CEO Overconfidence and the COVID-19 Pandemic

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Abstract: We examine the impact of CEO overconfidence on firm performance during the COVID-19 pandemic and find that firms with overconfident CEOs exhibit significantly better stock market returns, implying CEO overconfidence helps instill investor confidence during the crisis period. Utilizing a text-based measure of firm-specific exposure to the pandemic, we show that CEO overconfidence substantially mitigates the negative effect of firm exposure to the COVID-19 pandemic. We further show how overconfident CEOs instill confidence by uplifting public sentiment while withholding bad news during the pandemic. However, the impact of CEO overconfidence diminishes when firms are facing ex-ante higher levels of risk with weaker fundamentals. Overall, our finding demonstrates the bright side of CEO overconfidence at times of crises.

Keywords: CEO overconfidence; COVID-19 pandemic; firm exposure; sentiment; bad news hoarding

JEL Classifications: G01; G14; M14; I18

1. Introduction

The COVID-19 brings an unprecedented health crisis all over the world. Besides the damage on public health, it has also brought acute economic disruptions on a scale and speed not seen before (Abadi et al., 2020; Baker et al., 2020). The OECD predicted world GDP to decline by up to 7.6% for 2020 (OECD, 2020). Within the first few months of the pandemic, economic turmoil associated with the COVID-19 pandemic has had severe impacts upon the financial markets, especially the stock market. It is documented that the stock market crash associated with the COVID-19 in the U.S. surpasses the Global Financial Crisis (GFC) in 2008 and even the Great Depression in 1933, and rivals the two largest stock market crashes in history, the Great Crash in 1929 and Black Monday in 1987 (Baker et al., 2020). Both Dow Jones Industrial Average (DJIA) and FTSE saw their biggest drops since 1987 (Jones et al., 2020), with the U.S. stock market hitting the circuit breaker mechanism four times in 10 days in March 2020 (Zhang et al., 2020). The global stock markets declined over 30% by March 2020, as the coronavirus outbreak spread worsened substantially outside China in that month. Singh et al. (2020) show cumulative abnormal returns range from -0.7% to -42.69% among the stock market indices of the G20 countries in the first 43 days from the onset of the COVID-19 pandemic. Schoenfeld (2020) further shows, at the firm-level, S&P 500 firms suffer an average economic loss of $18 billion from January to March of 2020.

In this study, we study the role of CEO, in particular CEO overconfidence, on aiding firms to weather the economic catastrophe brought upon by the COVID-19 pandemic. At unprecedented times like this, a firms' CEO plays an important role in crisis management to ensure survival of the business. Management scholars have long established that CEOs have ultimate control and direction on firms' corporate strategies (e.g., Calori et al., 1994; Hiller and Hambrick, 2005). However, it is well documented that overconfident CEOs tend to underestimate risk and overestimate returns (e.g., Banjeree et al., 2015; Cain and McKeon, 2013; Goel and Thakor, 2008; Hirshleifer et al., 2012; Malmendier and Tate, 2008). As a consequence, they could be making less-than-optimal decisions that destroy firm value (Hiller and Hamrbick, 2005).

We take a unique perspective on the bright side of CEO overconfidence. Although overconfident CEOs tend to underestimate risk and overestimate returns, dispositional optimism plays a crucial role in achieving success in various contexts (Puri and Robinson, 2007). Specially, we conjecture that CEO overconfidence could be beneficial to a firm at times of crises, particularly

the current coronavirus pandemic. The COVID-19 has brought an unparallel level of uncertainty and volatility to the capital market. A confident CEO could deem to be essential to display leadership, to devise plans of mitigation, and to instill investor confidence during this crisis. Bolton et al. (2013) and Phua et al. (2018) show overconfident CEOs are better leaders as stakeholders such as suppliers and employees would more strongly believe in the leadership of the CEO. Van den Steen (2005) also argues that overconfidence can attract employees with similar preferences and shared beliefs. Importantly, powerful leadership could be more indispensable to guide and reassure employees through difficult times during the COVID-19 crisis (Garnett, 2020).

CEO overconfidence, which resembles over-optimism (Hillary et al., 2016), could also be helpful to CEOs for devising their actions plans fast to navigate through such a challenging business environment. Higher optimism could lead to better economic choices (Puri and Robinson, 2007), and confident CEOs may be able to hedge and insure their exposure through faster, and more decisive operational or financial strategies (Robert Baum and Wally, 2003). On the other hand, firms with unconfident CEOs may be indecisive in devising immediate actions to react to the COVID-19 pandemic, and their inactions could be damaging to shareholder wealth.

Moreover, overconfident CEOs may be perceived by investors as more competent and credible, and these CEOs could be more persuasive to their shareholders, based on psychology and organization literature on the social benefits of overconfidence (Kennedy et al., 2013; Tenney et al., 2008) and its persuasion power (Smith et al., 2017; Von-Hippel and Trivers, 2011). The perception of overconfidence is especially important under uncertainty (Anderson et al., 2012). Johnson and Fowler (2011) also show that under conditions of resource scarcity, the perception of overconfidence becomes advantageous. Several empirical studies support this idea in a corporate setting by showing that leaders' perceptions of success likelihood and optimism have a strong impact on helping them to compete for and to eventually obtain external financing (Dai et al., 2017; Eckhardt et al., 2006).

We focus on investor perception in this study and hypothesize that firms with more confident CEOs have better stock market performance during the COVID-19 pandemic. To examine this hypothesis empirically, we test the impact of CEO overconfidence on stock market performance using a sample of U.S. firms over the period of January 22nd, 2019 to March 23rd, 2020, one year before to two months after the first confirmed COVID-19 cases reported in the U.S. on January 21st, 2020, and we include only firms that have not experienced CEO turnover over the

sample period. We focus on the period of the COVID-19 crisis from January 21st, 2020 up to March 23rd, 2020 as our test period, since it includes the lowest points of the S&P index for the first half of 2020 and also covers the period with the highest increase in daily confirmed cases,[1] as shown in Figure 1. Moreover, we intend to isolate the effect of the crisis from the cofounding effect of government interventions since March 23rd (Davison, 2020; Fahlenbrach et al., 2020; Li et al., 2020).[2]

[--- INSERT FIGURE 1 ABOUT HERE ---]

We follow prior literature (e.g., Campbell et al., 2011; Hirshleifer et al., 2012; Malmendier and Tate, 2005, 2008; Malmendier et al., 2011) and measure the level of CEO overconfidence based on CEOs' stock options holdings. We then conduct multivariate analysis by adopting a difference-in-difference approach and regress firms' abnormal returns on CEO overconfidence during the COVID-19 period. We control for a detailed list of CEO and firm variables, including CEO characteristics, ex-ante firm fundamentals, four factor loadings (Carhart, 1997; Fama and French, 1993), and industry fixed effects.

Our results show that CEO confidence helps boost stock returns by mitigating the negative impact brought upon by the COVID-19 pandemic. Specifically, firms with overconfident CEOs exhibit significantly higher (i.e., less negative) abnormal returns during the COVID-19 period than other firms with less confident CEOs. Economically, alternative measurements of CEO overconfidence mitigate the negative impact of the COVID-19 by 29.3-37.0% and 26.6-33.7%, in terms of abnormal returns and cumulative abnormal returns, respectively.

We further examine whether the effect from CEO confidence is more pronounced in firms that have higher exposure to the COVID-19 pandemic, as investors would be more concerned when a firm's exposure to the outbreak is more virulent and the role of CEO overconfidence could be deemed more important. To quantify firms' exposure to the COVID-19 pandemic, we utilize a text-based measure of firm-specific exposure to the COVID-19 in the first quarter of 2020 from Hassan et al. (2020). As expected, firms' exposure to the COVID-19 has a significant negative effect on their stock market performance, demonstrating the adverse impact due to the pandemic. Importantly, we find that CEO overconfidence matters more for firms with higher COVID-19

[1] In robustness analysis, we also extend the sample period to June 30th, 2020 to include the recovery period as defined in Fahlenbrach et al. (2020).

[2] For instance, the Federal Reserve Board announced two new facilities on March 23rd, 2020 to supply credit to large corporations. On March 27th, the U.S. government approved a $2 trillion relief bill, known as the Coronavirus Aid, Relief, and Economic Security Act, and made it into law.

exposure. The findings imply for firms that suffer more from the COVID-19 crisis, confident CEOs play a more crucial role in mitigating the negative market reaction due to the COVID-19 pandemic and they improve stock returns by managing investor perception.

We further investigate the channels through which CEO overconfidence influences investor perception and alleviates negative stock market performance during the COVID-19 pandemic. The psychology and organization literature argue that overconfident individuals could manage others' perceptions and instill confidence (Kennedy et al., 2013; Tenney et al., 2008; Smith et al., 2017; Von-Hippel and Trivers, 2011). We expect the effective management of public perception and investor sentiment by overconfident CEOs would also be more important when firms face high uncertainty and resource scarcity (Anderson et al., 2012; Johnson and Fowler, 2011) which are exemplary during the pandemic. To measure investor perception and market sentiment towards the firm, we adopt the Raven Pack Composite Sentiment Score (CSS), which utilizes firm-specific news[3] to measure market sentiment towards the firm, and we adopt the measure as a proxy of public investor perception. Two recent studies by Haroon and Rizvi (2020) and Salisu and Vo (2020) show market sentiment driven by media coverage has a strong impact on the equity markets during the COVID-19 crisis. We find consistent evidence that more positive firm-specific market sentiments, as measured by higher CSS in our context, lead to higher abnormal returns. More importantly, while average sentiments have expectedly decreased for all firms during the COVID-19 pandemic, we find that CEO overconfidence mitigates this negative sentiment effect in the crisis period. The results suggest overconfident CEOs have been more effective in managing public perception and sentiment, thereby influencing investor behavior amid the pandemic.

Alternatively, overconfident CEOs could also affect stock performance by managing investor perception via bad news withholding. The accounting literature has long established that overconfident CEOs tend to withhold bad news and accelerate good news (e.g., Ahmed and Duellman, 2013; Hsu et al., 2017; Kim et al., 2016). The practice of withholding negative information, which could be detrimental to disclosure quality at good times, might be beneficial at crisis periods. We conjecture that the return boosting effect of CEO overconfidence could be resulted from more bad news hoarding by these CEOs. Hence, firms with CEOs who hoard bad

[3] Raven Pack collects and analyzes all articles on the Dow Jones Newswire, the Wall Street Journal etc. by determining which companies are mentioned and how relevant the article is to the company. It reports different sentiment indicators assessing whether the article represents good or bad news to the firm (Von Beschwitz et al., 2013; Shi et al., 2016).

news would experience less negative returns during the pandemic. We proxy bad news hoarding with accounting conservatism, based on the prior literature that firms with more conservative accounting policies ex-ante tend to report bad news on a more timely basis, and they are less likely to withhold bad news (e.g., Basu, 1997; Kothari et al., 2009). We measure accounting conservatism at the firm-level following the methodology of Khan and Watts (2009). The variable of interest is the interaction effect of accounting conservatism and CEO overconfidence on firm performance during the COVID-19 crisis. Consistent with our expectation, we find that accounting conservatism weakens the mitigation impact of CEO overconfidence on firm performance. The results infer overconfident CEOs withhold more bad news during the pandemic.

To understand to what extent CEO overconfidence helps mitigate the negative shock from COVID-19, we conduct further heterogenous analyses. We argue that for firms with inherently higher risk or weaker fundamentals, we expect the mitigation effect of CEO overconfidence would be less pronounced as it would be more difficult to boost investor sentiment when the business outlook is more uncertain. We therefore examine the impact of firm risk and industry exposure and the impact of firm fundamentals on the relationship between CEO overconfidence and stock return during the COVID-19 period.

First, we examine whether the effect of CEO overconfidence during COVID-19 period varies with firm-level risk and industry-level exposure. We quantify firm risk using Altman Z-score (Altman, 1968), which measures firms' bankruptcy risk, as it is of concern whether firms can survive through the COVID-19 crisis (De Vito and Gómez, 2020). We also measure industry exposure based on the classification by Moody's (2020). We find that firms with high risk of failure, as measured by Altman Z-scores, and firms that belong to high exposure industries,[4] are less likely to benefit from the presence of overconfident CEOs during the pandemic, consistent with rational investors are less convinced by overconfident CEOs in risky firms and industries.

Next, we examine the impact of firm characteristics on CEO overconfidence's return mitigating effect during the COVID-19 period. Our findings show the influence of CEO overconfidence on stock return strengthens during the pandemic for firms with more cash holdings, lower leverage, higher ROA, and larger market capitalization ex-ante. Overall, the findings in the

[4] We follow Moody's EMEA Coronavirus Heat Map and classify automotive and auto supplies, apparel, retail (non-food), passenger airlines, tourism/lodging/cruise, global shipping, consumer durables, restaurants, and leisure and entertainment industries as high exposure industries.

heterogenous analyses indicate the extent that overconfident CEOs could moderate the negative effect of the crisis is concentrated at firms with less going concern, firms that have low industry risk exposure, and those with better fundamentals before the crisis. In other words, CEO overconfidence loses its effectiveness when it comes to firms that are deeply troubled.

