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COVID-19 and the march 2020 stock market crash. Evidence from S&P1500

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ABSTRACT

This paper investigates the US stock market performance during the crash of March 2020 triggered by COVID-19. We find that natural gas, food, healthcare, and software stocks earn high positive returns, whereas equity values in petroleum, real estate, entertainment, and hospitality sectors fall dramatically. Moreover, loser stocks exhibit extreme asymmetric volatility that correlates negatively with stock returns. Firms react in a variety of different ways to the COVID-19 revenue shock. The analysis of the 8K and DEF14A filings of poorest performers reveals departures of senior executives, remuneration cuts, and (most surprisingly) newly approved cash bonuses and salary increases.

1. Introduction

March 2020 saw one of the most dramatic stock market crashes in history. In barely four trading days[2], Dow Jones Industrial Average (DJIA) plunged 6,400 points, an equivalent of roughly 26%. The crash was caused by government's reaction to a novel coronavirus (COVID-19), a disease which originated in the Chinese city of Wuhan in December 2019 and quickly spread around the world causing a pandemic. Because the virus is highly contagious and fatal, the authorities imposed strict quarantines on their populations and ordered the shut-down of the bulk of business activity. At present, US economy seems to be affected most with the rate of unemployment reaching above 20%[3].

In this paper we investigate the effect of COVID-19 on the stock market behavior during the crash of March 2020 using the universe of S&P1500 firms. Clearly, COVID-19 represents a massive revenue shock to the economy. Since most of the businesses are prohibited from remaining fully operational during the imposed quarantine, they choose to adjust their labor costs by laying off employees. Consequently, this leads to the sharp reduction in consumption and economic output, lowering the stream of expected future cash flows. Nevertheless, COVID-19, may not necessarily be equally detrimental to all firms and industries. Whereas most sectors suffer and their stock prices collapse, some other may benefit from the pandemic and the resulting lockdown. This paper attempts to answer these questions by examining the differential stock price reactions to the rapid spread of the coronavirus and the abrupt government interventions that triggered the crash. We also investigate the implications for the stock price volatility. Finally, by using hand-collected

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[2] March 9, 12, 16 and 23, 2020

[3] https://faculty.fuqua.duke.edu/~charvey/Audio/COVID/COVID-Harvey.html

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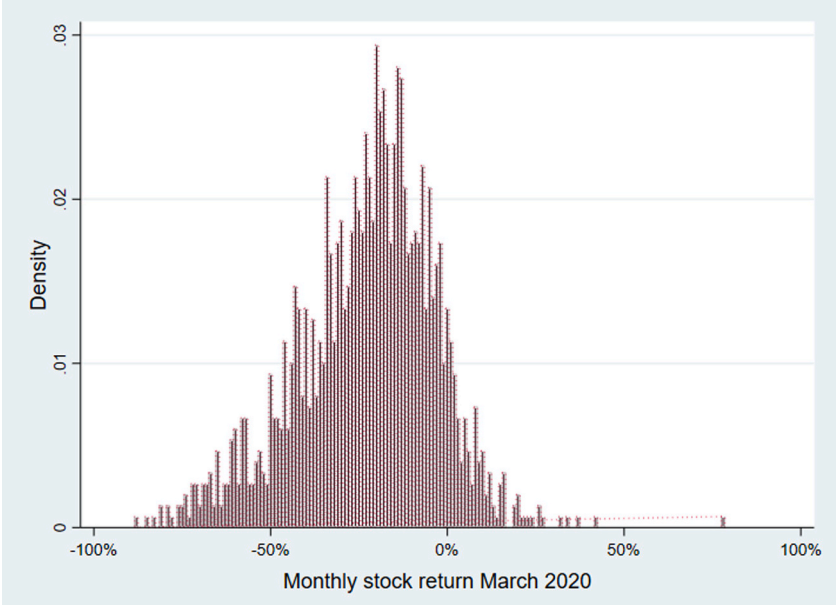

Fig. 1.. March 2020 stock returns.
The plot shows the relative frequency distribution of monthly stock returns for the universe of the S&P1500 firms in March 2020. The data are derived from Thomson Reuters Eikon.

