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CEO duality and firm performance during the 2020 coronavirus outbreak

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ABSTRACT

Stewardship theory suggests that CEO duality can provide strong leadership and facilitate the development and coordination of firm strategy. These benefits should affect firm risk and financial performance, particularly when the firm has high information-gathering costs. We use the 2020 coronavirus outbreak as a natural experiment to determine whether CEO duality is beneficial during crisis periods. We find that in 2020, S&P 1500 firms with CEO duality exhibit smaller increases in default probability risk than firms with non-duality in the presence of high information costs. Firms with CEO duality experience a smaller decrease in profitability when information costs are high. We also find that firms with CEO duality offer cumulative abnormal returns significantly higher than those of other firms. CEO duality is more valuable in firms with higher information costs. Our results indicate that CEO duality is valuable during crisis periods, particularly when information costs are high. These results are consistent with stewardship theory and indicate that the concentration of power from CEO duality is beneficial during crisis periods.

1. Introduction

The US coronavirus outbreak in early 2020 led governments worldwide to restrict travel and mandate stay-at-home orders. Universities, restaurants, theaters, and other settings where people were in close contact were shut down. Although prior coronaviruses like SARS-CoV (2003) and MERS-CoV (2013) caused economic damage, the world was unprepared to deal with COVID-19. Until governments began to provide fiscal stimulus to mitigate the effects of the outbreak, the value of decisive leadership was elevated. As such, the pandemic period provides a natural experiment to examine the value of corporate governance mechanisms across different economic conditions. Firms with decisive leadership in the form of powerful CEOs who also serve as the Chairman of the Board likely had an advantage over firms whose CEOs faced more oversight when making quick decisions.

One of the most studied corporate governance characteristics is CEO duality, where the CEO is also the Chairman of the Board. CEO duality allows the CEO a larger measure of control over the firm and its external policies. However, over the past several decades, CEO duality at publicly traded firms has declined as firms increasingly cite a desire to reduce agency costs (Goergen, Limbach, & Scholz-Daneshgari, 2020).

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There are two competing theories on the effect of CEO duality on firm performance: agency theory and stewardship theory. Agency theory states that CEO duality leads to greater agency costs for the firm due to weaker oversight of the CEO (Jensen and Meckling, 1976; Jensen, 1986; Alves, 2021; Canarella & Miller, 2022). On the other hand, stewardship theory suggests that CEO duality allows management to exhibit strong leadership (Donaldson & Davis, 1991; Finkelstein & D’aveni, 1994; Wijethilake & Ekanayake, 2020; Caiffa, Farina, & Fattobene, 2021; Erikson, Coleridge, & Bjornali, 2022).

CEOs who serve as Chairman could have made quicker decisions than other CEOs during the early months of the pandemic, thus giving them a competitive advantage. This would be particularly true if the firm operated in an environment with a large degree of information asymmetry, where the board and the public possess significantly less information than the CEO. According to stewardship theory, firms facing a high degree of information asymmetry would likely benefit from strong leadership during the early Covid-19 period. However, these firms with CEO duality could still suffer a loss of value due to increased agency costs. In this paper, we examine whether firms benefited early in the COVID-19 outbreak from the stronger leadership afforded by CEO duality or whether the increased agency costs led the firm to underperform.

Using data on S&P 1500 firms from the end of 2019, we find firms that maintained CEO duality experienced greater increases in default probability over the first quarter and the entire year of 2020. However, firms with high information costs benefitted from CEO duality through smaller-in-magnitude increases in default probability and volatility in ROA. Following Duchin, Matsusaka, and Ozbas (2010), we measure information costs as the absolute value of scaled expected minus actual earnings. We provide all variable definitions in Appendix A.1.

Firms’ CEO duality and mean information costs saw a 0.003% smaller increase in default probability than firms without CEO duality. Over 2020, firms with CEO duality experienced a 0.011% increase in ROA, while comparable firms experienced a –0.086% decrease in ROA. We find supporting results when performing nearest neighbor matching and a propensity scoring model. For example, firms with CEO duality had smaller increases in bankruptcy probability and earnings volatility while experiencing larger increases in profitability than their direct competitors with non-duality during the first year of the Covid-19 outbreak.