We further conduct a series of robustness analyses to corroborate our main findings. First, we perform placebo tests based on two non-event placebo periods: (1) November 22nd, 2019 to January 21st, 2020, the two-month period before the COVID-19 period; and (2) January 22nd, 2019 to March 23rd, 2019, the two-month period in the calendar year of 2019 covering the same dates as the COVID-19 period in 2020. We repeat the baseline analysis using these two placebo periods, and find the result is evident only in the COVID-19 period, and not in the placebo periods. Second, we extend our sample period to include the COVID-19 recovery period (from March 24th, 2020 to June 30th, 2020), based on the COVID-19 evolution periods defined in Fahlenbrach et al. (2020). We find the impact of CEO overconfidence is no longer significant in the recovery period, when firm performances have started to rebound in respondence to various government interventions and financial aids. Lastly, we perform various robustness tests to show that our findings are robust to alternative CEO overconfidence measures, and abnormal returns definitions using the market model instead of the capital asset pricing model. Moreover, we further enrich our analysis by performing subsample tests of different benchmark periods, controlling for year times month fixed effects, by including alternative measurements of contemporaneous firm characteristics variables, and by considering simultaneously the effects of firm-specific and industry exposures. We obtain qualitatively similar result.

Our paper contributes to the literature in two important ways. First, our study adds to the scant literature on the bright side of CEO overconfidence and demonstrates CEO overconfidence could be enhancing firm values especially in bad times. Most prior studies focus on the negative repercussions that CEO overconfidence have on corporate outcomes and performance management.[5] Little attention has been paid to the positive externality of CEO overconfidence. Several recent studies start to shed positive light on CEO overconfidence, indicating it could be

[5] A vast literature documents that CEO overconfidence could lead to various detrimental corporate outcomes (e.g., Andreou et al., 2019; Billett and Qian, 2008; Chen et al., 2014; Hayward and Hambrick, 1997; Ho et al., 2016; Huang and Kisgen, 2013; Kim et al., 2016; Malmendier and Tate, 2005, 2008). Moreover, overconfident CEOs have been associated with higher incidences of earnings management and financial reporting irregularities (e.g., Banjeree et al., 2018; Hribar and Yang, 2015; Hsieh et al., 2014; Presley and Abbott, 2013; Schrand and Zechman, 2012).

useful in particular situations (e.g., Galasso and Simcoe, 2011; Hirshleifer et al., 2012; Hilary et al., 2016; Tang et al., 2015; Adhikari et al., 2018; and Reyes et al., 2020). Utilizing the unique exogenous event of the COVID-19 pandemic, we differ from these prior studies by showing how investors can respond positively to CEO overconfidence in a highly uncertain and devastating economic scenario. In addition, we also provide evidence on the channels through which CEO confidence can enhance firm values under adverse market conditions.

Second, our study contributes to the literature examining the capital market reaction to financial crises and health pandemics (e.g., Campello et al., 2010; Chodorow-Reich, 2014; Duchin et al., 2010; Giroud and Mueller, 2017; Kahle and Stulz, 2013; Kuppuswamy and Villalonga, 2016; Lins et al., 2017; McTier et al., 2013). The COVID-19, while unfortunate to the world, offers a valuable research opportunity to study the impact of a rare disaster event that starts outside the financial sector, yet with an economic impact far more dramatic and widespread than crises such as the GFC and the Great Depression (Baker et al., 2020; Fahlenbrach et al., 2020; Shehzad et al., 2020). Our study provides novel evidence on the positive effect of overconfidence in this special crisis period. We add to the rapidly growing literature on the capital market consequences of the COVID-19 pandemic. In particular, we relate to studies examining the corporate factors that make firms better survive through the pandemic crisis (Acharya and Steffen, 2020; Albuquerque et al., 2020; Ding et al., 2020a, 2020b; Fahlenbrach et al., 2020; Pagano et al., 2020; Papanikolaou and Schmidt, 2020; Ramelli and Wagner, 2020; Shan and Tang, 2020). To the best of our knowledge, our study is the first to examine the importance of CEO overconfidence, or more broadly the traits of CEO, on firm performance in the midst of the pandemic.

The rest of the paper is organized as follows. The next section reviews the related literature on CEO overconfidence and the COVID-19 pandemic. Section 3 develops the hypotheses and outlines the research methodology. Section 4 presents the sample selection process and descriptive statistics. Section 5 reports the empirical findings. We offer our concluding remarks in Section 6.

2. Literature Review

2.1 CEO Overconfidence

Our paper is related to the literature examining CEO personality traits, and in particular, CEO overconfidence. Overconfidence is more prevalent in CEOs than in the general population

(Graham et al., 2013), and both Goel and Thakor (2008) and Gervais et al. (2011) argue in their theoretical models that CEO overconfidence can enhance firm value via the mitigation of the underinvestment problem. However, empirical studies on CEO overconfidence obtain mixed findings when it comes to the benefits of CEO overconfidence in risky investment ventures such as innovation (e.g., Galasso and Simcoe, 2011; Hirshleifer et al., 2012; Tang et al., 2015), capital investment (e.g., Malmendier and Tate, 2005), and M&A activities (e.g., Billett and Qian, 2008; Ferris et al., 2013; Hayward and Hambrick, 1997; Malmendier and Tate, 2008). Recent studies by McCarthy et al. (2017) and Park et al. (2020) also show CEO overconfidence leads to reduced corporate social responsibility (CSR) activities. Moreover, overconfident CEO is associated with earnings management and financial misreporting (e.g., Hribar and Yang, 2015; Hsieh et al., 2014; Schrand and Zechman, 2012), which could eventually lead to financial restatement and security class actions (e.g., Banerjee et al., 2018; Presley and Abbott, 2013). During the GFC, Ho et al. (2016) also show banks with overconfident CEOs experience more increases in loan defaults and have higher likelihood of CEO turnover or failure.

When overconfident CEOs make less-than-optimal business decisions and at the same time ignore constructive feedbacks (Bolton et al., 2013; Chen et al., 2015), they could dampen firm value and investors might react negatively. Chen et al. (2014) show overconfidence leads to underperformance in firms with significant increase in R&D. Malmendier and Tate (2008) document negative investor reaction for merger announcements for firms with overconfident CEOs. Huang and Kisgen (2013) show male CEOs, who exhibit higher overconfidence, result in lower announcement returns for acquisition as well as financing activities, and Kim et al. (2016) also show firms with overconfident CEOs have higher stock price crash risk. Andreou et al. (2019) show CEO overconfidence leads to value loss of corporate diversification. Overconfidence also leads to attribution bias, as investors would react less to management forecasts (Hilary and Hsu, 2011).

It is puzzling why CEO overconfidence is a prevalent phenomenon despite its many negative consequences. A growing literature has been demonstrating overconfident CEOs could bring benefits to firms and induce positive capital market responses in certain situations and under proper governance mechanisms. Burkhard et al. (2018) find a small but positive relationship between CEO overconfidence and firm performance based on the results of a meta-analysis of prior studies. Hirshleifer et al. (2012) find CEO overconfidence is associated with higher Tobin's

Q, though only when it comes to innovative industries. Hilary et al. (2016) argue over-optimistic managers may enhance firm returns when these managers exert greater effort to meet their own overly optimistic forecasts. Banerjee et al. (2015) show while overconfident CEOs are associated with lower Tobin's Q, the relationship changed after the imposition of the Sarbanes-Oxley Act (SOX), indicating that CEO overconfidence could be beneficial with improved governance. Similarly, Kolasinski and Li (2013) suggest that strong governance, as evident by independent boards, help overconfident CEOs avoid mistakes in acquisitions. Hsu et al. (2017) find firms that practice conservative accounting and are run by overconfident CEOs exhibit better cash flow performance, implying accounting conservatism makes overconfident CEOs acknowledge problems earlier and seek for remedial actions. Two recent studies examine the impact of CEO overconfidence in light of different market environments: Adhikari et al. (2018) examine market competition and show firms perform better with overconfident CEOs when competition increases. Reyes et al. (2020) compare the relationship of CEO overconfidence and firm performance during economic expansions and recessions. They show the effect is marginally stronger during expansions and it weakens during recessions.

2.2 The Economic Impact of the COVID-19

The adverse capital market impact of the COVID-19 is undeniably serious and widespread (Ali et al., 2020; Bai et al., 2020; Shehzad et al., 2020; Zhang et al., 2020). Singh et al. (2020) document an overall negative effect of the COVID-19 pandemic on the stock market indices of the G-20 countries, and Gerding et al. (2020) show stock returns react more negatively in countries with higher sovereign debt during the COVID-19 pandemic, suggesting sovereign debt is a key determinant of equity risk in the face of the health crisis. Ozili and Arun (2020) analyze the COVID-19 outbreak and its spillover effect to the global economy. They reveal that social distancing measures and travel restrictions have both contributed to reduction of economic activities and stock returns. De Vito and Gómez (2020) show the COVID-19 has seriously affected firm liquidity across the world, in which they predict $1/10^{th}$ of sample firms would become illiquid within six months from the onset of the pandemic if governments do not intervene and mitigate the impact of the COVID-19.

In the U.S., Alfaro et al. (2020) examine the changes in infection prediction and show its negative association with aggregate stock returns. Baker et al. (2020) also examine the U.S. stock market, and they document an unprecedented negative stock market response to the COVID-19 pandemic, more so than any previous pandemic. Schoenfeld (2020) further shows the pandemic triggered significant decreases of the values in stock, bond, commodity and currency in the U.S. financial markets from the onset of the pandemic. Within the U.S., Chen et al. (2020) show returns are lower for firms located in states with lockdown announcements, but the effect moderates when there is a high number of infections.

At the firm-level, recent corporate finance papers that examine the COVID-19 pandemic have investigated the impact of different firm fundamentals and corporate policies on firm performance during the pandemic. For instance, Ding et al. (2020b) show that firms with stronger finances before the pandemic, less exposure to the pandemic, more CSR activities, and better governance survive better through the pandemic. Similarly, Acharya and Steffen (2020) show firms with higher cash holdings and access to line of credit, and Fahlenbrach et al. (2020) show firms with greater financial flexibility are better able to survive through the health crisis. Albuquerque et al. (2020) show firms with higher environmental and social ratings fare better. Li et al. (2020) show firms with strong culture are more resilient to the pandemic. Pagano et al. (2020) and Papanikolaou and Schmidt (2020) show firms that rely more on technology and less affected by social distancing outperform during the pandemic. Davison (2020) shows lower stock returns for firms with higher levels of debt that are more affected by the pandemic as measured by exposure to social distancing requirements. Hassan et al. (2020) show firms that have higher exposure to the COVID-19 experience more significant disruptions, but those that experienced SARS or H1N1 before are better in handling the COVID-19 pandemic. Ramelli and Wagner (2020) focus on the outset of the pandemic outbreak in the U.S., and they find U.S. firms that have lower exposure to China were less affected by the pandemic. Ding et al. (2020a) examine stock market responses in China with two events, and they show firms with Hubei (foreign) exposures earn significantly lower returns at the lockdown of the province (the spread to overseas). Finally, Shan and Tang (2020) use survey data on employee satisfaction in China to show firms with higher employee satisfaction is associated with better stock price performance during the pandemic.

3. Hypothesis Development and Research Design

3.1 Hypothesis Development

CEO overconfidence has been a widespread phenomenon (Graham et al. 2013). The negative side of CEO overconfidence is well documented in the literature. Overconfident CEOs tend to overestimate returns or underestimate risk, resulting in irrational decision-making (e.g., Banjeree et al., 2015; Cain and McKeon, 2013; Goel and Thakor, 2008; Hiller and Hamrbick, 2005; Hirshleifer et al., 2012; Malmendier and Tate, 2008).

However, we argue overconfident CEOs could be beneficial, or even essential, in light of the COVID-19 pandemic. The COVID-19 has brought an unprecedented crisis to the capital market in a scale and magnitude unlike most recessions in recent histories. It is unique because the COVID-19 also brings disruptions to firms in many facets from employee to financing to investment strategies. At crisis times like this, overconfident CEOs could provide strong leadership, keeping employees and investors intact with the firms (Phau et al., 2018). Moreover, overconfident CEOs need less coordination effort (Van den Steen, 2005) and could act fast (Robert Baum and Wally, 2003) to implement immediate mitigation strategies in face of the crisis, which could result in better decision making (Puri and Robinson, 2007). Prior management studies also show that fast and efficient decision-making is particularly important when it comes to firm survival (e.g., Bingham and Eisenhardt, 2011). Further, overconfident individuals can be perceived as being more competent and credible (Kennedy et al., 2013; Tenney et al., 2008). They also tend to be more persuasive (Smith et al., 2017; Von-Hippel and Trivers, 2011). This perception is shown to be more important under uncertainty and resource scarcity (Anderson et al., 2012; Johnson and Fowler, 2013). Hence, we argue that CEO overconfidence could be more important in creating a positive signal to investors for instilling confidence during the COVID-19 crisis.

Although overconfident CEOs could exhibit strong leadership and make fast decisions, Bolton et al. (2013) note that overconfidence could lead to the danger of CEOs being too egoistic and not listening to others, and Chen et al. (2015) further show overconfident CEOs ignore corrective feedback. A dictatorship corporate culture could also make firms less adaptive to a changing environment (Mintzberg, 1980). Our first hypothesis, stated in alternative form, is as follows:

Hypothesis H_1: The impact of CEO overconfidence on firm performance is positive during the COVID-19 pandemic.