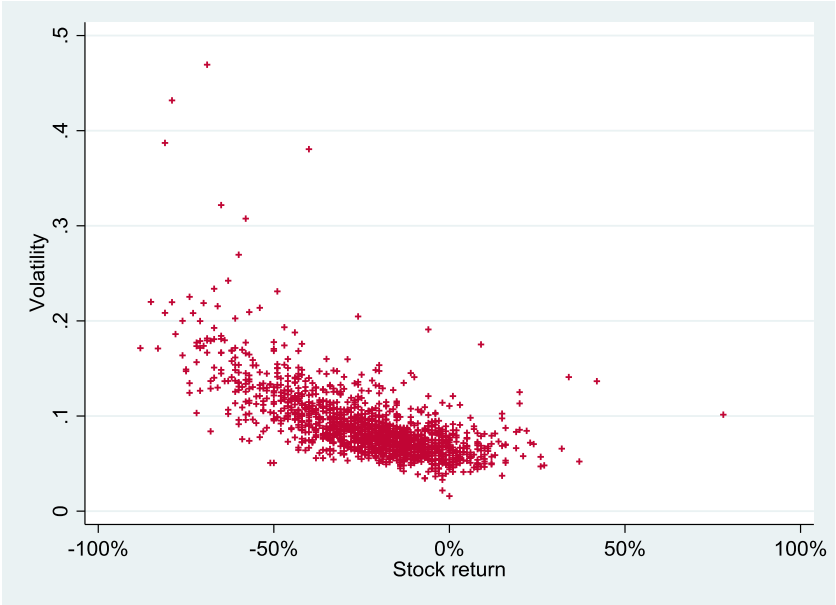

Fig. 2.. March 2020 stock return and stock return volatility.
The plot shows the relationship between monthly stock returns and daily stock return volatility for the universe of the S&P1500 firms in March 2020. Because of its extreme value, Gulfport Energy data point has been omitted from the plot (see Table 2). The data are derived from Thomson Reuters Eikon.

data we examine firms' immediate responses to COVID-19.

We find that that approximately 90% of the S&P1500 stocks generate asymmetrically distributed large negative returns (Fig. 1). When analyzing single-day extreme events, namely Black Monday, Black Thursday, and Black Monday II, we find that firms that operate in crude petroleum sector are hit hardest and lose over 60% of their market values in a day. In contrast, firms in natural gas and chemicals sectors improve their market valuations and earn positive returns of more than 10%, on average. Further, we study industry-level patterns and show that during March 2020 stock market crash the best performing industries include healthcare, food, software

and technology, as well as natural gas. The superior performers in these industries yield a positive monthly return of over 20%. On the other hand, sectors including crude petroleum, real estate, as well as hospitality and entertainment experience rapid descent of their market capitalizations and plunge over 70%.

Stock price crashes unfold extreme volatility. We document extreme asymmetric volatility for S&P1500 firms and find that volatility correlates negatively with realized stock returns (Fig. 2). The highest level of volatility is observed for stocks in the crude petroleum sector whose prices tumble most. For example, Gulfport Energy displays the widest daily amplitude of price movement of roughly 130%. Entertainment and hospitality industries are highly volatile as well at an average level of about 20%. It is worth noting that in normal times, daily volatility is an order of magnitude lower.

In the final analysis, we investigate how poorest performers react to COVID-19 and the associated revenue shock. We examine the information disclosed in 8K and DEF14A reports filed with the Securities and Exchange Commission (SEC) in March and April 2020. We find that firms respond differently to profit uncertainty induced by COVID-19. Some of them reduce salaries for their top executives and board members. The other reduce the amount of dividend, however, dividends are never suspended. Surprisingly, a subset of firms increases salaries for senior executives or approve new bonus awards. Arguably, this latter behavior could be viewed as manifestation of poor corporate governance.