Next, we examine the impact of the pandemic shutdown in February 2020 on firms. We find that while firms with low information costs and CEO duality experienced more negative cumulative abnormal returns (CARs) around the outbreak, firms with CEO duality and high information costs experienced less-negative returns. Firms with CEO duality had more negative CARs around the outbreak, but having mean information costs reduced the negative CARs’ magnitude by 61 basis points. To ensure that our results are not driven by the small sample of firms that moved from separate CEO and chairman roles to CEO duality (or vice versa) immediately prior to the outbreak, we remove these firms. Our results remain consistent and indicate that CEO duality was especially beneficial when firms exhibited high information costs at the start of the pandemic.

Our results suggest that during the beginning of the COVID-19 outbreak, CEOs with greater agency were able to more effectively direct corporate policy than other CEOs when the cost of gathering information was high. This result is consistent with stewardship theory and indicates that firms derive more value from CEO power during crises and when informational asymmetry is high. Given the prior mixed evidence of agency costs to CEO duality (Goyal & Park, 2002; O’Connor, Priem, Coombs, & Gilley, 2006; Tuggle, Sirmon, Reutzel, & Bierman, 2010; Uyar, Kuzey, Kilic, & Karaman, 2021), it appears the net value of CEO duality fluctuates through time.

The remainder of this paper is ordered as follows. In Section 2, we discuss related literature and our hypotheses. Next, we provide our data in methods in Section 3. We detail our results in Section 4. Finally, we offer conclusions in Section 5.

2. Hypothesis development

The outbreak of the Covid-19 pandemic led to significant shifts in firm behavior over an extremely short amount of time. Many researchers have noted the impact Covid-19 had on firm operations (Ding, Levine, Lin, & Xie, 2021; Fahlenbrach, Rageth, & Stulz, 2021; Ramelli & Wagner, 2020). Firms with greater flexibility (Fahlenbrach et al., 2021), higher environmental and social scores (Albuquerque, Koskinen, Yang, & Zhang, 2020), and higher profitability (Ding et al., 2021) were better able to weather the US shutdown and international lockdowns than other firms. Other factors, such as the amount of R&D investment, also preserved firm value during the initial outbreak (Biswas, 2021). Given all of these factors affecting firm performance, examining how strong corporate leadership affected firms during the outbreak seems natural.

2.1. The support for agency theory

The debate over whether firms should separate management and the chairmanship of the board has raged for over thirty years. When Sarbanes-Oxley (2002) was passed, approximately 80% of firms had CEO duality (Krause, Semadeni, & Cannella, 2014). Over time, the perceived costs of CEO duality have led to nearly half of the S&P 1500 firms (48% in our sample) separating their CEO and chairman roles. These costs include increased information asymmetry (He & Wang, 2009; Hsu, Lin, Chen, & Huang, 2021), entrenchment (Dahkli & Mitraoui, 2021; Fama & Jensen, 1983; Mallette and Fowler, 1992; Seifzadeh, Rajaeei, & Allahbakhsh, 2021; Tuggle et al., 2010), and risk avoidance (Castaner & Kavadis, 2013; Mascarenhas, 2018).

When firms exhibit non-duality, the CEO must communicate regularly with the Chairman of the Board. Failure to develop a clear strategy that can be effectively executed can lead to poor firm performance. If there is a disagreement between the CEO and board, firm performance could suffer. If the Chairman and CEO lead the firm based on different goals, firm performance could suffer. He and Wang

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1 We provide all variable definitions in Appendix A.1.
2 We assume mean information costs.
CEO duality increases managerial entrenchment activity, and the possibility of CEO risk avoidance since the decreased probability of removal allows a manager’s actions to deviate from the board’s ideals. Dual-role CEOs can increase their entrenchment by introducing poison pill provisions to the corporate charter (Mallette and Fowler, 1992). Mallette and Hogler (1995) note that firms with CEO duality were more likely to introduce director liability protection prior to Sarbanes-Oxley (2002). Several authors note that firms with CEO duality are less likely to fire CEOs for poor performance (Goyal & Park, 2002; Harrison, Torres, & Kukalis, 1988; Tuggle et al., 2010).

