR strategy of the corresponding firm. In consequence, a possible recommendation for action would be to avoid buying stocks of firms with high individual scores during recovery phases or to pay close attention to how ESG activities are embedded in the business model of the respective company.

Looking at the ESG compound score (Table VI, Panel D), the emerging pattern is similar to that of the previous period (Table VII, Panel D). No significant coefficients are to be observed, which overall suggests that investors do not consider the compound score, but have more specific decision-making criteria.

Looking at the coefficients, that *EPS Sur.* seemed to have had a negative relation with actual share prices. However, due to the lack of significance, it cannot be stated that *EPS Sur.* influences actual or abnormal share prices.

January 01 – May 29, 2020

To supplement the results of the two periods considered separately, a regression was also performed for the entire period, i.e. from Jan 01 – May 29. The results can be viewed in Table VIII.

Here the annualized returns from the crash and the counter movement are regressed. Because no differentiation is made, conclusions can be drawn here especially for investors who buy and hold shares. It is noticeable that none of the ESG dimensions seem to have an influence on abnormal

Table VIII

Regression Results: Jan 01 - May 29

This table represents regression results for Jan 01 until May 29. A detailed description of variables, including dummies for industries, can be found in section 3. Standard errors in parentheses. *, **, *** represent a 1%, 5%, or 10% significance level, respectively.

	ACT	3FF	4C	5FF
	Panel A: Environmental Score			
Env	**0.0005**	**0.0012**	**0.0001**	**0.0007**
	(0.0009)	**(0.0009)**	**(0.0010)**	**(0.0009)**
Size	-0.0564***	0.0571***	0.0589***	0.0548***
	(0.0201)	(0.0204)	(0.0219)	(0.0206)
Leverage	-0.2835***	-0.1447***	-0.1932***	-0.1484***
	(0.0504)	(0.0511)	(0.0547)	(0.0517)
Volatility	-1.3799***	1.2885***	0.6249*	1.4448***
	(0.3105)	(0.3150)	(0.3373)	(0.3184)
EPS Sur.	0.0217	0.0825**	0.0665	0.0761*
	(0.0390)	(0.0396)	(0.0424)	(0.0400)
R^2	30.7%	9.6%	8.7%	9.7%
	Panel B: Social Score			
Soc	**0.0009**	**0.0007**	**-0.0003**	**0.0000**
	(0.0012)	**(0.0012)**	**(0.0013)**	**(0.0012)**
Size	-0.0574***	0.0632***	0.0616***	0.0603***
	(0.0198)	(0.0201)	(0.0215)	(0.0203)
Leverage	-0.2834***	-0.1437***	-0.1930***	-0.1477***
	(0.0504)	(0.0512)	(0.0547)	(0.0517)
Volatility	-1.3785***	1.2698***	0.6177*	1.4288***
	(0.3101)	(0.3152)	(0.3370)	(0.3183)
EPS Sur.	0.0233	0.0840**	0.0661	0.0763*
	(0.0390)	(0.0397)	(0.0424)	(0.0401)
R^2	30.8%	9.3%	8.7%	9.6%
	Panel C: Governance Score			
Gov	**-0.0028****	**0.0000**	**-0.0011**	**-0.0005**
	(0.0012)	**(0.0012)**	**(0.0013)**	**(0.0012)**
Size	-0.0448**	0.0671***	0.0629***	0.0617***
	(0.0188)	(0.0192)	(0.0206)	(0.0194)
Leverage	-0.2772***	-0.1435***	-0.1908***	-0.1467***
	(0.0501)	(0.0513)	(0.0548)	(0.0517)
Volatility	-1.3880***	1.2595***	0.6234*	1.4289***
	(0.3079)	(0.3149)	(0.3362)	(0.3178)
EPS Sur.	0.0177	0.0828**	0.0649	0.0756*
	(0.0388)	(0.0397)	(0.0424)	(0.0401)
R^2	31.6%	9.3%	8.8%	9.6%