Our paper extends the literature on stock market crashes by providing insights into the March 2020 collapse. At least 20 percent decline in the main index can be defined as a stock market crash (Mishkin and White, 2002). On October 28-29, 1929 DJIA declined by 24.5%, whereas on October 19, 1987, by 22.6%. For the sake of comparison, the sequence of panic selling on March 9, 12, 16 and 23 of 2020 led to the cumulative 26% percent drop of DJIA. Interestingly, financial crisis of 2007-2009 did not produce a sharp fall of comparable magnitude and the stock market decline was, instead, extended in time (Anand, Puckett, Irvine, and Venkataraman, 2013). Further, the March 2020 stock market crash does not reflect the bursting of asset price bubble. To the contrary, perhaps for the first time in economic history the crash occurs when fundamentals are sound and the slump in market capitalizations is rather due to the lockdown of populations and the shutdown of most of manufacturing and service business. Next, we complement existing studies and find extreme negative asymmetries in stock return volatility (Chen, Hong, and Stein, 2001). Further, our study suggests that March 2020 stock market crash may uncover corporate governance scandals similarly to the ones that emerged in the early 2000s (Nelson, Price, and Rountree, 2008; Bhagat and Bolton, 2013). Finally, our paper extends emerging literature on COVID-19 and financial markets (Akhtaruzzaman, Boubaker, and Sensoy, 2020; Akhtaruzzaman, Boubaker, Lucey, and Sensoy, 2020; Baker, Bloom, Davis, Kost, Sammon, and Viratyosin, 2020; Zhang, Hu, and Ji, 2020).

The paper is organized as follows. Section 2 describes the data, Section 3 presents the result, and Section 4 concludes.

2. Data

We use the universe of the Standard and Poor's (S&P) 1,500 firms for the month of March 2020. Stock price and trading volume data come from Thomson Reuters (TR) Eikon. To derive complementary information, we match these data by ticker with CRSP Daily Stock File and Compustat Index Constituents. For the industry-level analysis we exclude very few firms that could not be matched due to ticker incompatibility. For example, in TR Eikon, Aqua America's ticker is WTRG, whereas in CRSP it is WTR. Moreover, we exclude firms that do IPOs in March 2020 (e.g., Otis Worldwide), as IPO stocks begin trading in the middle of the month. Finally, we hand collect information on fundamentals from 8K and DEF14A filings available on SEC's EDGAR.

3. Results

3.1. Panic selling: Black monday, Black tuesday, Black monday II

Quite surprisingly, natural gas companies are among winner stocks earning between +17% and +11% daily on Black Monday and Black Tuesday. One possible reason for the increase in stock prices of these firms is that for crude petroleum producers natural gas is a byproduct extracted only during extraction of oil. Since oil prices declined sharply in March 2020, crude producers decided to reduce the output of oil and therefore they automatically reduced production of natural gas. Needless to say, this had a positive impact on market prices of natural gas and expected future cashflows of natural gas producers. Similarly, firms in food industry (e.g., United Natural Foods) and chemicals (e.g., Kraton) experience a significant price jump of 20% in a single day.

At the other extreme, crude petroleum stocks plunge drastically by more than 60%. Stocks in hospitality, real estate, and entertainment sectors suffer a decline of similar magnitude. For example, Eldorado Resorts or EPR Properties each lose more than 60% of their values.

3.2. March 2020 stock market crash and industry-level performance

The best performing industries include healthcare and medical devices, which is understandable on the basis that virtually every country in the world is going through catastrophic mortality deterioration due to COVID-19 (Table 2). Another well performing sector is food and grocery distribution that is currently benefiting from the upward shift in demand, as restaurants and eateries have been shut down for the public. Software and technology sector has performed equally well. For example, providers of resources for the remote work (e.g., Citrix) and multinational networking services (e.g., Netgear) experience an unusual surge in demand. This is due to the fact that a large fraction of employees moved to online working, which spurred the need for appropriate software and hardware. Finally, natural gas industry is another big winner for the reasons already stated above. Overall, each of these these industries earn a monthly

Table 1
Single-day returns during the March 2020 stock market crash.