If CEO duality allows a CEO to increase entrenchment, poorly-performing CEOs are more likely to be retained at the start of a crisis. Their ineffectiveness and weaker ability to coordinate corporate strategy with the board could make these firms less effective at guiding their firm through the coronavirus outbreak. If this were the case, we would expect that CEO duality would lead to larger increases in firm risk during the outbreak. At the same time, firms with CEO duality that cannot adapt quickly to changing business conditions would exhibit worse financial performance.

2.2. The support for stewardship theory

Stewardship theory states that firms with CEO duality should allow the CEO to develop a clear, executable strategy (Davis, Schoorman, & Donaldson, 1997; Donaldson & Davis, 1991). Much of the early literature finds no relationship between CEO duality and firm performance (Rechner & Dalton, 1989; Daily & Dalton, 1992; Dalton, Daily, Ellstrand, and Johnson, 1998). Later papers find either a positive or negative effect on firm performance, conditional on some factor (Davidson, Nemec, & Worrell, 2001; Quigley and Hambrick, 2012; Krause and Semadeni, 2013; Hsu et al., 2021). These factors include environmental complexity (Boyd, 1995), whether an heir apparent exists (Davidson et al., 2001), and the presence of innovative intellectual capital (He & Wang, 2009).

The mixed evidence for whether CEO duality is a net benefit or cost leads us to ask whether that benefit is conditional on market fluctuations. In uncertain environments, having a CEO who can respond to conditions quickly should be important. For example, it should be easier for the CEO who also holds the chairman role to coordinate a board meeting and alter the firm’s financial policy and investment policy. In addition, firms with more power in the hands of the CEO could be quicker to cut a dividend, relax the requirements for employees to be physically in the workplace, and negotiate deals with suppliers and potential partners.

The outbreak of COVID-19, which began in early 2020, caught every firm by surprise and forced most of them to react quickly to the crisis. Firms with greater CEO power could more quickly adopt innovative solutions to the work-from-home environment that, in normal times, might have met resistance from the board. For example, the pharmaceutical firm Incyte quickly allocated resources to allow employees to work from home. CEO and Chairman Herve Hoppenot quickly reorganized the firm’s operations so that by March 13th, employees were working remotely.\(^3\) Grocery chain Kroger, which has CEO duality, announced in April 2020 that it would increase Covid-19 testing and provide “hero bonuses” to workers.\(^4\) Target Chairman and CEO announced wage increases and the rapid installation of partitions in checkout lanes and donated to Covid-19 charities.

The exogenous shock of COVID-19 provides a natural experiment to determine if CEO duality allows firms to respond more effectively during crisis periods. Because CEO duality means a CEO can effectively alter a firm’s strategy and corporate practices with less pushback from the board, firms with CEO duality should be able to develop policies that allow them to compete and survive quickly. We, therefore, hypothesize that firms with CEO duality had smaller increases in default risk than their competitors.

Their ability to quickly change firm policy should also allow these firms to be early adopters of work-from-home technology and techniques for monitoring socially distanced employees. Finally, suppose these firms can respond to the COVID-19 outbreak more effectively than their direct competitors. In that case, they could capture market share, improve their industry positioning, and offer financial performance superior to their direct competitors. This finding should be exacerbated in firms that have high information costs.

Firms with higher information costs often exhibit greater economic asymmetry between corporate insiders and outsiders, including analysts. Perhaps the operations of this firm are less clear, or the firm operates across multiple industries or geographic areas. Firms with greater information costs should derive greater value from CEO duality during crisis periods because these CEOs with weaker governance restrictions have greater flexibility to alter operations, adjust capital budgets, borrow funds, and issue new equity to raise capital. During periods such as the US outbreak of the coronavirus in early 2020, this flexibility should allow firms to adjust firm financial and operational policy more appropriately to a work-from-home environment. Therefore, we hypothesize that firms with CEO duality and high information costs exhibited a smaller increase in default risk and financial performance than their competitors with separate CEO and Chairman roles or low informational costs.

H1a. CEO duality is negatively related to the change in default probability in the presence of information costs.

H2a. CEO duality is positively related to the change in financial performance in the presence of information costs.

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\(^3\) [https://investor.incyte.com/press-releases/press-releases/2020/Incyte-Ranked-Second-Among-Science-Magazines-2020-Top-Biopharma-Employers/default.aspx](https://investor.incyte.com/press-releases/press-releases/2020/Incyte-Ranked-Second-Among-Science-Magazines-2020-Top-Biopharma-Employers/default.aspx).