There are significant cross-sectional differences in firm-level exposure to the COVID-19 pandemic. While the pandemic exerts a negative impact on almost all firms, their magnitudes are considerably different. For instance, Kumar and Haydon (2020) show the industry most impacted is the airline industry, in which they predict the probability of default of airline companies increased from less than 10% to 23.16% in the month of March 2020. On other hand, the life and health insurance companies are some of the least affected, with their average default probability increased from 0.62% to merely 1.00% in the same period. Moreover, the severity of the COVID-19 varies across different geographical locations in the U.S. Ling et al. (2020) show firms' exposure to the COVID-19 depends critically on the locations of their asset portfolios. In general, exposure to the COVID-19 also relates to locations of firms' employees, customers and suppliers. Naturally, we expect the higher the exposure to the COVID-19 pandemic, the more important is the role of CEO in handling the crisis. Hence, the impact of CEO overconfidence on firm performance is increasing in its firm-specific exposure to the COVID-19 pandemic, and we state our second hypothesis in alternative form as follows:

Hypothesis H_2: The impact of CEO overconfidence on firm performance is increasing in firm-specific exposure to the COVID-19 pandemic.

3.2 Research Methodology

We estimate regression model specifications (1) and (2) of abnormal stock returns as a function of CEO overconfidence, the COVID-19 period, and a vector of control variables:

$$
\begin{aligned}
&(AR, CAR)_t = \alpha + b_1\, Overconfidence_{t\text{-}1} * \\
&(COVID, COVID\ Exposure, COVID\ Risk, COVID\ Negative)_t + \\
&b_2\, Overconfidence_{t\text{-}1} + \\
&b_3\, (COVID, COVID\ Exposure, COVID\ Risk, COVID\ Negative)_t + Control_{t\text{-}1} + \\
&Four\ Factor\ Loadings + Industry\ Fixed\ Effects + e_{it} \qquad \text{------ (1)}
\end{aligned}
$$

$$(AR, CAR)_t = \alpha + b_1\, Holder67_{t\text{-}1} * (COVID, COVID\ Exposure, COVID\ Risk, COVID\ Negative)_t + b_2\, Overconfidence_{t\text{-}1} + b_3\, (COVID, COVID\ Exposure, COVID\ Risk, COVID\ Negative)_t + Control_{t\text{-}1} + Four\ Factor\ Loadings + Industry\ Fixed\ Effects + e_{it} \quad \text{------ (2)}$$

The dependent variables of the model are abnormal returns (*AR*) and cumulative abnormal returns (*CAR*) measured using the capital asset pricing model (CAPM). Under the CAPM, we calculate a stock's daily abnormal return in one trading day (e.g., Remalli and Wagner, 2020). Specifically, we first regress the stock's excess return over the risk-free rate on the market excess return using the samples of the 12-month period before our study period. The risk-free rate equals the daily return of the one-month Treasury bill, and the market excess return is obtained from Kenneth French's website. Then we estimate the stock's daily expected return in our study period using the model coefficients from the regression. The stock's *AR* in one trading day is defined as the stock's raw daily buy-and-hold return minus the expected return, winsorized at the top and bottom 1%. *CAR* is defined as the cumulative *AR* over a 3-day window from *t-1* to *t+1*.[6]

We follow Malmendier and Tate (2005, 2008) and measure CEO confidence based on CEOs' options holdings. Since rational CEOs would have exercised their vested stock options, given they already have large stakes in their own firms, the amount of in-the-money vested stock options of CEOs serves as a proxy of CEO overconfidence in the company. Hence, *Overconfidence* is defined as the average value of unexercised exercisable in-the-money options, scaled by the average strike price of those options. The average strike price of the options equals the stock price at the time the option-value is determined less the value-per-vested option, on the premise that the value-per-vested option is essentially the stock price minus the strike price (Malmendier et al., 2011). Since the COVID-19 pandemic started to incubate in late 2019, we follow Li et al. (2020) to use the value at the end of 2018, to eliminate any concern that CEOs changed their expectation of firm performance in anticipation of the public health crisis. Hence, the measure of *Overconfidence* captures the overconfidence levels of the CEOs in the year before the COVID-19 outbreak. Alternatively, we also measure CEO overconfidence by *Holder67* (Campbell et al., 2011;

[6] In robustness analysis, we also measure abnormal returns and cumulative abnormal returns using the market model (*AR_MM* and *CAR_MM*).

Hirshleifer et al., 2012), an indicator that equals to one if a CEO has failed to exercise the options that are at least 67% in the money for at least twice during their tenure by the end of 2018 (zero otherwise).[7] Since overconfidence is theoretically a personality trait, CEOs should exhibit consistent behavior over time (Reyes et al. 2020). The alternative measure of overconfidence, *Holder67,* reflects CEOs' overall overconfidence levels through time.

To measure the impact of the COVID-19 on firm performance, we construct several measures. First, we define an indicator variable, *COVID*, which denotes the COVID-19 period from January 22nd to March 23rd, 2020 (zero otherwise). Second, we measure firm-specific exposure to the COVID-19 pandemic following Hassan et al. (2020) with machine learning techniques using earnings call transcript data. These measures include *COVID Exposure*, *COVID Risk*, and *COVID Negative*. Particularly, *COVID Exposure* counts the frequency of keywords (scaled by the total number of words) related to the COVID-19 mentioned in earnings conference call transcripts, and it is used as a proxy of firms' exposure to the spread of the virus (Hassan et al. 2020; Li et al. 2020). *COVID Risk* utilizes the same textual analysis tools from computational linguistics to quantify the share of the earnings conference call devoted specifically to discussing firm risk related to the COVID-19. *COVID Negative* counts the negative tone words used during the earnings conference call when discussing the COVID-19, which measures management pessimism associated with the pandemic.

Our key variables of interest include the interaction terms of the CEO overconfidence (*Overconfidence* and *Holder67*) and the COVID-19 period (*COVID*) and firm-specific exposure (*COVID Exposure*, *COVID Risk*, *COVID Negative*) variables. We include the following set of control variables in our regression analysis. We include CEO observable characteristics to mitigate the concerns of omitted variable bias and endogeneity related to CEO selection (e.g., Malmendier and Tate, 2005). The observable characteristics are as follows: *CEO Gender*, and the logarithms of *CEO Age*, *CEO Compensation*, and *CEO Tenure*. We also include *CEO Directorship*, that equals to one if the CEO also serves on the board of directors (zero otherwise), as a proxy of CEO power that could facilitate overconfident CEOs to instill confidence (Vitanova, 2019).

[7] Malmendier and Tate (2005, 2008) and Malmendier et al. (2011) define *Holder67* as an indicator variable of one if the CEO has an option with five years remaining duration and is at least 67% in the money (zero otherwise). As we do not have detailed data on a CEO's options holdings and exercise prices for each option grant, we follow the method by Campbell et al. (2011), which has shown to generate results similar to those from the previous method (Hirshleifer et al., 2012). Particularly, Campbell et al. (2011) define *Holder67* as an indicator variable equal to 1 if a CEO has failed to exercise the options that are at least 67% in the money for at least twice during the entire tenure.

At the firm-level, we include firm fundamentals that affect stock returns, which include firm size measured by the logarithm of *Market Cap*, *Leverage Ratio*, *Returns-on-Assets (ROA)*, *Cash Holding*, and *Book-to-Market* ratio. Similar to prior studies (e.g., Ding et al., 2020b; Fahlenbrach et al., 2020; Li et al., 2020), we measure the firm characteristics *before* the pandemic to capture the ex-ante influences of these variables on firms' resilience to the COVID-19 and to minimize endogeneity bias.[8] It is also important we include these firm fundamentals, as extant studies show CEO overconfidence influences firms' financing (e.g., Malmendier and Tate 2005; Malmendier et al. 2007) and investment (e.g., Gervais et al. 2011; Malmendier and Tate 2008). In so doing, we distinguish the indirect effects of overconfidence via CEOs' prior decisions on firms' financing and investment strategies, and we focus on the direct personality effect of CEO overconfidence on managing the crisis. We control for firms' four-factor loadings (e.g., Li et al., 2020; Lins et al., 2017), based on the Fama-French three-factor model plus the momentum factor from Fama and French (1993) and Carhart (1997), estimated over a 5-year window before the sample period. Lastly, given that significant differences exist on the impact of the COVID-19 across industries, we include industry fixed effects in all regressions. Appendix 1 contains detailed definitions of all variables used in the study.

4. Sample and Measures

4.1 Sample and Data

We include firm-level stock returns in the period from January 22nd, 2019 to March 23rd, 2020, one year before to two months after the first confirmed COVID-19 cases reported in the U.S. on January 21st, 2020. As mentioned, the COVID-19 period from January 21st, 2020 up to March 23rd, 2020, suffered the largest drops in the U.S. stock market and reported the highest increases of daily confirmed cases for the first half of 2020. Moreover, since March 23rd, 2020, the U.S. state and local governments have implemented various action plans to respond to the crisis (Gupta et al., 2020; Nguyen et al., 2020). As our focus is on the COVID-19 pandemic, we do not include the subsequent period in our main analysis due to the cofounding effect of government interventions since March 23rd (Davison, 2020; Fahlenbrach et al., 2020; Li et al., 2020). Nevertheless, in our

[8] In robustness analysis, we also measure the control variables contemporaneously using firm data through the COVID-19 period. Our results, discussed in a subsequent section and presented in the internet appendix, remain robust with the alternative measurement of the control variables.

additional analysis, we extend the sample period and further examine the impact of CEO overconfidence on firms' stock performances in the recovery period from March 24th, 2020 up to June 30th, 2020 (Fahlenbrach et al. 2020).

We obtain stock return data from the Center for Research in Security Prices (CRSP). We use ExecuComp and Compustat to retrieve information related to CEO stock options and other CEO characteristics. Firm fundamental data are obtained from Compustat and CRSP. We use the factor returns from Kenneth French's website to calculate the four-factor loadings and use the four-digit SIC codes to identify industry effect. We exclude firms that miss any daily price information in our study period and have incomplete firm fundamental data. Importantly, we further eliminate firms that have changed CEOs since 2018.[9] The total sample include 229,320 daily firm-day observations of 780 firms over the sample period, of which 33,540 observations are from the COVID-19 period.

We calculate a stock's AR in one trading day based on the CAPM model (e.g., Remalli and Wagner, 2020). Specifically, we first regress the stock's excess return over the risk-free rate on the market excess return using the sample in 12 months before our study period. The risk-free rate equals the daily return of the one-month Treasury bill, and the market excess return is obtained from Kenneth French's website. Then we estimate the stock's daily expected return in our study period using the model coefficients from the regression. The stock's AR in one trading day is defined as the stock's raw daily buy-and-hold return minus the expected return, winsorized at the top and bottom 1%. CAR is defined as the cumulative AR over a 3-day window from t-1 to t+1.

Firm-specific exposure from the COVID-19 are calculated with earnings call transcript data extracted by Hassan et al. (2020). Specifically, the firm-level exposure to COVID-19 (*COVID Exposure*) is defined as the number of words in the transcripts related to the firm's pandemic exposure, following definitions in Hassan et al. (2020), divided by the total number of words, multiplied by 1,000. The firm-level risk (*COVID Risk*) and negative sentiment (*COVID Negative*) of COVID-19 are calculated with the same methodology but using the numbers of corresponding words as defined by Hassan et al. (2020) and Loughran and McDonald (2011), respectively.

[9] Unfortunately, we cannot empirically examine firms that have changed CEOs over the COVID-19 period with a different research design, since the number of firms with CEO turnover since 2018 is very low. The ExecuComp data shows, out of 1,483 firms with information on CEOs in 2019, only 60 firms do not have corresponding CEO information for the same CEO in the previous year.

4.2 Descriptive Statistics of Key Measures

Table 1 reports the descriptive statistics for the total sample observations. Abnormal returns and cumulative abnormal returns are slightly negative over the whole sample period, with averages of -0.202% and -0.603% under the CAPM model, respectively. The CEO overconfidence measures, *Overconfidence* and *Holder67*, have means of 0.395 and 0.437, respectively. *COVID* has a mean of 14.6%, representing the proportion of the sample observations that belong to the crisis period. Measures of firm-specific exposure to the COVID-19, including *COVID Exposure*, *COVID Risk*, and *COVID Negative*, have respective means of 0.064, 0.007, and 0.018, indicating that on average, 0.64%, 0.07% and 0.18% of the words in the conference call transcripts are related to firm-level exposure, risk and negative sentiment of COVID 19, respectively (Hassan et al., 2020).

[--- INSERT TABLE 1 ABOUT HERE ---]

Consistent with prior studies (e.g., Huang and Kisgen 2013), most CEOs (94.6%) are male. *Log (CEO Age)* and *Log (CEO Tenure)* have means of 4.050 and 1.883, translating into average age and experience of 57.8 and 9.03 years respectively. We find that most CEOs serve on the corporate board (97.7%). On average, the sample firms have *Log (Market Cap)* of 7.944, *Leverage Ratio* of 0.268, *ROA* of 0.05, *Cash Holding* of 12.7%, and *Book-to-Market* of 0.544. In channel and heterogenous analysis, we also examine the impact of news sentiment (*Raven Pack News Sentiment*), accounting conservatism (*Conservatism*), firm risk (*Altman [1.81, 2.99]* and *Altman <1.81*) and industry exposure (indicator variables for *Moderate Exposure Industry* and *High Exposure Industry*). We include their summary statistics in Table 1.