Panel A: Black monday (9 March 2020)								
Firm name	Ticker	Ret. (%)	Index	Exchange	Industry	SIC	Market cap ($M)	IPO year
Superior Performer								
SOUTHWESTERN ENERGY	SWN	+16.79	SP400	NYSE	Natural gas	1321	828	1978
E Q T	EQT	+10.49	SP400	NYSE	Natural gas	1311	1,805	1978
C N X Resources	CNX	+7.59	SP400	NYSE	Natural gas	1221	1,032	1999
TEGNA	TGNA	+5.29	SP400	NYSE	Media	7929	3,883	1978
AUTOZONE	AZO	+5.03	SP500	NYSE	Aftermarket automotive parts	5531	26,275	1991
Worst performer								
CALLON PETROLEUM	CPE	-68.08	SP400	NYSE	Crude petroleum	1382	162	1994
MATADOR RESOURCES	MTDR	-64.12	SP400	NYSE	Crude petroleum	1382	274	2012
OASIS PETROLEUM	OAS	-61.67	SP400	NASDAQ	Crude petroleum	1321	106	2010
S M ENERGY	SM	-61.26	SP600	NYSE	Crude petroleum	1321	167	1992
Q E P RESOURCES	QEP	-58.69	SP400	NYSE	Crude petroleum	1311	141	2010
Panel B: Black thursday (12 March 2020)								
Firm name	**Ticker**	**Ret. (%)**	**Index**	**Exchange**	**Industry**	**SIC**	**Market cap ($M)**	**IPO year**
Superior performer								
TUPPERWARE BRANDS	TUP	+20.10	SP400	NYSE	Plastic containers food storage	3089	111	1996
SOUTHWESTERN ENERGY	SWN	+13.85	SP400	NYSE	Natural gas	1321	801	1978
TITAN INTERNATIONAL	TWI	+10.98	SP600	NYSE	Tires	5099	116	1993
EXTERRAN	EXTN	+10.75	SP600	NYSE	Natural gas midstream infrastructure	7353	183	2000
O I GLASS	OI	+10.00	SP400	NYSE	Container glass products	3221	993	1991
Worst performer								
TIVITY HEALTH	TVTY	-68.08	SP600	NASDAQ	Health nutrition fitness	8060	237	1998
ELDORADO RESORTS	ERI	-64.12	SP400	NASDAQ	Hotels and casinos	9999	1,204	2014
E P R PROPERTIES	EPR	-61.67	SP400	NYSE	Real estate	6798	2,220	1997
NORWEGIAN CRUISE LINE	NCLH	-61.26	SP500	NYSE	Cruise line	4481	2,053	2013
DINE BRANDS GOBAL	DIN	-58.69	SP600	NYSE	Restaurants	5812	588	1991
Panel C: Black monday II (16 March 2020)								
Firm name	**Ticker**	**Ret. (%)**	**Index**	**Exchange**	**Industry**	**SIC**	**Market cap ($M)**	**IPO year**
Superior Performer								
UNITED NATURAL FOODS	UNFI	+29.20	SP600	NYSE	Food wholesaler	5149	395	1996
KRATON	KRA	+19.15	SP600	NYSE	Chemicals	2822	258	2009
B & G FOODS	BGS	+16.65	SP600	NYSE	Branded foods	2033	1,032	2007
ADVANSIX	ASIX	+14.30	SP600	NYSE	Chemicals	2821	341	2016
WARRIOR MET COAL	HCC	+14.22	SP600	NYSE	Coal	5052	796	2017
Worst performer								
GULFPORT ENERGY	GPOR	-65.33	SP400	NASDAQ	Natural gas and oil	1310	151	1997
OASIS PETROLEUM	OAS	-57.99	SP600	NASDAQ	Crude petroleum	1321	135	2010
DAVE & BUSTERS	PLAY	-45.74	SP600	NASDAQ	Restaurants and entertainment	9999	220	2014
PENN NATIONAL GAMING	PENN	-44.80	SP400	NASDAQ	Casinos and racetracks	7948	990	1994
CHEFS WAREHOUSE	QEP	-43.19	SP600	NASDAQ	Gourmet foods and restaurant supply	9999	301	2011

The data are derived from Thomson Reuters Eikon. *Ret.* denotes daily return.

return of over +20%.