Table VIII - *continued*

	Panel D: Compound Score			
ESG	**-0.0023***	**0.0013**	**-0.0003**	**0.0003**
	(0.0013)	**(0.0014)**	**(0.0015)**	**(0.0014)**
Size	-0.0514***	0.0666***	0.0600***	0.0604***
	(0.0186)	(0.0190)	(0.0203)	(0.0192)
Leverage	-0.2829***	-0.1435***	-0.1931***	-0.1477***
	(0.0502)	(0.0512)	(0.0547)	(0.0517)
Volatility	-1.4278***	1.2811***	0.6179*	1.4338***
	(0.3096)	(0.3153)	(0.3373)	(0.3185)
EPS Sur.	0.0228	0.0822**	0.0667	0.0761*
	(0.0389)	(0.0396)	(0.0424)	(0.0400)
R^2	31.1%	9.4%	8.7%	9.6%

returns. For the environmental and the social score, the same is true for actual returns. Here the coefficients are positive, but not significant. For the remaining two dimensions, governance and compound, there is even a negative relationship between score and stock returns. However, it is important to note that especially for abnormal returns the model has a very small explanatory power, as shown by R^2 values around 9%.

For the other variables, the image is similar to what you see when you observe shock and recovery separately: *Size* has a positive relationship with actual returns, but a negative one with abnormal returns. The opposite is the case for *Volatility*. *Leverage* has, as expected, led to worse returns in these uncertain or pessimistic times. *EPS Sur.* has positive coefficients for all types of returns, but is only significant for the Fama-French adjusted returns, 3FF and 5FF.

5.2 Earnings Forecasts

The purpose of this additional series of tests is to give an indication of whether ESG scores are related to firm-specific profitability. In other words, ESG scores could lead to more stable cash flows if the underlying activities result in better talents remaining loyal to the company or people interested in sustainability and fairness becoming customers of the company. Studies such as Hull et al. (2008) have shown that this is the case in normal times. However, it should be checked whether this is also true in this time of general pessimism and liquidity shortage in society. From this result, conclusions can then be drawn about the motives of investors: Is the trading of certain shares based on sustainable thinking, or are sales or purchases of certain shares due to profit-

maximizing behavior, namely when it is assumed that short-term EPS benefit from ESG dimensions?

The columns of Table IX have a change in the EPS forecast for each firm in the next and second next fiscal year as an independent variable.

First, it is striking that – apart from leverage with a negative impact on change in EPS forecasts – the control variables have no real impact. Furthermore, FY2 forecasts seem to be better explained by the variables of this model, R^2 of around 30%, which can be due to the longer time horizon and the expectations of market participants that COVID-19 is gone by then and therefore earnings are better predictable.

The findings, with one exception, are unambiguous: almost none of the coefficients throughout all panels is significantly different from zero, therefore meaning ESG performance has little to no impact on changes of earnings estimates through a period of uncertainty. The exception is seen when looking at FY1 estimates in relation to social score, where the change in earnings estimates is positively affected. This makes particular sense if one considers that the social score reflects aspects such as dealing with the workforce, whose cohesion is of enormous importance for the success or survival of the firm, especially in difficult times.

Nevertheless, after studying the figures and results, one must conclude that the majority of ESG dimensions do not contribute to the stability of earnings, at least from the point of view of analysts.

On a side note, it should be stated that the *EPS Sur.*, as expected has a significant positive relation with ΔEPSFY1 and ΔEPSFY2 with exception of ΔEPSFY1 in Panel A.

In combination with the results from section 4.1, it can, therefore, be said that the actuality of environmental activities means that this dimension does have a positive impact on stock price returns. However, especially in the recovery phase, which often follows a sharp downturn, investors are primarily concerned with short-term performance and solvency, and since the majority of ESG dimensions do not seem to contribute positively to these, investors cannot have them as a first criterion for their decisions in stressful times.

To conclude, the ESG dimensions do not appear to have had a positive impact on cash flow or earnings-generating aspects of the business during the crisis. As a result, investors would be forced to accept financial losses, if necessary, in order to select shares according to how the corresponding

Table IX

Regression results: change in earnings forecasts

This table represents regression results for the changes in EPS forecasts. A detailed description of variables, including dummies for industries, can be found in section 3. Standard errors in parentheses. *, **, *** represent a 1%, 5%, or 10% significance level, respectively.