5. Empirical Analysis

5.1 Main Empirical Findings

Table 2 reports the multivariate regression results of our main findings of hypothesis H_1, the effect of CEO overconfidence and the COVID-19 pandemic on abnormal stock returns. In the first two columns (1) and (2), we report findings with *Overconfidence* as the measure of CEO overconfidence. Our key variable of interest is the interaction term of *Overconfidence* and *COVID*. We find that the interaction terms are positively significant (at the 1% level), confirming H_1 that overconfidence CEOs exert a positive effect during the COVID-19 pandemic. The findings are

economically significant, as the coefficients of 0.1628 and 0.4490 imply that a one standard deviation increase of *Overconfidence* raises *AR* and *CAR* by 0.15 and 0.40 percentage points, respectively. The effects are also substantial when compared to the main effects of *COVID*, which have coefficients of -0.5018 and -1.5200 respectively on *AR* and *CAR* (significant at the 1% level). This implies that a one standard deviation increase of *Overconfidence* mitigates the impact of *COVID* on *AR* and *CAR* by 29.3% and 26.6%, respectively.

[--- INSERT TABLE 2 ABOUT HERE ---]

The coefficients of *Overconfidence* are negatively significant (at the 1% level), confirming with the vast literature documenting the detrimental outcomes of CEO overconfidence in normal situations (e.g., Andreou et al., 2019; Billett and Qian, 2008; Chen et al., 2014; Hayward and Hambrick, 1997; Ho et al., 2016; Huang and Kisgen, 2013; Kim et al., 2016; Malmendier and Tate, 2005, 2008). For the control variables, we find that CEO compensation (e.g., Jensen and Murphy, 1990) and *Cash Holdings* (e.g., Lins et al., 2017) have positive and significant effects on firm performance. Columns (3) and (4), with *Holder67* as the measure of CEO overconfidence, report similar findings. The coefficients of 0.1930 and 0.5299 translate into economic significances that the overconfident CEOs mitigate the negative impact of the COVID-19 by 37.0% and 33.7% on *AR* and *CAR*, respectively.

In Table 3, we report the empirical findings of hypothesis H_2, the effect of CEO overconfidence and firm-specific COVID-19 exposure on abnormal stock returns. In Panel A, we show our measures of COVID-19 exposure are positively correlated with each other at a significance level of 0.01. The highest correlation is between *COVID Exposure* and *COVID Negative* with a coefficient of 0.7611. It indicates that these variables provide consistent measurements of the firm-specific impacts from the COVID-19, albeit with considerable variations across exposures, risks, and negative sentiments (Hassan et al., 2020). Panels B to D report the regression results of *COVID Exposure*, *COVID Risk* and *COVID Negative* respectively. We find that the interaction effects of CEO overconfidence with the COVID-19 exposure variables are all positive and significant, thus confirming our second hypothesis H_2 that the impact of CEO overconfidence on firm performance is increasing in firm-specific exposure to the COVID-19 pandemic. In other words, the presence of overconfident CEOs is shown to be especially beneficial in mitigating the negative impact at firms more exposed to the COVID-19, as evident by more mentions of the pandemic during CEOs' conference calls.

[--- INSERT TABLE 3 ABOUT HERE ---]

5.2 Channel Analysis

Our channel analysis proposes two alternative explanations that CEO overconfidence could lessen the negative pandemic effect on stock market performance. First, overconfident CEOs could manage public perceptions and instill investor confidence on their firms. This perception of competence and credibility is more important when firms face high uncertainty and scarce resources (Anderson et al., 2012; Johnson and Fowler, 2011). We analyze this channel during the COVID-19 period by utilizing the Raven Pack Composite Sentiment Score (CSS), which measures market sentiment towards the firm. The Raven Pack News Analytics database calculates a composite measure of firm-level sentiment from new reports, which covers publications by reputable content sources such as the Dow Jones Newswires, the Wall Street Journal, etc. We conjecture overconfident CEOs could manage public perception and instill confidence, resulting in more positive sentiments towards the firms when times are rough during the pandemic. Our regression results, presented in the columns (1) and (2) of Panel A in Table 4, confirm our conjecture and show higher CEO overconfidence is associated with more positive public sentiments, as the coefficients of *Overconfidence* and *COVID* are positively statistically significant in the COVID-19 period. As expected, general market sentiments towards the sample firms are highly negative during the pandemic (Haroon and Rizvi, 2020; Salisu and Vo, 2020). Columns (3) and (4) further show more positive public sentiments are associated with higher abnormal returns and cumulative abnormal returns.[10] Overall, the findings in Panel A show one possible channel of overconfident CEOs affecting stock market performance is through changing the market perception by creating more positive outlooks for their companies.

[--- INSERT TABLE 4 ABOUT HERE ---]

We propose a second channel that overconfident CEOs could affect stock market performance. Overconfident CEOs tend to withhold bad news and accelerate good news (Ahmed and Duellman, 2013; Hsu et al., 2017; Kim et al., 2016). During the COVID-19 pandemic, withholding bad news could be especially beneficial when firms possess more negative

[10] As there is no a priori expectation on the differential impact of news sentiment during the COVID-19 pandemic, we do not test for the interaction effect of the sentiment measure and *COVID*. Nonetheless, we include time fixed effect to account for any possible time-variant properties of the sentiment measure.

information. We examine the bad news hoarding channel using the level of accounting conservatism before the crisis as a moderating mechanism of overconfident CEOs' bad news hoarding, since firms with more conservative accounting policies more effectively constrain CEOs' bad news withholding behavior (Basu, 1997; Kothari et al., 2009). We estimate accounting conservatism with a firm-level measure by Khan and Watts (2009),[11] and we interact the level of accounting conservatism with CEO overconfidence variables and *COVID*. Our findings reported in Panel B of Table 4 show the coefficients of the triple-interaction effect are negative and significant. The results imply the positive effect on firm performance observed for CEO overconfidence and *COVID* weakens when CEOs are less able to withhold bad news with more conservative accounting policies in place. Overall, the findings in Panel B infer overconfident CEOs could have been withholding more bad news, resulting in less negative stock price reactions during the pandemic.

5.3 Heterogenous Analysis

In this section, we present our findings of the heterogenous analysis. We first conjecture the moderating effect of CEO overconfidence on firm performance during the COVID-19 critically hinges on the level of risk borne by firms and exposure borne by the industry they belong to. We quantify firm risk with the Altman Z-score, as the COVID-19 pandemic pertains particularly to business failure. We define firms as having high risk when the scores are below 1.81, and medium risk when the scores are between 1.81 and 2.99 (Altman, 1968). The remainder of firms are classified as low risk. We further quantify industry exposure following Moody's (2020) classification of high, moderate and low risk exposure industries (Fahlenbrach et al., 2020). High exposure industries include automotive and auto supplies, apparel, retail (non-food), passenger airlines, tourism/lodging/cruise, global shipping, consumer durables, restaurants, and leisure and entertainment industries. Moderate exposure industries include chemicals, manufacturing, oil and gas, steel production, metals and mining, services companies, media, gaming, education services, and beverages industries. The rest of the industries are considered as low exposure. We show, in

[11] We follow the same methodology in Khan & Watts (2009) to calculate the firm's score of accounting conservatism. Particularly, we estimate the firm's asymmetric timeliness in good news and bad news using a linear model of firm specific characteristics such as market-to-book ratio, firm size, and leverage. The accounting conservatism is measured as the incremental bad news timeliness in comparison to the good news timeliness. The firms' ex-ante accounting conservatism levels are estimated using firm-year samples over 10 years (i.e., 2009 to 2018) prior to our study period.

Panel A of Table 5, findings with firm risk and industry exposure as moderating factors on the interaction effect of *Overconfidence* and *COVID*. Columns (1) and (2) show the coefficients of high and medium risk, *Altman Z<1.81* and *Altman Z [1.81, 2.99]* respectively, are both negative and significant. Moreover, the coefficients are statistically significantly larger for high risk when compared to medium risk firms (at 10% level). In columns (3) and (4), we report significant negative coefficients for *High Exposure Industry*, while *Moderate Exposure Industry* have insignificant coefficients. The findings are very similar in Panel B when we use *Holder67* as the measure of CEO overconfidence. Overall, the findings in Table 5 show overconfident CEOs are less likely to exert an influence when their firms are predisposed to high risk of failure.

[--- INSERT TABLE 5 ABOUT HERE ---]

We next examine the impact of different firm fundamentals on the interaction effect of CEO overconfidence and *COVID*. We report our results in Table 6, with Panels A and B focusing on *Overconfidence* and *Holder67* as the measures of overconfidence respectively. In both panels, we show that *Cash Holding*, *ROA*, and *Log (Market Cap)* have positive and significant effects on the interaction of the overconfidence variables and *COVID*, while *Leverage Ratio* has negative and significant coefficients. The findings indicate the influence of CEO overconfidence strengthens for firms with larger cash holdings, lower leverage, higher ROA, and larger market capitalization. These results imply the extent that overconfident CEOs can moderate the effect of the crisis is stronger at firms with better fundamentals before the crisis.

[--- INSERT TABLE 6 ABOUT HERE ---]

5.4 Robustness Analysis

We conduct a battery of robustness analysis to corroborate and enrich our main findings. First, to rule out the alternative explanation that our results may be driven by other confounding factors not related to the Covid-19 crisis, we replace the original COVID-19 period from January 21st, 2020 up to March 23rd, 2020 with two placebo periods. The first placebo period covers November 22nd, 2019 to January 21st, 2020, and refers to the two-month period before the COVID-19 period; the second placebo period covers January 22nd, 2019 to March 23rd, 2019, and refers to the two-month period in the calendar year of 2019 that corresponds to the same calendar dates as the COVID-19 period in 2020.

We repeat the main analysis in Table 2 using the two placebo periods. In Table 7, we report the regression results of including these additional placebo periods in the model. While the interaction terms of overconfidence and the real *COVID* period remain statistically significant, we find that neither of the two interaction effects using the two placebo periods is significant. The placebo test results confirm that the baseline result in Table 2 is not due to chance as there is no result when randomizing the Covid-19 period.

[--- INSERT TABLE 7 ABOUT HERE ---]

Second, we examine whether the return boosting effect of CEO overconfidence exists in the recovery period of the COVID-19 pandemic. We extend the sample period to include the period from March 24th, 2020 to June 30th, 2020, the recovery period as defined in Fahlenbrach et al. (2020). We rerun the test in Table 2 using the augmented sample including the recovery period and report the results in Table 8. Once again, while the interaction effects of overconfidence and *COVID* continue to be positive and significant, we find the impact of CEO overconfidence is insignificant in the recovery period. The findings in the recovery period coincide with the recovery of the stock market, and could be the outcome of the series of government interventions imposed across the U.S.

[--- INSERT TABLE 8 ABOUT HERE ---]

We further conduct several additional robustness checks and report the results in the internet appendix. To ensure that our result on stock return is robust using alternative definition of abnormal return, we replace the capital market pricing model in the *AR* definition with the market model (Lins et al., 2017, Malmendier and Tate, 2008). We then estimate abnormal returns *(AR_MM)* and cumulative abnormal returns *(CAR_MM)* based the market model and use them as the dependent variable to run the main analysis. Table A1 reports the result using the market model based abnormal returns, which is qualitatively similar to the baseline result using CAPM based return Table 2, which support the robustness to our findings.

We have used the dummy variable *COVID* in the main analyses to denote the pandemic period to capture the average impact of the COVID-19 crisis on stock market performance, thus time fixed effects are omitted (Moser and Voena, 2012). As a robustness check, we include year times month fixed effects in lieu of *COVID* to better capture the unobserved time-variant trends. The estimation results are reported in Table A2. We next conduct two sub-sample tests, using the two placebo periods to represent the non-*COVID* period, to address the potential concern for

unbalanced lengths in the periods before and after the COVID-19. The findings are respectively reported in Panels A and B of Tables A3.

We have used the ex-ante firm control variables before the COVID-19 crisis in our baseline models to minimize the potential endogeneity bias (e.g., Ding et al., 2020b; Fahlenbrach et al., 2020; Li et al., 2020). To alleviate the concern that stock performances may reflect the recent changes in the firm fundamentals, we measure the control variables contemporaneously instead of using their values before the crisis. The results are reported in Table A4. Our findings are robust to all these different sensitivity analyses.

Lastly, it is puzzling that CEO overconfidence exerts a positive influence when facing high firm-specific exposure in Panel B, Table 3, but not when firms belong to high exposure industry in Table 5. We argue that the mitigating impact of CEO overconfidence on firm-specific COVID-19 exposure is limited when it comes to high exposure industries that are experiencing extremely devastating situations during the pandemic. We replicate the analyses in Table 5 on industry exposure by replacing *COVID* with firm-specific *COVID Exposure*. The results presented in Table A5 show consistently negative coefficients for the triple-interaction terms, signifying the mitigating impact of CEO overconfidence on *COVID Exposure* is diminished in high exposure industries.

6. Conclusion

In this study, we examine the impact of CEO overconfidence on firm performance during the COVID-19 crisis. Literature on CEO confidence mainly focus on the negative side showing CEO overconfidence can lead to incorrect assessment of investment returns and risk. Our study sheds positive light on overconfident CEOs by providing novel evidence that CEO overconfidence boosts stock returns during the COVID-19 pandemic. Specifically, we find CEO overconfidence has a significant positive effect on abnormal returns during COVID-19 crisis, implying CEO overconfidence could help mitigate the negative repercussions brought upon by the COVID-19 pandemic.