Among the industries that perform the worst are crude petroleum and oil services (-77%), real estate (-72%), and hospitality and entertainment (-70%).

What explains rapid declines in stock prices for the great majority of industries? Many sectors are in a position of strength and despite that their values collapse. Theoretical underpinning for these findings relies arguably on the theory of economic relationships between linked firms, where a shock to one firm has a resulting effect on all the linked partners (e.g., customers and suppliers) (Bernanke, 1983; Cohen and Frazzini, 2008). Therefore, even for unrelated industries, a revenue shock to one firm may have a negative revenue effect on all economically related firms, precipitating a cascade of price declines in the stock market.

3.3. Additional analyses

Following the event-study methodology described in Peterson (1989), we assess firm and industry performance relative to the benchmark on Black Monday, Black Thursday, and Black Monday II (Table 3). In comparison to raw returns presented in Tables 1 and 2, we expect the event-study returns to be significantly higher for well- and poor-performing stocks and industries during the indicated event days, due to the highly negative returns on the market as a whole. As expected, for example, on Black Monday II, the abnormal return to superior performers is roughly +32%, whereas the equal-weighted raw return is +18.7%. Likewise, the return to the worst performing stocks on the same day is -36.3%, whereas the equal-weighted raw return is considerably lower (-51.4%) (Table 1).

Table 2
Industry return and volatility during the March 2020 stock market crash.

Industry	Firm name	Ret. (%)	Sigma (%)
Healthcare and medical devices	ORASURE TECHNOLOGIES; OWENS & MINOR; EHEALTH; L H C GROUP; MOLINA HEALTHCARE; INOGEN; REPLIGEN	+25.58	7.82
Food and grocery distribution	UNITED NATURAL FOODS; BJS WHOLESALE CLUB; CAL MAINE FOODS; B & G FOODS; SANFILIPPO JOHN B & SON; CORE MARK HOLDING; SPROUTS FARMERS MARKET; TREEHOUSE FOODS; TOOTSIE ROLL INDS; SPARTANNASH; SENECA FOODS;	+24.55	7.87
Software and technology	CITRIX SYSTEMS; N I C; NETGEAR; DIGITAL REALTY TRUST; COGENT COMMUNICATIONS	+22.32	5.95
Natural Gas	CABOT OIL & GAS; E Q T; SOUTHWESTERN ENERGY	+20.95	8.94
Crude petroleum and oil services	VALARIS; Q E P RESOURCES; APACHE; S M ENERGY; PENN VIRGINIA; OASIS PETROLEUM; NABORS INDUSTRIES; CALLON PETROLEUM; HELIX ENERGY SOLUTIONS GROUP; DENBURY RESOURCES; TETRA TECHNOLOGIES; NEWPARK RESOURCES; OIL STATES INTERNATIONAL; MATADOR RESOURCES; OCEANEERING INTERNATIONAL; HIGHPOINT RESOURCES; PROPETRO HOLDING; APERGY	-76.88	20.13
Real estate	INVESCO MORTGAGE CAPITAL; NEW YORK MORTGAGE TRUST; MACERICH; WASHINGTON PRIME GROUP; REDWOOD TRUST; SERVICE PROPERTIES TRUST; GRANITE POINT MORTGAGE TRUST	-72.05	21.71
Hospitality and entertainment	ELDORADO RESORTS; NORWEGIAN CRUISE LINE; RED ROBIN GOURMET BURGERS; HERSHA HOSPITALITY TRUST	-69.96	18.12

To identify industry clusters, we use the top and bottom 2% of the S&P1500 firms sorted by monthly stock return estimated for March 2020. For ease of exposition, we merge related industries into one. We report the industry, once it appears more than twice within each 2% tail. *Ret.* denotes monthly return using daily data. *Sigma* denotes average daily volatility. The data are derived from Thomson Reuters Eikon.

Table 3
Additional analyses.