	ΔEPSFY1	ΔEPSFY2
	Panel A: Environmental Score	
Env	**0.0005**	**0.0002**
	(0.0005)	**(0.0004)**
Size	-0.0171	-0.0105
	(0.0119)	(0.0094)
Leverage	-0.0759**	-0.0770***
	(0.0325)	(0.0240)
Volatility	-0.2922	-0.0412
	(0.1952)	(0.1463)
EPS Sur.	0.2381	0.0476*
	(0.1455)	(0.0246)
R^2	19.5%	30.4%
	Panel B: Social Score	
Soc	**0.0013***	**0.0005**
	(0.0007)	**(0.0006)**
Size	-0.0195*	-0.0117
	(0.0116)	(0.0093)
Leverage	-0.0743**	-0.0767***
	(0.0325)	(0.0240)
Volatility	-0.2780	-0.0368
	(0.1949)	(0.1462)
EPS Sur.	0.2440*	0.0480*
	(0.1451)	(0.0246)
R^2	19.9%	30.5%
	Panel C: Governance Score	
Gov	**-0.0006**	**-0.0002**
	(0.0007)	**(0.0005)**
Size	-0.0111	-0.0083
	(0.0111)	(0.0088)
Leverage	-0.0750**	-0.0768***
	(0.0326)	(0.0240)
Volatility	-0.3044	-0.0448
	(0.1948)	(0.1460)
EPS Sur.	0.2403*	0.0472*
	(0.1455)	(0.0246)
R^2	19.4%	30.4%

Table IX - *continued*

	Panel D: Compound Score	
ESG	**0.0008**	**-0.0002**
	(0.0008)	**(0.0006)**
Size	-0.0130	-0.0086
	(0.0110)	(0.0087)
Leverage	-0.0757**	-0.0771***
	(0.0325)	(0.0240)
Volatility	-0.2881	-0.0487
	(0.1956)	(0.1463)
EPS Sur.	0.2475*	0.0480*
	(0.1455)	(0.0246)
R^2	19.5%	30.4%

firm deals with available resources, whether human, natural, or similar. However, since the crisis initiated by COVID-19 has led to a great deal of uncertainty and pessimism and many firms are fighting for their very existence, investors – with exception of the environmental aspects that currently concern the whole world – do not seem to be willing to take unnecessary risks, but rather focus their decisions on criteria such as short-term performance and probability of survival. Furthermore, the additional test series for the five worst days makes it clear that when there is panic there are other criteria that are much more important to investors.

6. Conclusion

Awareness of the sustainable use of resources will continue to play an increasingly important role in the future. Although this is the case throughout society as a whole, special attention will be paid to commercial firms and investors who seek to maximize profits. The increased, and still increasing, importance is visible: Firstly, in the capital that is now invested using ESG criteria. Secondly, in science, which draws relations between ESG factors and other company aspects. While much of the later studies when it comes to the relationship between firm risk or asset pricing and ESG relate to fairly normal times with the usual volatility, I focus on a period of immediate uncertainty and price declines in equities.

When it comes to the relationship of ESG performance and firm risk or asset pricing, a large part of the studies give attention to fairly normal times with the usual volatility and use theoretical

concepts to predict stock behavior in tough times. The present study extends the literature in this area by focusing on the examination of the relationship between the four main ESG dimensions and crash risk during the selloff triggered by COVID-19.. Furthermore, to find out the origin of potential relationships between stock prices and ESG dimensions are, I test the relationship between change in earnings estimates during the crisis and ESG dimensions to allow for interpretations of investors' considerations.

The specific findings can be summarized as follows: firstly, none of the ESG dimensions has an impact on share prices at the peak of the turmoil, i.e. the worst five days. Secondly, environmental activities have a positive impact on shareholder value in the period from January 01 to March 23, not because the corresponding firm's earnings are more stable, but because they seem to influence investor decisions. Thirdly, there is even a negative relationship between three of the four tested ESG dimensions – environmental, social, and governance – and stock prices in the recovery phase, suggesting that investors associate increased activity in these areas with lower short-term performance in this phase. Moreover, the shock and recovery phase observed together, no relationship can be established. Finally, none of the ESG dimensions do appear to have had a positive impact on cash flow or earnings-generating aspects of the business during the crisis. When all results are viewed together, the impression is also created that investors do not consider the compound score, but have more specific decision-making criteria when incorporating ESG scores in their models.

Although the results are well-founded and allow clear conclusions to be drawn, a few things should be noted. The findings of this study should be considered tentatively in relation to the crisis triggered by COVID-19 on an ongoing basis, as the crisis is not yet over and further so-called waves may follow. Furthermore, there might have been other influences during the observation period, such as the oil crisis and political tensions, which potentially have slightly distorted the results. In order to make a statement to longer-term shareholders, it is therefore necessary to recheck the results ongoingly. Finally, although I selected firms from the broad S&P 500 index, it is possible that a larger sample or the selection of a different geographic region, such as Europe, would have led to different results.