We then conduct heterogeneity analysis in terms of firm-level characteristics to ascertain to what extent CEO overconfidence helps alleviate the negative shock from the COVID-19 crisis. We find the positive effect of CEO overconfidence is more pronounced in firms that have higher firm-specific exposure to the COVID-19 pandemic. Moreover, CEO optimism loses its return

boosting effect when firms face high risk of failure and when they already have weak fundamentals prior to the COVID-19 crisis, implying the positive effect is limited to fundamentally sound firms. We further establish two channels in which CEO overconfidence could make firms more resilient to the pandemic. First, overconfident CEOs can better manage investor perception and instill confidence. Second, they might withhold more bad news amid the pandemic. And we find supportive evidence of both two channels.

This study contributes to the scant literature on the positive side of CEO overconfidence. The primary objective of our study is to establish the role of CEO overconfidence in boosting investors' sentiment and mitigating the negative effect brough upon by a pandemic crisis. In so doing, we emphasize on the often-overlooked bright side of overconfident CEOs. Nonetheless, we show that their influences are contingent on the business environment. Our channel analysis also shows better stock market performance could merely be the undesirable consequence of overconfident CEOs withholding more bad news during the COVID-19 crisis. Overall, we provide first evidence on the effect of CEO optimism during the COVID-19 pandemic, and we show that overconfidence can be beneficial in curbing stock price crashes at unprecedented crisis times like this. We urge future research to explore further the contextual factors that moderate the effect of CEO during a pandemic event.

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Appendix 1: Variable Definition

Variable	Definition
AR	The stock's daily abnormal return in one trading day, estimated based on the capital asset pricing model (CAPM). Specifically, AR equals the stock's raw daily buy-and-hold return in one trading day minus the *expected return*, winsorized at the top and bottom 1%. The *expected return* is estimated with the CAPM model (e.g., Remalli and Wagner, 2020): $$E_i - E_f = \alpha_i + \beta_i(E_m - E_f) + \varepsilon_i$$ E_i is the expected return of stock *i*. E_f is the risk-free rate, which equals the daily return of the one-month Treasury bill, $E_m - E_f$ is the excess return on the market, which is obtained from the Kenneth French's website. α_i is the return of the stock that is not related to the market's return. ε_i is the error term. We estimate the model coefficients using the daily returns over the previous one year of our sampling period, and then predict the expected return of the stock during our sample period.
CAR	The cumulative abnormal return of *AR_CAPM* of a 3-day window [-1, +1].
AR_MM	The daily stock's abnormal return in one trading day, estimated with the standard market model. Specifically, it equals the stock's raw daily buy-and-hold return in one trading day minus the stock's *expected return*, and it is winsorized at the top and bottom 1%. The *expected return* is estimated with the following market model (Lins et al., 2017): $$E_i = \alpha_i + \beta_i E_m + \varepsilon_i$$ E_i is the *expected return* of stock *i*. E_m is the return of the market benchmark, which is the daily return of the S&P 500 index. α_i is the return of the stock that is not related to the market's return. ε_i is the error term. We estimate the model coefficients using the daily returns over the previous one year of our sampling period, and then predict the expected return of the stock during our sample period.
CAR_MM	The cumulative abnormal return of *AR_MM* of a 3-day window [-1, +1].
Overconfidence	It equals the average value-per-vested option owned by the CEO divided by the average strike price by the end of the fiscal year 2018. The average value-per-vested option equals the

	value of vested unexercised options divided by the number of vested unexercised options. The average strike price equals the stock price minus the average value-per-vested option. It is winsorized at the top and bottom 1%.
Holder67	A dummy variable equals to one if *Overconfidence* is no less than 67% in at least two years during their tenure by the end of 2018, zero otherwise.
COVID	A dummy variable denoting the COVID-19 period. It equals to one for the samples period from January 22nd to March 23rd, 2020, zero otherwise.
COVID Exposure	Firm-specific exposure to the COVID-19 pandemic, measured as the frequency of keywords related to the COVID-19 extracted from the earnings call transcripts (Hassan et al., 2020).
COVID Risk	Firm-specific exposure to the COVID-19 pandemic, measured as the share of discussions on firm risk related to the COVID-19 extracted from the earnings call transcripts (Hassan et al., 2020).
COVID Negative	Firm-specific exposure to the COVID-19 pandemic, measured as the number of negative tone words used related to the COVID-19 extracted from the earnings call transcripts (Hassan et al., 2020).
CEO Gender	A dummy variable denoting the gender of the firm's CEO. It equals to one if the CEO is male, zero otherwise.
Log (CEO Age)	Equals to the logarithm of the CEO's present age.
Log (CEO Compensation)	Equals to the logarithm of the CEO's total compensation, including salary, bonus and all the other option grants.
Log (CEO Tenure)	Equals to the logarithm of the CEO's tenure years.
CEO Directorship	A dummy variable that equals to one if the CEO serves on the board of directors, zero otherwise.
Log (Market Cap)	The logarithm of a firm's equity market capitalization.
Leverage Ratio	Total debt divided by total assets.
ROA	Net income divided by total assets.
Cash Holding	Cash and marketable securities divided by total assets.
Book-to-Market	Book value of equity divided by market value of equity.

Raven Pack News Sentiment	The daily news sentiment score of a firm from Raven Pack database (the CSS score).
Conservatism	A firm's score of accounting conservatism, which is calculated following Khan & Watts (2009).
Altman Z [1.81, 2.99]	A dummy variable that equals to one if the Altman Z-score of the firm is between 1.81 and 2.99, zero otherwise.
Altman Z <1.81	A dummy variable that equals to one if the Altman Z-score of the firm is below 1.81, zero otherwise.
Moderate Exposure Industry	A dummy variable that equals to one if the firm is in an industry with medium exposure to COVID-19, zero otherwise. The definition of medium-exposure industries is from Moody's, which includes chemicals, manufacturing, oil and gas, steel production, metals and mining, services companies, media, gaming, educations services, and beverages.
High Exposure Industry	A dummy variable that equals to one if the firm is in an industry with high exposure to COVID-19, zero otherwise. The definition of high-exposure industries is from Moody's, which includes automotive and auto-suppliers, apparels, retail (non-food), passenger airlines, tourism/lodging/cruise, global shipping, consumer durables, restaurants, and leisure and entertainment.
Placebo Period 1	A dummy variable that denotes the first placebo period. It equals to one for the period from November 22nd, 2019 to January 21st, 2020, the two-month period before the COVID-19 period, zero otherwise.
Placebo Period 2	A dummy variable that denotes the second placebo period. It equals to one for the period from January 22nd, 2019 to March 23rd, 2019, the two-month period in the calendar year of 2019 covering the same dates as the COVID-19 period, zero otherwise.
Recovery Period	A dummy variable that equals to one for the samples between March 24th to June 30th, 2020, zero otherwise.

Figure 1. Daily Confirmed COVID-19 Cases in U.S. and S&P 500 Index Performance

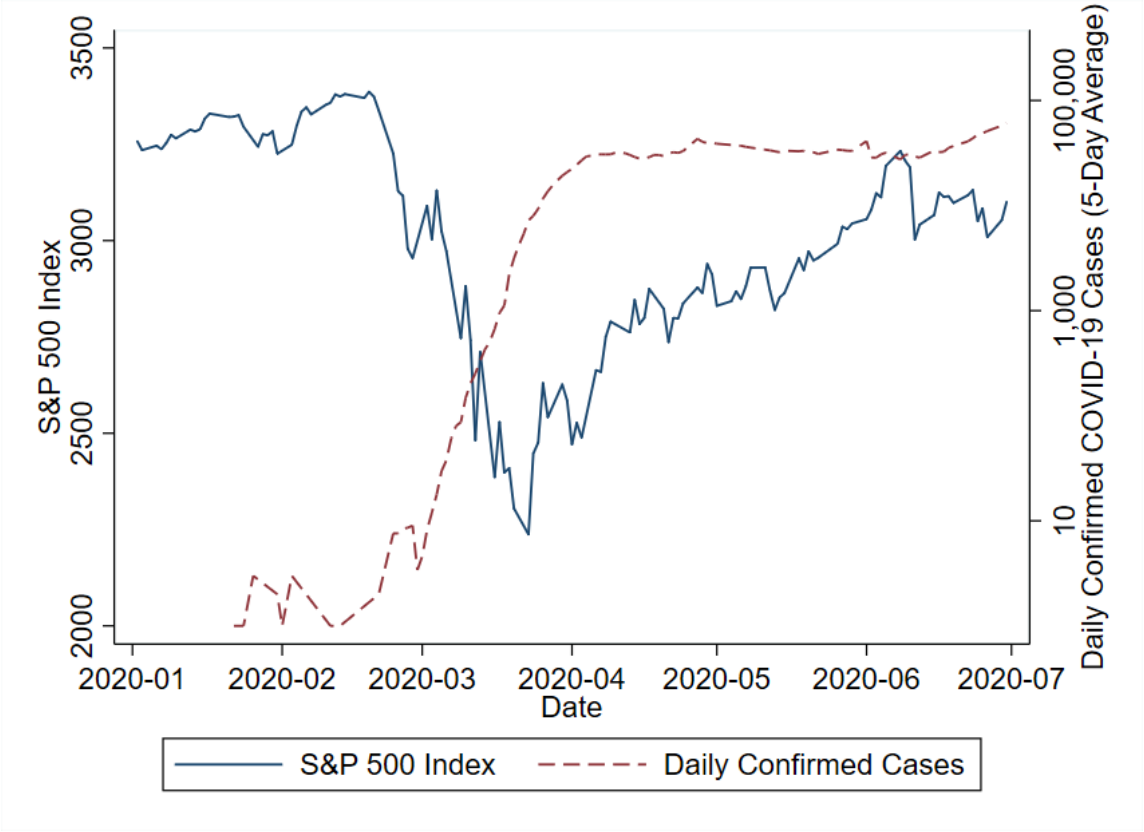

Table 1. Summary Statistics

This table presents the summary statistics of the key variables used in the study. Our main sample period is from January 22nd, 2019 to March 23rd, 2020, one year before to two months after the first confirmed COVID-19 cases reported in the U.S. on January 21st, 2020. The non COVID-19 period is from January 22nd, 2019 to Jan 21st, 2020, one year before the date when the first confirmed COVID-19 case was reported in the U.S. The COVID-19 period is from Jan 22nd, 2020 to March 23rd, 2020, two months after the first confirmed COVID-19 case was reported in the U.S. Detailed definitions of all variables are provided in Appendix 1.

Variable	Obs.	Mean	Std. Dev.	Min	Q1	Median	Q3	Max
Return Measures								
AR	229,320	-0.202	2.446	-12.960	-0.979	-0.041	0.834	7.443
CAR	227,760	-0.603	4.921	-38.890	-1.842	-0.140	1.429	22.330
AR_MM	229,320	-0.207	2.461	-13.000	-0.991	-0.045	0.840	7.479
CAR_MM	227,760	-0.620	4.947	-38.990	-1.869	-0.150	1.429	22.440
CEO Characteristics								
Overconfidence	229,320	0.395	0.902	0	0.0148	0.0488	0.349	5.155
Holder67	229,230	0.437	0.496	0	0	0	1	1
CEO Gender	229,320	0.946	0.226	0	1	1	1	1
Log (CEO Age)	229,320	4.050	0.119	3.664	3.970	4.060	4.127	4.419
Log (CEO Compensation)	229,320	8.428	0.987	0	7.947	8.499	9.036	10.670
Log (CEO Tenure)	229,320	1.883	0.816	0	1.386	1.869	2.485	4.043
CEO Directorship	229,320	0.977	0.150	0	1	1	1	1
Firm Characteristics								
COVID	229,320	0.146	0.353	0	0	0	0	1
COVID Exposure	225,122	0.064	0.294	0	0	0	0	4.415
COVID Risk	225,122	0.007	0.053	0	0	0	0	1.096
COVID Negative	225,122	0.018	0.119	0	0	0	0	3.362
Log (Market Cap)	229,320	7.944	1.651	1.720	6.912	7.768	8.908	13.890
Leverage Ratio	229,320	0.268	0.224	0	0.087	0.251	0.392	2.231
ROA	229,320	0.050	0.092	-0.602	0.014	0.044	0.086	0.561
Cash Holding	229,320	0.127	0.151	0	0.025	0.069	0.167	0.941
Book-to-Market	229,320	0.544	1.427	-6.553	0.203	0.389	0.673	135.300
Raven Pack News Sentiment	266,667	51.235	4.238	4	50	51	53	100
Conservatism	221,676	0.070	0.108	-0.220	0.003	0.060	0.133	0.764
Altman Z [1.81, 2.99]	183,162	0.201	0.400	0	0	0	0	1
Altman Z <1.81	183,162	0.202	0.402	0	0	0	0	1
Moderate Exposure Industry	229,230	0.153	0.360	0	0	0	0	1
High Exposure Industry	229,320	0.164	0.370	0	0	0	0	1

Table 2. Effect of CEO Overconfidence during the COVID-19 Pandemic

This table presents the regression results on the effect of CEO overconfidence on firms' abnormal stock returns during COVID-19 pandemic. The sample period is from January 22nd, 2019 to March 23rd, 2020, one year before to two months after the first confirmed COVID-19 cases reported in the U.S. on January 21st, 2020. Detailed definitions of all variables are provided in Appendix 1. Robust standard errors are clustered at the industry level and reported in parentheses. ***, **, and * denote significance at the < 1%, 5% and 10% levels, respectively.