\(^4\) [https://www.forbes.com/sites/ezequielminaya/2020/05/26/the-forbes-corporate-responders-new-ranking-of-nations-top-employers-responses-to-pandemic/?sh=7867e48d4a51](https://www.forbes.com/sites/ezequielminaya/2020/05/26/the-forbes-corporate-responders-new-ranking-of-nations-top-employers-responses-to-pandemic/?sh=7867e48d4a51).
Investors likely recognize the value of CEO duality in the presence of information costs around the initial period of the shutdown. If this is true, these investors should respond more positively when firms with high information costs have CEO duality. We therefore hypothesize:

H3a. CEO duality is positively related to the cumulative abnormal returns around the initial US shutdown in the presence of information costs.

However, it is important to note that duality could lead a CEO to engage in incongruous behavior with most firms’ shareholder value maximization objective. This is the expectation of Agency theory, and it would be especially true in the presence of high information costs. We, therefore, provide alternative hypotheses that are supported by Agency theory:

H1b. CEO duality is positively related to the change in default probability in the presence of information costs.

H2b. CEO duality is negatively related to the change in financial performance in the presence of information costs.

H3c. CEO duality is negatively related to the cumulative abnormal returns around the initial US shutdown in the presence of information costs.

3. Data and methods

Our accounting and corporate governance data come from the Bloomberg terminal and the Compustat database. We collect quarterly data from the third quarter of 2019 to the fourth quarter of 2020 for S&P 1500 firms. We drop observations from utilities (SIC codes 4000–4999) and financial firms (SIC codes 6000–6999). We Winsorize all accounting ratios at the 5% and 95% levels. We match the data from Bloomberg to Compustat and CRSP.

We include several control variables in our models. First, we follow Hsu et al. (2021) and include board size, the percent of firm shares held by the CEO, and the percentage of independent directors. Second, we add to these variables the number of board meetings per year to control the board’s involvement. We also include the percentage of insider shares outstanding. Third, we include the natural log of total assets to control for firm size. Fourth, we include the ROA to control for the firm’s past profitability. Finally, we add debt/total assets, firm market/book, capital expenditure/sales, and cash/total assets to control for firm debt, valuation, investment, and liquidity to account for characteristics previously noted as impacting firm value (Huynh, Wu, & Duong, 2020) and. Lastly, we calculate the coefficient of variation of ROA using the rolling standard deviation of quarterly ROA in the past eight quarters. We provide a more detailed description of our variables in Appendix A.1.

As noted by Syed (2022), the initial investor response to the Covid-19 in the US was sudden and significant. We use daily return data from CRSP to calculate value-weighted cumulative abnormal returns (CARs). We calculate abnormal returns using the Fama and French 3-factor model with momentum (Carhart, 1997; Fama & French, 1993). We calculate CARs as

\[
CAR_d = \sum_{t=1}^{T} AR_d
\]

where abnormal returns are \( AR_d = R_d - E(R_d) \) and \( R_d \) is the return of stock i at time t.

To examine the investor response to expected firm performance changes during the coronavirus outbreak, we examine the cumulative abnormal returns around February 19, 2020. We select this date since it represents the start of the market sell-off associated with Covid-19 lockdowns in the United States. Our ending date (3/20/2020) represents the end of a decline in the value of the S&P 1500 index.6

We follow DaDalt, Gay, and Nam (2002) and Duchin et al. (2010) when constructing our measure of information costs, which we report in Equation (3):

\[
\text{Analyst Accuracy} = \left( \frac{\sum |\text{EPS}_t - \text{EPS}_{\text{act}}|}{\text{Price}} \right) / N
\]

We use analyst accuracy during the quarter as our proxy for information costs.7 We calculate the average absolute value of the deviations between the estimated quarterly earnings per share (EPS) and the actual quarterly EPS in the fourth quarter of 2019. We use the final estimate for each analyst prior to the EPS announcement. We scale this by the average price of the firm’s stock during the quarter. The larger this metric is, the opaquier the firm’s operations are.

We report our sample firms’ risk, volatility, and financial performance in Panel A of Table 1. Each measure represents a dependent or control variable in our later tests. For example, our primary measure of default risk is the Bloomberg 1-year default probability. The Bloomberg 1-year default probability is calculated using a Merton distance-to-default model that incorporates other factors.5

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5 The Diamond Princess docked in the United States on 2/18/2020 with at least 14 passengers who tested positive for coronavirus. Our event date is the first full trading day after this event.