Panel A: Firm-level	AR (%)	*t*-stat.	Obs.
Black Monday (9 March 2020)			
Superior performer	17.96	7.42***	5
Worst performer	-53.22	33.08***	5
Black Thursday (12 March 2020)			
Superior performer	24.24	12.14***	5
Worst performer	-25.31	20.33***	5
Black Monday II (16 March 2020)			
Superior performer	32.01	11.54***	5
Worst performer	-36.31	6.73***	5
Panel B: Industry-level	AR (%)	*t*-stat.	Obs.
Black Monday (9 March 2020)			
Healthcare and medical devices	4.59	2.42*	7
Food and grocery distribution	3.97	3.53***	11
Software and technology	4.44	4.18**	5
Natural gas	18.94	4.18*	3
Crude petroleum and oil services	-40.01	17.29***	18
Real estate	-2.18	1.08	7
Hospitality and entertainment	-13.31	6.45***	4
Black Thursday (12 March 2020)			
Healthcare and medical devices	6.50	5.91***	7
Food and grocery distribution	0.45	0.20	11
Software and technology	4.43	3.59**	5
Natural gas	14.84	2.83	3
Crude petroleum and oil services	2.19	0.90	18
Real estate	-8.17	6.12***	7
Hospitality and entertainment	-21.88	7.17***	4
Black Monday II (16 March 2020)			
Healthcare and medical devices	2.74	0.69	7
Food and grocery distribution	16.42	4.43***	11
Software and technology	5.40	3.68**	5
Natural gas	11.37	1.79	3
Crude petroleum and oil services	-10.04	3.01***	18
Real estate	-12.08	5.34***	7
Hospitality and entertainment	-7.68	1.16	4

This table reports event-study results. The event dates are defined as in Table 1. Abnormal returns are measured over a single trading day on March 9, 12, and 16, 2020 using the mean-adjusted return model relative to the S&P500, S&P400, or S&P600 value-weighted index depending on the index constituent stock. *Superior (Worst) performers* are grouped based on the identification used in Table 1. The industries are defined as in Table 2. *AR* denotes mean abnormal return. ***, **, * indicate significance at the 1, 5, and 10% levels, respectively.

Table 4
Volatility during the March 2020 stock market crash.

Panel A: S&P600 Firm name	Ticker	Sigma (%)	Volume (M)	Close price ($)	SIC	Industry
Extreme volatility						
GULFPORT ENERGY	GPOR	127.7	62.79	0.44	1310	Natural gas and oil
OASIS PETROLEUM	OAS	43.18	168.30	0.35	1321	Crude petroleum
PENN VIRGINIA	PVAC	38.71	5.53	3.09	9999	Crude petroleum
LAREDO PETROLEUM	LPI	32.17	56.05	0.37	1382	Crude petroleum
GUESS	GES	30.75	14.37	6.77	5641	Clothing retailer
Lowest volatility						
EL PASO ELECTRIC	EE	1.58	6.20	67.96	4911	Electric utility
KEMET	KEM	3.45	9.23	24.16	3675	Capacitors
STURM RUGER	RGR	4.12	2.19	50.91	3484	Firearms
QUALYS	QLYS	4.41	4.69	86.99	9999	Cloud security
TRUEBLUE	TBI	4.49	4.36	12.76	7363	Recruitment
Panel B: S&P400 Firm name	**Ticker**	**Sigma (%)**	**Volume (M)**	**Close price ($)**	**SIC**	**Industry**
Extreme volatility						
MATADOR RESOURCES	MTDR	22.53	59.84	2.48	1382	Crude petroleum
PENN NATIONAL GAMING	PENN	20.92	71.25	12.65	7948	Casinos
CINEMARK HOLDINGS	CNK	20.26	27.85	10.19	7812	Movie theatres
ELDORADO RESORTS	ERI	19.98	53.67	14.4	9999	Hotels and casinos
APERGY	APY	18.15	11.96	5.75	5084	Oilfield equipment
Lowest volatility						
LEGG MASON	LM	2.18	19.99	48.85	6282	Asset management
LOGMEIN	LOGM	3.72	9.58	83.28	9999	Remote access software
SILGAN HOLDINGS	SLGN	4.14	7.06	29.02	3441	Packaging
WATSCO	WSO	4.61	5.60	158.0	5075	Air con and heating
MASIMO	MASI	4.68	4.78	177.1	3845	Medical technology
Panel C: S&P500 Firm name	**Ticker**	**Sigma (%)**	**Volume (M)**	**Close price ($)**	**SIC**	**Industry**
Extreme volatility						
APACHE	APA	17.10	89.40	4.18	1321	Crude petroleum
NOBLE ENERGY	NBL	16.89	112.7	6.04	1311	Crude petroleum
OCCIDENTAL PETROLEUM	OXY	14.85	200.1	11.58	1311	Crude petroleum
ROYAL CARIBBEAN	RCL	14.57	98.68	32.17	4481	Cruise line
DIAMONDBACK ENERGY	FANG	14.50	50.84	26.2	9999	Crude petroleum
Lowest volatility						
NORTONLIFELOCK	NLOK	3.29	84.29	18.71	7372	Cyber safety
ALLERGAN	AGN	3.46	35.74	177.1	2834	Pharmaceuticals
CERNER	CERN	3.88	38.16	62.99	7373	Health information
VERIZON	VZ	3.93	177.2	53.73	4813	Telecom
EBAY	EBAY	4.20	141.6	30.06	7389	E-commerce