	(1)	(2)	(3)	(4)
	AR	*CAR*	*AR*	*CAR*
Overconfidence COVID*	0.1628***	0.4490***		
	(0.0305)	(0.0979)		
Overconfidence	-0.0523***	-0.1546***		
	(0.0085)	(0.0252)		
*Holder67 * COVID*			0.1930***	0.5299**
			(0.0566)	(0.1730)
Holder67			-0.1100**	-0.3261**
			(0.0414)	(0.1233)
COVID	-0.5018***	-1.5200***	-0.5219***	-1.5743***
	(0.0648)	(0.1704)	(0.0764)	(0.2018)
CEO Gender	-0.0625	-0.1757	-0.0712	-0.2024
	(0.0685)	(0.2036)	(0.0698)	(0.2070)
Log (CEO Age)	-0.0421	-0.1070	-0.0227	-0.0459
	(0.4952)	(1.4857)	(0.4952)	(1.4848)
Log (CEO Compensation)	0.0597**	0.1736**	0.0626**	0.1827**
	(0.0215)	(0.0654)	(0.0227)	(0.0687)
Log (CEO Tenure)	0.1075	0.3171	0.1164	0.3439
	(0.0975)	(0.2944)	(0.0980)	(0.2957)
CEO Directorship	0.1512	0.4601	0.1632	0.4979
	(0.1338)	(0.3980)	(0.1316)	(0.3905)
Log (Market Cap)	-0.0119	-0.0278	-0.0111	-0.0255
	(0.0284)	(0.0817)	(0.0281)	(0.0810)
Leverage Ratio	0.2561	0.7802	0.2505	0.7632
	(0.1500)	(0.4559)	(0.1445)	(0.4396)
ROA	0.5524	1.6976	0.5670	1.7408
	(0.4094)	(1.2152)	(0.4233)	(1.2567)
Cash Holding	0.2833*	0.8351*	0.2651*	0.7763*
	(0.1233)	(0.3749)	(0.1222)	(0.3720)
Book-to-Market	-0.0565	-0.1303	-0.0570	-0.1315
	(0.0324)	(0.0760)	(0.0324)	(0.0759)
Constant	-0.7344	-2.3275	-0.8341	-2.6434
	(1.6599)	(4.9755)	(1.6543)	(4.9554)
Four-Factor Loadings	Y	Y	Y	Y
Industry Fixed Effects	Y	Y	Y	Y
Observations	229,320	227,760	229,320	227,760
R-squared	0.046	0.100	0.045	0.100

Table 3. Effect of CEO Overconfidence and Firm Exposure to the COVID-19 Pandemic

This table presents the regression results for the interaction effect of CEO overconfidence and firm-specific exposure to the COVID-19 pandemic on abnormal stock returns. The sample period is from January 22nd, 2019 to March 23rd, 2020, one year before to two months after the first confirmed COVID-19 cases reported in the U.S. on January 21st, 2020. Detailed definitions of all variables are provided in Appendix 1. Robust standard errors are clustered at the industry level and reported in parentheses. ***, **, and * denote significance at the < 1%, 5% and 10% levels, respectively.

Panel A. Correlations of COVID Exposure, COVID Risk, and COVID Negative

	COVID Exposure	*COVID Risk*	*COVID Negative*
COVID Exposure	1		
COVID Risk	0.5935	1	
COVID Negative	0.7611	0.4217	1

Panel B. Using COVID Exposure as the measure of Firm Exposure to COVID-19

	(1) *AR*	(2) *CAR*	(3) *AR*	(4) *CAR*
Overconfidence COVID Exposure*	0.1408***	0.3898***		
	(0.0204)	(0.0588)		
Overconfidence	-0.0403***	-0.1225***		
	(0.0111)	(0.0326)		
*Holder67 * COVID Exposure*			0.2165***	0.6135***
			(0.0578)	(0.1766)
Holder67			-0.0723*	-0.2145*
			(0.0359)	(0.1044)
COVID Exposure	-0.2065***	-0.6535***	-0.2734***	-0.8452***
	(0.0516)	(0.1296)	(0.0598)	(0.1551)
Constant	-0.2235	-0.7941	-0.3207	-1.0999
	(1.4153)	(4.2459)	(1.4164)	(4.2433)
CEO & Firm Features	Y	Y	Y	Y
Four-Factor Loadings	Y	Y	Y	Y
Industry Fixed Effects	Y	Y	Y	Y
Observations	225,122	223,592	225,122	223,592
R-squared	0.045	0.099	0.045	0.099

Panel C. Using COVID Risk as the measure of Firm Exposure to COVID-19

	(1) *AR*	(2) *CAR*	(3) *AR*	(4) *CAR*
Overconfidence COVID Risk*	0.2792***	0.7555***		
	(0.0602)	(0.2079)		
Overconfidence	-0.0338**	-0.1041***		
	(0.0103)	(0.0308)		
*Holder67 * COVID Risk*			0.6372**	1.5928*
			(0.2153)	(0.6992)
Holder67			-0.0643	-0.1915
			(0.0370)	(0.1075)
COVID Exposure	-0.5910***	-1.9086***	-0.7103***	-2.1893***
	(0.1458)	(0.3793)	(0.1007)	(0.3371)
Constant	-0.2235	-0.7941	-0.3207	-1.0999
	(1.4153)	(4.2459)	(1.4164)	(4.2433)
CEO & Firm Features	Y	Y	Y	Y
Four-Factor Loadings	Y	Y	Y	Y
Industry Fixed Effects	Y	Y	Y	Y
Observations	225,122	223,592	225,122	223,592
R-squared	0.044	0.098	0.044	0.098

Panel D. Using COVID Negative as the measure of Firm Exposure to COVID-19

	(1) *AR*	(2) *CAR*	(3) *AR*	(4) *CAR*
Confidence COVID Negative*	0.2156***	0.5894***		
	(0.0382)	(0.1205)		
Confidence	-0.0355***	-0.1088***		
	(0.0105)	(0.0306)		
*Holder67 * COVID Negative*			0.5612***	1.6528***
			(0.0943)	(0.3433)
Holder67			-0.0678	-0.2025*
			(0.0369)	(0.1073)
COVID Negative	-0.3598**	-1.1490***	-0.6550***	-2.0302***
	(0.1115)	(0.2948)	(0.0450)	(0.1412)
Constant	-0.2540	-0.8907	-0.3510	-1.1913
	(1.4316)	(4.2983)	(1.4270)	(4.2779)
CEO & Firm Features	Y	Y	Y	Y
Four-Factor Loadings	Y	Y	Y	Y
Industry Fixed Effects	Y	Y	Y	Y
Observations	225,122	223,592	225,122	223,592
R-squared	0.044	0.099	0.044	0.099

Table 4. Channel Analysis of the Effect of CEO Overconfidence during the COVID-19 Pandemic

This table presents the regression results for the channel analysis. The sample period is from January 22nd, 2019 to March 23rd, 2020, one year before to two months after the first confirmed COVID-19 case reported in the U.S. on January 21st, 2020. In Panel A, *Raven Pack News Sentiment* is the daily news sentiment score from Raven Pack. In Panel B, Conservatism is a firm's score of accounting conservatism, calculated from the methodology of Khan and Watts (2009). Detailed definitions of all other variables are provided in Appendix 1. Robust standard errors are clustered at the industry level and reported in parentheses. ***, **, and * denote significance at the < 1%, 5% and 10% levels, respectively.

Panel A. Raven Pack News Sentiment

	(1) *Raven Pack News Sentiment*	(2) *Raven Pack News Sentiment*	(3) *AR*	(4) *CAR*
*Overconfidence * COVID*	0.0430**			
	(0.0172)			
Overconfidence	0.0052			
	(0.0092)			
*Holder67 * COVID*		0.0621*		
		(0.0318)		
Holder67		0.0613		
		(0.0366)		
COVID	-0.4092***	-0.4183***		
	(0.0284)	(0.0292)		
Raven Pack News Sentiment			0.0174***	0.0449***
			(0.0016)	(0.0043)
Constant	51.2475***	51.3065***	-0.8316	-2.1360
	(0.5835)	(0.5808)	(1.0897)	(3.1472)
CEO & Firm Features	Y	Y	Y	Y
Industry Fixed Effects	Y	Y	Y	Y
Four-Factor Loadings	N	N	Y	Y
Year & Month Fixed Effects	N	N	Y	Y
Observations	266,667	266,667	195,220	193,814
R-squared	0.008	0.008	0.058	0.133

Panel B. Accounting Conservatism

	(1) *AR*	(2) *CAR*	(3) *AR*	(4) *CAR*
*Overconfidence * COVID * Conservatism*	-0.4473**	-1.4064**		
	(0.1920)	(0.5570)		
*Overconfidence * COVID*	0.1945***	0.5504***		
	(0.0274)	(0.0870)		
Overconfidence	-0.0513***	-0.1517***		
	(0.0085)	(0.0252)		
*Holder67 * COVID * Conservatism*			-1.6309***	-5.0312***
			(0.3313)	(1.0628)
*Holder67 * COVID*			0.2753***	0.7879***
			(0.0589)	(0.1816)
Holder67			-0.1078**	-0.3204**
			(0.0431)	(0.1288)
COVID	-0.4985***	-1.5139***	-0.5127***	-1.5510***
	(0.0656)	(0.1768)	(0.0738)	(0.1981)
Conservatism	0.5288	1.5628	0.5725	1.6972
	(0.4000)	(1.1846)	(0.4218)	(1.2509)
Constant	-2.7446	-2.7721	-2.6212	-2.5670
	(5.0096)	(4.9234)	(4.9212)	(4.9531)
CEO & Firm Features	Y	Y	Y	Y
Four-Factor Loadings	Y	Y	Y	Y
Industry Fixed Effects	Y	Y	Y	Y
Observations	221,676	220,168	221,676	220,168
R-squared	0.047	0.102	0.047	0.102

Table 5. Heterogeneity Analysis of Firm Risk and Industry Exposure

This table presents the regression results for the heterogenous analysis of firm risk and industry exposure. The sample period is from January 22nd, 2019 to March 23rd, 2020, one year before to two months after the first confirmed COVID-19 cases reported in the U.S. on January 21st, 2020. In Panel A, we present results with *Overconfidence* as the key independent variable. In Panel B, we present results with *Holder67* as the key independent variable. *Altman Z [1.81, 2.99]* and *Altman Z <1.81* are dummy variables denoting whether the Altman Z-score of the firm is between 1.81 and 2.99, or below 1.81, respectively. *Moderate Exposure Industry* and *High Exposure Industry* are dummy variables indicating if the firm belongs to the industry with moderate-risk or high-risk exposure, respectively. Detailed definitions of all other variables are provided in Appendix 1. Robust standard errors are clustered at the industry level and reported in parentheses. ***, **, and * denote significance at the < 1%, 5% and 10% levels, respectively.

Panel A. Using *Overconfidence* as CEO Overconfidence Measure

	(1)	(2)	(3)	(4)
	AR	*CAR*	*AR*	*CAR*
*Overconfidence * COVID * Altman Z [1.81, 2.99]*	-0.1731***	-0.5301***		
	(0.0394)	(0.1433)		
*Overconfidence * COVID * Altman Z < 1.81*	-0.2629***	-0.8227***		
	(0.0455)	(0.1574)		
*Overconfidence * COVID * Moderate Exposure Industry*			0.0185	0.0460
			(0.0744)	(0.2116)
*Overconfidence * COVID * High Exposure Industry*			-0.1784**	-0.6069**
			(0.0698)	(0.2149)
*Overconfidence * COVID*	0.2216***	0.6398***	0.1880***	0.5361***
	(0.0152)	(0.0409)	(0.0363)	(0.1102)
Overconfidence	-0.0425***	-0.1262***	-0.0522***	-0.1544***
	(0.0082)	(0.0238)	(0.0085)	(0.0250)
COVID	-0.4652***	-1.4504***	-0.5025***	-1.5222***
	(0.0641)	(0.1862)	(0.0664)	(0.1759)
Constant	-2.3921***	-7.2752***	-0.7224	-2.2884
	(0.6195)	(1.8781)	(1.6525)	(4.9519)
CEO & Firm Features	Y	Y	Y	Y
Four-Factor Loadings	Y	Y	Y	Y
Industry Fixed Effects	Y	Y	Y	Y
Observations	183,162	181,916	229,320	227,760
R-squared	0.051	0.127	0.046	0.100

Panel B. Using *Holder67* as CEO Overconfidence Measure

	(1) *AR*	(2) *CAR*	(3) *AR*	(4) *CAR*
*Holder67 * COVID * Altman Z [1.81, 2.99]*	-0.4268***	-1.2845***		
	(0.0953)	(0.2968)		
*Holder67 * COVID * Altman Z < 1.81*	-0.5540**	-1.7513**		
	(0.2372)	(0.7235)		
*Holder67 * COVID * Moderate Exposure Industry*			-0.0104	-0.0824
			(0.1104)	(0.2716)
*Holder67 * COVID * High Exposure Industry*			-0.5759***	-1.7929***
			(0.1327)	(0.3602)
*Holder67 * COVID*	0.3600***	1.0453***	0.2807***	0.8097***
	(0.0570)	(0.1747)	(0.0498)	(0.1473)
Holder67	-0.0780	-0.2343	-0.1095**	-0.3244**
	(0.0458)	(0.1366)	(0.0422)	(0.1258)
COVID	-0.4820***	-1.4916***	-0.5217***	-1.5738***
	(0.0712)	(0.2069)	(0.0762)	(0.2014)
Constant	-2.4350***	-7.4205***	-0.7947	-2.5230
	(0.6092)	(1.8431)	(1.6332)	(4.8957)
CEO & Firm Features	Y	Y	Y	Y
Four-Factor Loadings	Y	Y	Y	Y
Industry Fixed Effects	Y	Y	Y	Y
Observations	183,162	181,916	229,320	227,760
R-squared	0.051	0.128	0.046	0.101

Table 6. Heterogeneity Analysis of Firm Fundamentals

This table presents the regression results for the heterogenous analysis of firm fundamentals. The sample period is from January 22nd, 2019 to March 23rd, 2020, one year before to two months after the first confirmed COVID-19 cases reported in the U.S. on January 21st, 2020. In Panel A, we present results with Overconfidence as the key independent variable. In Panel B, we present results with Holder67 as the key independent variable. Detailed definitions of all other variables are provided in Appendix 1. Robust standard errors are clustered at the industry level and reported in parentheses. ***, **, and * denote significance at the < 1%, 5% and 10% levels, respectively.