6 The end of the decline in share prices was likely due to the introduction of a $1 trillion stimulus bill by the senate majority leader.

7 There is one observation in our sample in which analysts perfectly predict quarterly earnings per share. For this observation, ACCUR = 0.

8 A description of the model can be found here: https://www.bloomberg.com/professional/blog/alternative-credit-perspectives-for-an-uncertain-world/.
Table 1
Descriptive Statistics

In this table, we provide the summary statistics of our sample. In Panel A, we report the distribution of the dependent variables in our later tables. In Panel B, we report the descriptive statistics of our accounting variables. We report the descriptive statistics of the sample governance variables in Panel C. We Winsorize all accounting variables at the 5% and 95% levels.

### Panel A: Default Risk Statistics

| Variable | Num. of Obs. | Mean | 25th % | Median | 75th % | St. Dev. | Min. | Max. |
|----------|-------------|------|--------|--------|--------|---------|------|------|
| 1 Year Default Probability (12/31/2019) | 652 | 0.187% | 0.000% | 0.004% | 0.055% | 0.680% | 0.000% | 8.667% |
| Change in 1 year default probability (12/31/19 to 3/31/20) | 652 | 0.726% | 0.022% | 0.143% | 0.619% | 1.466% | -2.558% | 10.442% |
| Change in 1 year default probability (12/31/19 to 6/30/20) | 650 | 0.754% | 0.035% | 0.219% | 0.830% | 1.535% | -2.680% | 15.829% |
| Change in 1 year default probability (12/31/19 to 9/30/20) | 648 | 0.674% | 0.027% | 0.184% | 0.625% | 1.697% | -4.784% | 17.339% |
| Change in 1 year default probability (12/31/19 to 12/31/20) | 646 | 0.396% | 0.022% | 0.127% | 0.428% | 1.271% | -6.315% | 18.180% |
| Rolling Std. Dev. Of ROA | 652 | 0.021 | 0.005 | 0.009 | 0.017 | 0.059 | 0.001 | 1.135 |
| Change in Std. Dev. Of ROA (12/31/19 to 3/31/20) | 652 | 0.000 | 0.000 | 0.000 | 0.000 | 0.004 | -0.043 | 0.065 |
| Change in Std. Dev. Of ROA (12/31/19 to 6/30/20) | 650 | 0.000 | -0.001 | 0.000 | 0.000 | 0.018 | -0.079 | 0.402 |
| Change in Std. Dev. Of ROA (12/31/19 to 9/30/20) | 646 | 0.002 | -0.001 | 0.000 | 0.000 | 0.021 | -0.107 | 0.390 |
| Change in Std. Dev. Of ROA (12/31/19 to 12/31/20) | 642 | 0.002 | -0.001 | 0.000 | 0.001 | 0.021 | -0.138 | 0.378 |

### Panel B: Descriptive Statistics of Accounting Statistics

| Stats | Num. of Obs. | Mean | 25th % | Median | 75th % | SD | Min | Max. |
|-------|-------------|------|--------|--------|--------|----|-----|------|
| Information Cost | 652 | 0.005 | 0.001 | 0.001 | 0.004 | 0.017 | 0.000 | 0.300 |
| Total Assets ($ million) | 652 | 25757.8 | 1627.3 | 4162.0 | 13711.3 | 107628.5 | 149.5 | 195158.0 |
| Return on Assets (2019) | 652 | 5.057% | 1.694% | 4.468% | 8.001% | 5.559% | 5.826% | 17.214% |
| Debt/Total Assets | 652 | 0.366 | 0.225 | 0.365 | 0.496 | 0.197 | 0.027 | 0.761 |
| Market/Book | 652 | 3.403 | 1.407 | 2.341 | 4.298 | 3.096 | 0.000 | 12.481 |
| Capital expenditure/sales | 652 | 0.166 | 0.036 | 0.094 | 0.193 | 0.223 | 0.000 | 0.922 |
| Cash/Total Assets | 652 | 0.066 | 0.015 | 0.040 | 0.096 | 0.067 | 0.003 | 0.238 |
| Number of Employees | 649 | -0.310 | -0.271 | 0.550 | 1.159 | 23.245 | 0.000 | 1220000.0 |