Close price is the close stock price on March 31, 2020. *Sigma* denotes average daily volatility. The data are derived from Thomson Reuters Eikon.

3.4. Extreme volatility

Stocks that exhibit extreme negative returns during the March 2020 crash exhibit also extreme volatility (Fig. 1). Crude petroleum stocks are particularly volatile irrespective of firm market capitalization. In one instance (Gulfport Energy) the level of volatility reaches staggering 130% (Table 4). Entertainment and hospitality stocks are also marked by high volatility in the neighborhood of 20%. A similar picture emerges when we analyze volatility at the industry level (Table 2). High return industries are significantly less volatile (6% to 9%), whereas industries that plummet experience excessive volatility (around 20%).

Existing finance theories suggest that asymmetric volatility (increase of volatility together with negative returns) can be explained either by heterogenous believes and short-sale constraints of certain types of investors (Hong and Stein, 1999), or alternatively, by operating and financial leverage effects (Schwert, 1989; Bekaert and Wu, 1997). The context of COVID-19 stock market crash, however, differs from other crashes that occurred in the past. At present, most of the listed firms have valuable assets in place and strong free cash flow potential indicating that the collapse of stock prices did not occur due to popping of the bubble. Our results suggest that a better model of extreme volatility would be one that recognizes that fact.

3.5. Firms' response to COVID-19

COVID-19 represents a revenue shock to majority of industries that remain shut down during the quarantine period. From this perspective, March 2020 stock market crash does not occur due to weak economic fundamentals. Nevertheless, because of suppressed consumer spending, firms revise downwards their earnings prospects. Consequently, this leads to market's reassessment of firms'

Table 5
Firms' response to COVID-19.

Firm name	Ret. (%)	Date	Response
Gulfport energy	-45.74	March 11, 2020	Cash awards to be granted on March 16, 2020 to the named executive officers including CEO, CFO and other senior executives. Board of directors approved new 2020 incentive plan for selected employees.
SM Energy	-81.43	April 9, 2020	Board of Directors approved a semi-annual cash dividend of $0.01 per share of common stock outstanding (a cut from the $0.05 level).
		April 17, 2020	Temporary reduction to our CEO's base salary by 20%; possible additional temporary reductions to our CEO's base salary, as well as the base salaries of other executive officers, if business conditions do not improve; reduction of 2020 LTIP target grant values, as compared to 2019 grant values, and/or delay of 2020 LTIP awards, if business conditions do not improve; possible temporary reduction to executive officers' annual cash bonus targets and award (to be paid in 2021); indefinite suspension of scheduled 2020 base salary increases for all employees
Penn virginia	-80.56	April 7, 2020	Salary increase for CEO (5%) and SVP Operations and Engineering (10%)
Oasis petroleum	-78.59	March 30, 2020	No reaction
Apache	-83.22	March 31, 2020	Resignation of senior vice president, Energy Technology, Data Analytics & Commercial Intelligence effective immediately. Reducing the dividend by 90% from $0.25 to $0.025; Reducing capital spending from $2.4 billion in 2019 to a range of $1.0 billion to $1.2 billion in 2020; Fully capturing the $150 million of promised G&A cost savings, with efforts still underway to reduce costs substantially further; Closing all US offices so employees can work remotely
Callon petroleum	-75.86	April 17, 2020	Board members agreed to reduce their total compensation by 35%; CEO agreed to reduce his salary by 20% and his total target cash compensation by 35%; All other officers agreed to reduce their total target cash compensation by at least 25%, including salary reductions of 15% and 10% by senior vice presidents and vice presidents, respectively.