Panel A. Using *Overconfidence* as CEO Overconfidence Measure

	(1) *AR*	(2) *CAR*	(3) *AR*	(4) *CAR*	(5) *AR*	(6) *CAR*	(7) *AR*	(8) *CAR*
*Overconfidence * COVID * Cash Holding*	0.1328**	0.3521*						
	(0.0565)	(0.1748)						
*Overconfidence * COVID * Leverage Ratio*			-0.1131**	-0.3561**				
			(0.0422)	(0.1125)				
*Overconfidence * COVID * ROA*					0.6852**	1.9662**		
					(0.2522)	(0.7098)		
*Overconfidence * COVID * Log (Market Cap)*							0.0431**	0.1364**
							(0.0144)	(0.0469)
*Overconfidence * COVID*	0.1309***	0.3645**	0.1920***	0.5410***	0.1011**	0.2720*	-0.1017	-0.3878
	(0.0381)	(0.1219)	(0.0226)	(0.0723)	(0.0395)	(0.1229)	(0.0667)	(0.2214)
Overconfidence	-0.0517***	-0.1531***	-0.0521***	-0.1541***	-0.0515***	-0.1523***	-0.0517***	-0.1529***
	(0.0083)	(0.0247)	(0.0082)	(0.0244)	(0.0079)	(0.0234)	(0.0082)	(0.0241)
COVID	-0.4999***	-1.5147***	-0.5026***	-1.5223***	-0.5001***	-1.5151***	-0.5051***	-1.5302***
	(0.0654)	(0.1716)	(0.0666)	(0.1760)	(0.0650)	(0.1710)	(0.0634)	(0.1667)
Constant	-0.7437	-2.3518	-0.7418	-2.3507	-0.7371	-2.3354	-0.7275	-2.3062
	(1.6601)	(4.9748)	(1.6601)	(4.9758)	(1.6580)	(4.9698)	(1.6612)	(4.9800)
CEO & Firm Features	Y	Y	Y	Y	Y	Y	Y	Y
Four-Factor Loadings	Y	Y	Y	Y	Y	Y	Y	Y
Industry Fixed Effects	Y	Y	Y	Y	Y	Y	Y	Y
Observations	229,320	227,760	229,320	227,760	229,320	227,760	229,320	227,760
R-squared	0.046	0.100	0.046	0.100	0.046	0.100	0.046	0.100

Panel B. Using *Holder67* as CEO Overconfidence Measure

	(1) *AR*	(2) *CAR*	(3) *AR*	(4) *CAR*	(5) *AR*	(6) *CAR*	(7) *AR*	(8) *CAR*
*Holder67 * COVID * Cash Holding*	1.1682***	3.2321***						
	(0.1574)	(0.4165)						
*Holder67 * COVID * Leverage Ratio*			-0.6437***	-1.8304***				
			(0.1048)	(0.2094)				
*Holder67 * COVID * ROA*					2.2890**	6.7711**		
					(0.8666)	(2.6833)		
*Holder67 * COVID * Log (Market Cap)*							0.0502*	0.1790**
							(0.0232)	(0.0743)
*Holder67 * COVID*	0.0227	0.0587	0.3550***	0.9905***	0.0289	0.0443	-0.1288	-0.6189
	(0.0761)	(0.2147)	(0.0588)	(0.1718)	(0.1091)	(0.3302)	(0.1670)	(0.5216)
Holder67	-0.1065**	-0.3166**	-0.1087**	-0.3225**	-0.1069**	-0.3170**	-0.1090**	-0.3225**
	(0.0408)	(0.1219)	(0.0409)	(0.1221)	(0.0401)	(0.1195)	(0.0413)	(0.1226)
COVID	-0.5220***	-1.5746***	-0.5219***	-1.5742***	-0.5221***	-1.5749***	-0.5220***	-1.5746***
	(0.0765)	(0.2020)	(0.0764)	(0.2018)	(0.0764)	(0.2017)	(0.0764)	(0.2018)
Constant	-0.8713	-2.7446	-0.8801	-2.7721	-0.8265	-2.6212	-0.8123	-2.5670
	(1.6749)	(5.0096)	(1.6442)	(4.9234)	(1.6427)	(4.9212)	(1.6533)	(4.9531)
CEO & Firm Features	Y	Y	Y	Y	Y	Y	Y	Y
Four-Factor Loadings	Y	Y	Y	Y	Y	Y	Y	Y
Industry Fixed Effects	Y	Y	Y	Y	Y	Y	Y	Y
Observations	229,320	227,760	229,320	227,760	229,320	227,760	229,320	227,760
R-squared	0.046	0.101	0.046	0.100	0.046	0.101	0.046	0.100

Table 7. Placebo Tests

This table presents the regression results for the placebo tests based on false event periods. The sample period is from January 22nd, 2019 to March 23rd, 2020, one year before to two months after the first confirmed COVID-19 cases reported in the U.S. on January 21st, 2020. *Placebo Period 1* denotes the first placebo period from November 22nd, 2019 to January 21st, 2020, which is the two-month period before the COVID-19 period. *Placebo Period 2* denotes the second placebo period from January 22nd, 2019 to March 23rd, 2019, which is the same period as the COVID-19 period in the year of 2019. Detailed definitions of all other variables are provided in Appendix 1. Robust standard errors are clustered at the industry level and reported in parentheses. ***, **, and * denote significance at the < 1%, 5% and 10% levels, respectively.

	(1)	(2)	(3)	(4)
	AR	*CAR*	*AR*	*CAR*
*Overconfidence * COVID*	0.1664***	0.4595***		
	(0.0326)	(0.1040)		
*Overconfidence * Placebo Period 1*	0.0237	0.0715		
	(0.0179)	(0.0500)		
*Overconfidence * Placebo Period 2*	0.0000	-0.0038		
	(0.0125)	(0.0400)		
Overconfidence	-0.0560***	-0.1651***		
	(0.0088)	(0.0250)		
*Holder67 * COVID*			0.1903**	0.5220**
			(0.0593)	(0.1820)
*Holder67 * Placebo Period 1*			0.0203	0.0615
			(0.0117)	(0.0376)
*Holder67 * Placebo Period 2*			-0.0356	-0.1074
			(0.0248)	(0.0709)
Holder67			-0.1072**	-0.3181**
			(0.0438)	(0.1302)
COVID	-0.5056***	-1.5243***	-0.5229***	-1.5709***
	(0.0654)	(0.1707)	(0.0776)	(0.2051)
Placebo Period 1	0.0029	0.0080	0.0033	0.0093
	(0.0207)	(0.0650)	(0.0220)	(0.0709)
Placebo Period 2	-0.0250	-0.0339	-0.0094	0.0115
	(0.0249)	(0.0777)	(0.0273)	(0.0816)
Constant	-0.7344	-2.3275	-0.8341	-2.6434
	(1.6599)	(4.9755)	(1.6543)	(4.9554)
CEO & Firm Features	Y	Y	Y	Y
Four-Factor Loadings	Y	Y	Y	Y
Industry Fixed Effects	Y	Y	Y	Y
Observations	229,320	227,760	229,320	227,760
R-squared	0.046	0.100	0.045	0.100

Table 8. Robustness Analysis of Recovery Period

This table presents the regression results for the robustness analysis of recovery period. The sample period is from January 22nd, 2019 to March 23rd, 2020, one year before to two months after the first confirmed COVID-19 cases reported in the U.S. on January 21st, 2020. *Recovery Period* denotes the period from March 24th, 2019 to June 30th, 2020 as in Fahlenbrach et al. (2020). Detailed definitions of all other variables are provided in Appendix 1. Robust standard errors are clustered at the industry level and reported in parentheses. ***, **, and * denote significance at the < 1%, 5% and 10% levels, respectively.

	(1)	(2)	(3)	(4)
	AR	*CAR*	*AR*	*CAR*
*Overconfidence * COVID*	0.1483***	0.4095***		
	(0.0296)	(0.0951)		
*Overconfidence * Recovery Period*	0.0470	0.2627		
	(0.0864)	(0.2843)		
Overconfidence	-0.0315*	-0.1007*		
	(0.0166)	(0.0468)		
*Holder67 * COVID*			0.2164**	0.5988**
			(0.0728)	(0.2167)
*Holder67 * Recovery Period*			-0.2681	-0.7487
			(0.2537)	(0.8152)
Holder67			-0.0593	-0.1863
			(0.0592)	(0.1753)
COVID	-0.4484***	-1.3756***	-0.4840***	-1.4744***
	(0.0600)	(0.1521)	(0.0779)	(0.2041)
Recovery Period	1.5318***	5.0673***	1.6681***	5.5000***
	(0.2114)	(0.6102)	(0.2958)	(0.8906)
Constant	0.7618	2.0757	0.7068	1.9451
	(1.5589)	(4.3530)	(1.5068)	(4.1513)
CEO & Firm Features	Y	Y	Y	Y
Four-Factor Loadings	Y	Y	Y	Y
Industry Fixed Effects	Y	Y	Y	Y
Observations	281,816	277,236	281,816	277,236
R-squared	0.010	0.018	0.010	0.018

Internet Appendix Table A1. Robustness Analysis of Abnormal Returns from Market Model

This table presents the regression results for robustness analysis of abnormal returns from the market model. The sample period is from January 22nd, 2019 to March 23rd, 2020, one year before to two months after the first confirmed COVID-19 cases reported in the U.S. on January 21st, 2020. The dependent variable *AR_MM* is the daily abnormal return estimated with the market model (Lins et al., 2017). The market return used in the model is the daily return of the S&P 500 index. *CAR_MM* is the cumulative abnormal return of *AR_MM* over a 3-day window [-1, +1]. Detailed definitions of all variables are provided in Appendix 1. Robust standard errors are clustered at the industry level and reported in parentheses. ***, **, and * denote significance at the < 1%, 5% and 10% levels, respectively.

	(1)	(2)	(3)	(4)
	AR_MM	*CAR_MM*	*AR_MM*	*CAR_MM*
*Overconfidence * COVID*	0.1584***	0.4353***		
	(0.0314)	(0.1005)		
Overconfidence	-0.0521***	-0.1539***		
	(0.0085)	(0.0253)		
*Holder67 * COVID*			0.1889**	0.5157**
			(0.0579)	(0.1772)
Holder67			-0.1100**	-0.3259**
			(0.0415)	(0.1236)
COVID	-0.5122***	-1.5707***	-0.5322***	-1.6241***
	(0.0637)	(0.1687)	(0.0754)	(0.1997)
CEO Gender	-0.0624	-0.1757	-0.0712	-0.2025
	(0.0691)	(0.2053)	(0.0703)	(0.2086)
Log (CEO Age)	-0.0405	-0.1025	-0.0208	-0.0405
	(0.4972)	(1.4914)	(0.4972)	(1.4907)
Log (CEO Compensation)	0.0594**	0.1725**	0.0623**	0.1817**
	(0.0217)	(0.0659)	(0.0229)	(0.0692)
Log (CEO Tenure)	0.1075	0.3171	0.1165	0.3441
	(0.0978)	(0.2952)	(0.0982)	(0.2964)
CEO Directorship	0.1513	0.4606	0.1636	0.4989
	(0.1338)	(0.3976)	(0.1315)	(0.3900)
Log (Market Cap)	-0.0117	-0.0276	-0.0109	-0.0253
	(0.0284)	(0.0818)	(0.0281)	(0.0810)
Leverage Ratio	0.2566	0.7820	0.2511	0.7648
	(0.1510)	(0.4589)	(0.1455)	(0.4425)
ROA	0.5550	1.7055	0.5696	1.7487
	(0.4103)	(1.2179)	(0.4243)	(1.2593)
Cash Holding	0.2794*	0.8223*	0.2607*	0.7625*
	(0.1233)	(0.3748)	(0.1222)	(0.3720)
Book-to-Market	-0.0571	-0.1325	-0.0576	-0.1336
	(0.0325)	(0.0764)	(0.0325)	(0.0764)
Constant	-0.7426	-2.3468	-0.8439	-2.6674
	(1.6652)	(4.9908)	(1.6598)	(4.9715)
Four-Factor Loadings	Y	Y	Y	Y
Industry Fixed Effects	Y	Y	Y	Y
Observations	229,320	227,760	229,320	227,760
R-squared	0.045	0.100	0.045	0.099

Internet Appendix Table A2. Robustness Analysis of Time Fixed Effects

This table presents the regression results for robustness analysis of time fixed effects. The sample period is from January 22nd, 2019 to March 23rd, 2020, one year before to two months after the first confirmed COVID-19 cases reported in the U.S. on January 21st, 2020. We include year times month fixed effects, instead of including the dummy variable (*COVID*) to denote the post-COVID-19 period (Moser and Voena, 2012). Detailed definitions of all variables are provided in Appendix 1. Robust standard errors are clustered at the industry level and reported in parentheses. ***, **, and * denote significance at the < 1%, 5% and 10% levels, respectively.