Another reputable factor model was introduced by Pastor and Stambaugh (2003) who extend the 4C by adding a liquidity factor. Once sufficient data for the liquidity factor in 2020 is available, it

would be interesting to also use Pastor-Stambaugh abnormal returns as an independent variable as liquidity was one of the main concerns of many investors during the selloff in 2020. Further research on the impact of activities in the ESG dimensions would be particularly interesting in terms of the implied change in the cost of equity, once sufficient data is available. In addition, it would be worthwhile to test whether the results also apply to other geographical regions.

Appendix A: Computation of Abnormal Returns

Abnormal returns describe unusual profits over a specified period, taking into account the firm or the corresponding stock's aspects that can influence expected returns. For that matter, academics have developed factor models to estimate normal returns. One of the most widely accepted models is the three-factor model (3FF) by Fama and French (Fama and French, 1993). Their model takes into account coefficients for market risk premium, as well as market capitalization and book-to-market ratio. More recent models have been developed e.g. by Carhart (1997) who created a four-factor-model (4C) by extending the 3FF to include a momentum factor. Furthermore, Fama and French (2015), by adding operating profitability (RMW) and investment patterns (CMA) to their original model, created a five-factor-model (5FF).

To calculate abnormal returns, it is necessary to have actual returns and normal, or expected, returns. The latter are estimated in this study using the three models mentioned above. For that purpose, I first regress actual returns in the estimation window, January 2015 to December 2019, on the factors as illustrated in equations (1) to (3) utilizing the statistics software Stata. Factor data, for the estimation window as well as for the event window, was obtained from the Kenneth R. French data library.

$$3FF: r_{i,act} - r_f = \alpha + \beta_1 MRP + \beta_2 SMB + \beta_3 HML + \varepsilon_i \quad (2)$$

$$4C: r_{i,act} - r_f = \alpha + \beta_1 MRP + \beta_2 SMB + \beta_3 HML + \beta_4 MOM + \varepsilon_i \quad (3)$$

$$5FF: r_{i,act} - r_f = \alpha + \beta_1 MRP + \beta_2 SMB + \beta_3 HML + \beta_4 RMW + \beta_5 CMA + \varepsilon_i \quad (4)$$

After estimating the coefficients using market factors, the following equation (illustrative for 3FF) is used to calculate the normal (expected) daily returns for the event window:

$$E(r_i) = \alpha + \beta_1 MRP + \beta_2 SMB + \beta_3 HML \quad (5)$$

Finally, to obtain daily abnormal returns, I subtract normal expected returns from actual returns:

$$r_{i,\,abn} = r_i - E(r_i) \quad (6)$$

Having estimated daily returns, I calculate hypothetical share price movements throughout the event window in order to get periodic returns for the respective period, i.e. Jan 01 – Mar 23, Mar 23 – May 29, and Jan 01 – Mar 29.

Appendix B: SIC Codes for Industry Allocation

1 NoDur Consumer Nondurables -- Food, Tobacco, Textiles, Apparel, Leather, Toys

0100-0999

2000-2399

2700-2749

2770-2799

3100-3199

3940-3989

2 Durbl Consumer Durables -- Cars, TVs, Furniture, Household Appliances

2500-2519

2590-2599

3630-3659

3710-3711

3714-3714

3716-3716

3750-3751

3792-3792

3900-3939

3990-3999

3 Manuf Manufacturing -- Machinery, Trucks, Planes, Off Furn, Paper, Com Printing

2520-2589

2600-2699

2750-2769

3000-3099

3200-3569

3580-3629

3700-3709

3712-3713

3715-3715

3717-3749

3752-3791

3793-3799

3830-3839

3860-3899

4 Enrgy Oil, Gas, and Coal Extraction and Products

1200-1399

2900-2999

5 Chems Chemicals and Allied Products

2800-2829

2840-2899

6 BusEq Business Equipment -- Computers, Software, and Electronic Equipment

3570-3579

3660-3692

3694-3699

3810-3829

7370-7379

7 Telcm Telephone and Television Transmission

4800-4899

8 Utils Utilities

4900-4949

9 Shops Wholesale, Retail, and Some Services (Laundries, Repair Shops)

5000-5999

7200-7299

7600-7699

10 Hlth Healthcare, Medical Equipment, and Drugs

2830-2839

3693-3693

3840-3859

8000-8099

11 Money Finance

6000-6999

12 Other Other -- Mines, Constr, BldMt, Trans, Hotels, Bus Serv, Entertainment

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