This table summarizes firms' responses to the revenue shock caused by the COVID-19 pandemic. We select a set of crude petroleum producers, as this sector has been hit hardest by the March 2020 stock market crash. The data are hand-collected from 8K and DEF14 reports filed with the SEC in March and April 2020. *Ret.* denotes monthly return using daily data estimated for March 2020.

values and a large fall of stock prices as demonstrated in this study.

We analyze disclosures made by firms filing current reports (8K) and proxy statements (DEF14A) in March through April 2020. We choose a subset of crude oil firms affected most by March 2020 stock market crash. As expected and indicated in Table 5, firms decide to lower the amount of dividend payouts, reduce compensation for senior executives and directors, cut capital expenditures as well as other costs. Dividends, however, are never reduced to zero, meaning that despite economic contraction, firms that have been affected most by COVID-19 continue paying out cash to investors. Most surprisingly, some firms increase salaries for senior management and award cash bonuses approved by boards as late as March 2020 (e.g., Gulfport Energy). Moreover and equally intriguing, some firms choose not to respond at all to the current crisis (e.g., Oasis Petroleum).

The question is why we observe this differential reaction to COVID-19 for firms in the same sector. As shown theoretically, corporate governance has a profound impact on firm decision-making (Adams and Ferreira, 2007). Firms may have weak, management-friendly boards unaccountable to shareholders they represent (Almazan and Suarez, 2003). Our observations seem to be consistent with these theories. For instance, Gulfport Energy has recently been targeted by an activist investor Firefly who criticized it for not scheduling shareholders' meeting to discuss capital allocation and strategy decisions under COVID-19. Gulfport was also condemned in the early March 2020 for having incompetent and inattentive board. A deeper insight into the sample firms' corporate governance shows that, for example, Oasis Petroleum has two directors that used to hold managerial positions in the same organization at the same time. Also, in the last fiscal year its nominating and corporate governance committees were significantly less active than compensation committee. Obviously, weak boards would allow managers to appropriate resources in the form of e.g., higher remuneration, and would overall pay less attention to shareholders' interests.

4. Conclusion

The collapse of stock prices in March 2020 marks one of the biggest stock market crashes in history. As measured by DJIA, the market fell 26% in four days. The crash was caused by COVID-19 pandemic and government's dramatic response to it. According to the latest statistics, the US GDP decreased 4.8 percent in the first quarter of 2020 and the unemployment rate spiked to above 20%.

In this study, we show that during March 2020 stock market crash stocks in healthcare, food, natural gas, and software sectors perform abnormally well generating high returns, whereas firms operating in crude petroleum, real estate, entertainment and hospitality sectors plummet considerably losing more than 70% of their market capitalizations. Loser stocks have more asymmetric movements and exhibit extreme volatility that correlates negatively with stock returns. We also show that a subset of poorest performers respond to the revenue shock adequately by cutting costs, including remuneration for top management and board members, whereas others increase salaries and implement new cash awards. The latter behavior may signal poor corporate governance and indicates a fruitful area for future research.

Author Statement

Mieszko Mazur, Man Dang, and Miguel Vega contributed equally to the development of the manuscript

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