### Panel C: Descriptive Statistics of Governance Variables

| Variable | N | Mean | 25th % | Median | 75th % | SD | Min | Max. |
|----------|---|------|--------|--------|--------|----|-----|------|
| CEO Duality | 652 | 0.379 | 0.000 | 0.000 | 1.000 | 0.485 | 0.000 | 1.000 |
| Information Cost | 652 | 0.005 | 0.001 | 0.001 | 0.004 | 0.017 | 0.000 | 0.300 |
| % Insider Shares Outstanding | 652 | 0.005 | 0.001 | 0.001 | 0.004 | 0.017 | 0.000 | 0.300 |
| Inst. Own. % Shares Outstanding | 652 | 98.275 | 88.047 | 98.977 | 107.004 | 17.583 | 26.984 | 164.492 |
| Shares held by CEO as % of Total Equity | 652 | 1.212 | 0.086 | 0.247 | 0.695 | 4.046 | 0.000 | 73.419 |
| % Independent | 652 | 0.782 | 0.714 | 0.800 | 0.857 | 0.117 | 0.000 | 1.000 |
| Board Size | 652 | 9.808 | 8.000 | 10.000 | 11.000 | 2.077 | 4.000 | 17.000 |
| Board Duration | 644 | 1.601 | 1.000 | 1.000 | 3.000 | 0.927 | 1.000 | 5.000 |
| Board Average Age | 651 | 63.065 | 60.917 | 63.167 | 65.091 | 3.477 | 51.700 | 75.400 |
| Board Meeting Attendance % | 644 | 80.096 | 75.000 | 75.000 | 75.000 | 9.355 | 69.790 | 100.000 |
| Board Meetings per Year | 652 | 7.939 | 5.000 | 7.000 | 9.000 | 3.808 | 4.000 | 37.000 |
| % Employees Unionized | 399 | 12.970 | 0.000 | 0.000 | 22.000 | 22.000 | 19.455 | 84.000 |
| Independent Directors | 652 | 8.224 | 7.000 | 8.000 | 10.000 | 2.081 | 3.000 | 15.000 |
| % Women Employees | 215 | 40.325 | 24.600 | 39.000 | 52.500 | 17.328 | 0.545 | 91.900 |
| % Independent | 652 | 0.782 | 0.714 | 0.800 | 0.857 | 0.117 | 0.000 | 1.000 |
average 1-year default probability is 0.00187. We multiply this value by 100 in our regressions to avoid scaling issues.

The average firm in our sample experienced an increased default probability from the fourth quarter of 2019. The average and median changes in the default probability within one year reflect this. We measure the change in default probability as the difference between the default probability at the end of the more recent quarter and the default probability at the end of 2019. The average S&P 1500 firm in our sample experiences a 70 basis point increase in default probability in the first quarter of 2020. The average increase in default probability throughout 2020 is 40 basis points.

We also calculate the rolling standard deviation of quarterly profitability using the return on assets (ROA). First, we calculate the firm’s ROA over the past eight quarters, including the current quarter (t-7 to t). If we cannot obtain at least five quarters of data, we drop the observation. Next, we estimate the change in the rolling standard deviation as the absolute change. We find that the average firm has a rolling standard deviation of ROA of 0.021 as of the fourth quarter of 2019. In the first quarter of the pandemic, average volatility does not increase in our sample. However, the rolling standard deviation does noticeably increase throughout 2020 by 0.002.

We also estimate the quarterly return on assets and the change in return on assets for sample firms. We measure the change in ROA as the difference in ROA from the later period to the earlier period. We find that the average firm experiences a relatively large 3.98% decline in return on assets. However, it is notable that a large segment of firms experienced a slight increase in ROA during the period.

For example, the 75th percentile of the change from the fourth quarter of 2019 to the fourth quarter of 2020 is 84 basis points. Performing subsample analysis, we find that many of these firms are tech firms that were able to capture market share during lockdowns.

Finally, we measure and report the cumulative abnormal returns around the initial investor response to US lockdowns and the Diamond Princess docking in the US. Unsurprisingly, the median firm experiences a −0.11% CAR in the three days around the start of lockdowns. The average S&P 1500 firm experienced a −0.91% CAR in the fifteen days (−7, 7) around the announcement.