	(1)	(2)	(3)	(4)
	AR	*CAR*	*AR*	*CAR*
*Overconfidence * COVID*	0.1476***	0.4015***		
	(0.0259)	(0.0834)		
Overconfidence	-0.0500***	-0.1475***		
	(0.0081)	(0.0243)		
*Holder67 * COVID*			0.1357**	0.3522*
			(0.0551)	(0.1642)
Holder67			-0.1017**	-0.3009**
			(0.0408)	(0.1223)
CEO Gender	-0.0625	-0.1758	-0.0712	-0.2024
	(0.0685)	(0.2035)	(0.0697)	(0.2069)
Log (CEO Age)	-0.0437	-0.1116	-0.0245	-0.0509
	(0.4956)	(1.4868)	(0.4956)	(1.4858)
Log (CEO Compensation)	0.0597**	0.1735**	0.0625**	0.1825**
	(0.0216)	(0.0656)	(0.0228)	(0.0689)
Log (CEO Tenure)	0.1073	0.3165	0.1163	0.3434
	(0.0975)	(0.2944)	(0.0980)	(0.2957)
CEO Directorship	0.1503	0.4576	0.1623	0.4953
	(0.1337)	(0.3977)	(0.1314)	(0.3901)
Log (Market Cap)	-0.0114	-0.0265	-0.0106	-0.0241
	(0.0283)	(0.0815)	(0.0280)	(0.0807)
Leverage Ratio	0.2584	0.7868	0.2529	0.7701
	(0.1503)	(0.4567)	(0.1447)	(0.4402)
ROA	0.5587	1.7156	0.5736	1.7598
	(0.4076)	(1.2105)	(0.4216)	(1.2519)
Cash Holding	0.2869**	0.8452*	0.2688*	0.7872*
	(0.1239)	(0.3766)	(0.1228)	(0.3738)
Book-to-Market	-0.0518	-0.1167	-0.0521	-0.1174
	(0.0301)	(0.0696)	(0.0301)	(0.0696)
Constant	-0.8074	-2.5452	-0.9098	-2.8679
	(1.6532)	(4.9622)	(1.6456)	(4.9356)
Four-Factor Loadings	Y	Y	Y	Y
Industry Fixed Effects	Y	Y	Y	Y
Year * Month Fixed Effects	Y	Y	Y	Y
Observations	229,320	227,760	229,320	227,760
R-squared	0.050	0.110	0.050	0.109

Internet Appendix Table A3. Robustness Analysis of Subsample Periods

This table presents the regression results for the robustness analysis of subsample periods. In Panel A, the sample period is from November 22nd, 2019 to March 23rd, 2020, two months before and after the first confirmed COVID-19 cases reported in the U.S. on January 21st, 2020. In Panel B, the sample period includes the COVID-19 period from January 22nd, 2020 to March 23rd, 2020, and the same period in the previous year. Detailed definitions of all other variables are provided in Appendix 1. Robust standard errors are clustered at the industry level and reported in parentheses. ***, **, and * denote significance at the < 1%, 5% and 10% levels, respectively.

Panel A. Compare with Prior 2 Months Only

	(1) *AR*	(2) *CAR*	(3) *AR*	(4) *CAR*
*Overconfidence * COVID*	0.1438***	0.3906***		
	(0.0221)	(0.0724)		
Overconfidence	-0.0554***	-0.1584***		
	(0.0120)	(0.0346)		
*Holder67 * COVID*			0.1691**	0.4582**
			(0.0553)	(0.1651)
Holder67			-0.1281**	-0.3752**
			(0.0388)	(0.1130)
COVID	-0.5125***	-1.5423***	-0.5297***	-1.5884***
	(0.0725)	(0.1991)	(0.0797)	(0.2180)
CEO Gender	-0.0308	-0.0589	-0.0353	-0.0743
	(0.0678)	(0.1920)	(0.0708)	(0.1997)
Log (CEO Age)	-0.0782	-0.1199	-0.0914	-0.1490
	(0.4961)	(1.4795)	(0.4882)	(1.4558)
Log (CEO Compensation)	0.0465**	0.1245*	0.0447*	0.1208
	(0.0185)	(0.0573)	(0.0220)	(0.0666)
Log (CEO Tenure)	0.1237	0.3541	0.1330	0.3829
	(0.0976)	(0.2956)	(0.0938)	(0.2838)
CEO Directorship	0.1732	0.5600	0.1660	0.5448
	(0.1286)	(0.3764)	(0.1286)	(0.3744)
Log (Market Cap)	0.0265	0.0993	0.0285	0.1049
	(0.0315)	(0.0859)	(0.0309)	(0.0843)
Leverage Ratio	0.1339	0.4041	0.1343	0.4034
	(0.1340)	(0.4232)	(0.1246)	(0.3955)
ROA	0.5088	1.5724	0.5382	1.6587
	(0.5558)	(1.6109)	(0.5804)	(1.6832)
Cash Holding	0.6517***	1.8564***	0.6796***	1.9264***
	(0.1306)	(0.3908)	(0.1220)	(0.3619)
Book-to-Market	-0.0378	-0.0814	-0.0379	-0.0817
	(0.0226)	(0.0502)	(0.0226)	(0.0502)
Constant	-0.8720	-3.1644	-0.7969	-2.9978
	(1.6517)	(4.9174)	(1.6011)	(4.7659)
Four-Factor Loadings	Y	Y	Y	Y
Industry Fixed Effects	Y	Y	Y	Y
Observations	63,960	63,180	63,960	63,180
R-squared	0.035	0.084	0.035	0.083

Panel B. Compare with Same Period in Previous Year Only

	(1) *AR*	(2) *CAR*	(3) *AR*	(4) *CAR*
*Overconfidence * COVID*	0.1677***	0.4664***		
	(0.0351)	(0.1114)		
Overconfidence	-0.0791**	-0.2338**		
	(0.0239)	(0.0727)		
*Holder67 * COVID*			0.2239***	0.6243***
			(0.0500)	(0.1509)
Holder67			-0.1826***	-0.5409***
			(0.0422)	(0.1248)
COVID	-0.4852***	-1.5016***	-0.5167***	-1.5899***
	(0.0604)	(0.1649)	(0.0727)	(0.1903)
CEO Gender	-0.0183	-0.0100	-0.0259	-0.0347
	(0.0636)	(0.1878)	(0.0670)	(0.1973)
Log (CEO Age)	-0.1505	-0.3360	-0.1538	-0.3361
	(0.5084)	(1.5224)	(0.5068)	(1.5158)
Log (CEO Compensation)	0.0637**	0.1718**	0.0634**	0.1722**
	(0.0191)	(0.0588)	(0.0226)	(0.0685)
Log (CEO Tenure)	0.1199	0.3490	0.1320	0.3857
	(0.0947)	(0.2903)	(0.0925)	(0.2836)
CEO Directorship	0.1052	0.3471	0.1040	0.3493
	(0.1507)	(0.4442)	(0.1516)	(0.4442)
Log (Market Cap)	0.0281	0.1014	0.0301	0.1072
	(0.0313)	(0.0866)	(0.0313)	(0.0867)
Leverage Ratio	0.1653	0.4700	0.1631	0.4615
	(0.1588)	(0.5098)	(0.1484)	(0.4798)
ROA	0.5298	1.5810	0.5612	1.6729
	(0.4879)	(1.4356)	(0.5076)	(1.4916)
Cash Holding	0.6724***	1.9005***	0.6891***	1.9370***
	(0.1222)	(0.3583)	(0.1097)	(0.3210)
Book-to-Market	-0.0419	-0.0936	-0.0427	-0.0957
	(0.0311)	(0.0736)	(0.0312)	(0.0739)
Constant	-0.7141	-2.5956	-0.6829	-2.5578
	(1.7287)	(5.1534)	(1.7132)	(5.0976)
Four-Factor Loadings	Y	Y	Y	Y
Industry Fixed Effects	Y	Y	Y	Y
Observations	66,300	64,740	66,300	64,740
R-squared	0.035	0.083	0.034	0.083

Internet Appendix Table A4. Robustness Analysis of Using Control Variables that Match with the Year of Stock Returns

This table presents the regression results for robustness analysis of using control variables that match with the year of stock returns. The sample period is from January 22nd, 2019 to March 23rd, 2020, one year before to two months after the first confirmed COVID-19 cases reported in the U.S. on January 21st, 2020. Instead of including control variables measured before the crisis, we use the control variables that match with the year of stock returns. Detailed definitions of all variables are provided in Appendix 1. Robust standard errors are clustered at the industry level and reported in parentheses. ***, **, and * denote significance at the < 1%, 5% and 10% levels, respectively.

	(1)	(2)	(3)	(4)
	AR	*CAR*	*AR*	*CAR*
*Overconfidence * COVID*	0.1645***	0.4529***		
	(0.0309)	(0.0981)		
Overconfidence	-0.0533***	-0.1577***		
	(0.0084)	(0.0257)		
*Holder67 * COVID*			0.1897***	0.5281**
			(0.0510)	(0.1599)
Holder67			-0.1171**	-0.3476**
			(0.0433)	(0.1304)
COVID	-0.5084***	-1.5337***	-0.5265***	-1.5863***
	(0.0680)	(0.1802)	(0.0774)	(0.2065)
CEO Gender	-0.0493	-0.1374	-0.0594	-0.1678
	(0.0626)	(0.1867)	(0.0641)	(0.1908)
Log (CEO Age)	-0.0672	-0.1654	-0.0450	-0.0959
	(0.5447)	(1.6313)	(0.5429)	(1.6258)
Log (CEO Compensation)	0.0565**	0.1649**	0.0597**	0.1748**
	(0.0225)	(0.0676)	(0.0239)	(0.0716)
Log (CEO Tenure)	0.1106	0.3272	0.1211	0.3586
	(0.1056)	(0.3182)	(0.1064)	(0.3207)
CEO Directorship	0.1584	0.4875	0.1710	0.5273
	(0.1397)	(0.4149)	(0.1375)	(0.4076)
Log (Market Cap)	-0.0114	-0.0304	-0.0111	-0.0296
	(0.0310)	(0.0911)	(0.0307)	(0.0902)
Leverage Ratio	0.2420	0.7171	0.2404	0.7113
	(0.1820)	(0.5455)	(0.1801)	(0.5400)
ROA	0.6485**	1.9642**	0.6658**	2.0147**
	(0.2726)	(0.8158)	(0.2846)	(0.8518)
Cash Holding	0.2822*	0.8029*	0.2620*	0.7379
	(0.1323)	(0.3977)	(0.1368)	(0.4113)
Book-to-Market	-0.0668	-0.1945	-0.0710	-0.2066
	(0.0498)	(0.1516)	(0.0511)	(0.1558)
Constant	-0.8074	-2.5452	-0.9098	-2.8679
	(1.6532)	(4.9622)	(1.6456)	(4.9356)
Four-Factor Loadings	Y	Y	Y	Y
Industry Fixed Effects	Y	Y	Y	Y
Observations	222,404	220,883	222,404	220,883
R-squared	0.046	0.101	0.046	0.101

Internet Appendix Table A5. Robustness Analysis of Heterogeneity of Industry Exposure

This table presents the regression results for robustness analysis of heterogeneity of industry exposure. The sample period is from January 22nd, 2019 to March 23rd, 2020, one year before to two months after the first confirmed COVID-19 cases reported in the U.S. on January 21st, 2020. *Moderate Exposure Industry* and *High Exposure Industry* are dummy variables indicating if the firm belongs to the industry with moderate-risk or high-risk exposure, respectively. Detailed definitions of all other variables are provided in Appendix 1. Robust standard errors are clustered at the industry level and reported in parentheses. ***, **, and * denote significance at the < 1%, 5% and 10% levels, respectively.

	(1) *AR*	(2) *CAR*	(3) *AR*	(4) *CAR*
*Overconfidence * COVID Exposure * Moderate Exposure Industry*	0.1365	0.4086		
	(0.0909)	(0.3186)		
*Overconfidence * COVID Exposure * High Exposure Industry*	-0.2186**	-0.6624**		
	(0.0855)	(0.2575)		
*Overconfidence * COVID Exposure*	0.1634***	0.4584***		
	(0.0254)	(0.0675)		
Overconfidence	-0.0402***	-0.1221***		
	(0.0113)	(0.0330)		
*Holder67 * COVID Exposure * Moderate Exposure Industry*			-0.0750*	-0.1793
			(0.0348)	(0.0990)
*Holder67 * COVID Exposure * High Exposure Industry*			-0.5099**	-1.4343**
			(0.1874)	(0.5467)
*Holder67 * COVID Exposure*			0.3365***	0.9458***
			(0.0827)	(0.2313)
Holder67			-0.0726*	-0.2153*
			(0.0365)	(0.1059)
COVID Exposure	-0.2063***	-0.6529***	-0.2736***	-0.8458***
	(0.0562)	(0.1435)	(0.0603)	(0.1563)
Constant	-0.2076	-0.7466	-0.2311	-0.8500
	(1.4082)	(4.2257)	(1.3961)	(4.1880)
CEO & Firm Features	Y	Y	Y	Y
Four-Factor Loadings	Y	Y	Y	Y
Industry Fixed Effects	Y	Y	Y	Y
Observations	225,122	223,592	225,122	223,592
R-squared	0.045	0.099	0.045	0.100