In Panel B of Table 1, we report the accounting characteristics of our sample firms as of the fourth quarter of 2019. The median firm in our sample has total assets of approximately $4.16 billion and a 2019 ROA of 4.47%. Firms in our sample have a total debt/total assets of 36.6% and a market/book ratio of 3.4. Our firms are relatively liquid, with a cash ratio of 6.6%. The median firm employs 7000 workers, while the largest employer (Walmart) employs 2,200,000.

We report the corporate governance characteristics of our sample in Panel C of Table 1. Approximately 37.9% of our sample firms exhibit CEO duality, while 78.2% of directors are independent at the average firm. Sample firms have an average board size of 10 members, with an average of 7.94 board meetings per year. On average, corporate insiders own approximately 3.22% of the shares outstanding. Institutional investors own 96.79% of shares (including short positions). CEOs in our sample own approximately 1.2% of shares outstanding.

In Table 2, we report the industry breakdown of our sample. Of the 652 observations with necessary data, 18.25% of firms are in the manufacturing sector. Approximately 14.88% of our sample are healthcare, medical equipment, or pharmaceutical firms. The industry with the highest percentage of CEO duality is the chemicals and allied products sector (20.71%), while the sector with the lowest percentage is the telephone and television transmission sector (2.45%). CEO-chairman duality is highest in the chemicals and allied products sector (52.63%) and lowest in the wholesale, retail, and services sector (38.24%). The wholesale, retail, and services sector experienced the largest increase in default probability (0.97%), while firms in the healthcare sector experienced the lowest increase in default probability. The largest increase in volatility occurs in the consumer durables sector.

We report the Pearson correlation coefficients between relevant variables in Panel B of Table 2. We find a negative relationship between CEO duality and information cost, indicating that firms more likely to exhibit CEO-chairman duality are likely to have greater transparency in earnings. Firms with CEO-chairman duality are likely to have fewer board meetings per year, a smaller default probability, a larger percentage of independent board members, higher ROA, and greater valuations based on M/B. The default probability is positively related to the number of board meetings per year, the percentage of shares held by insiders, and the debt ratio. Information cost is positively associated with institutional ownership and negatively related to the natural log of total assets.

4. Results

4.1. Comparative statistics

We begin our analysis of the difference between firms with CEO duality and firms with separate roles for the CEO and Chairman in Table 3. In Panel A, we separate our sample based on CEO-chairman duality and compare the subsamples. Firms with separate CEO and chairman roles have an average one-year default probability of 0.97% at the end of 2019, while firms with CEO duality have a default probability of 0.82%. Notably, this difference is not statistically significant. The change in the one-year default probability is notably larger for firms with separate roles than forms with CEO duality across each period. However, this difference is again statistically insignificant. Firms with CEO duality experience a smaller volatility increase during the Covid pandemic outbreak than firms whose CEO and Chairman are different individuals. This result is (marginally) statistically significant over the pandemic’s first two months, three months, and full year. Firms with CEO duality experience only a −0.12% change in ROA in absolute terms, while other sample firms experience a −1.74% change in quarterly ROA from the fourth quarter of 2019 to the fourth quarter of 2020.

In Panel B, we report the differences in accounting and governance variables across firms with and without CEO-chairman duality. We find no difference in information cost across subsamples. However, firms with CEO-chairman duality have fewer board meetings per year than other firms (7.5 vs. 8.2), greater CEO equity holdings (2.3% vs. 0.6%), a larger percentage of independent board members (83.0% vs. 75.3%), and greater profitability (5.6% vs. 4.7%).
In this table, we report the number of descriptive statistics and correlation coefficients of firm observations. In Panel A, we report the number of observations by industry. We report the percentage of observations with CEO-chairman duality, change in 1-year default probability, and the change in rolling standard deviation in ROA from Q4 of 2019 to Q1 of 2020. We use the Fama and French 12-industry classification. In Panel B, we report the Pearson correlation coefficients and statistical significance. We Winsorize all accounting variables at the 5% and 95% levels. We report p-values below each correlation coefficient. *, **, and *** indicate significance at the 10%, 5%, and 1% levels.

### Table 2: Sample by Industry

| Fama-French Industry Groupings | Num. of Obs. | Percent of Obs. | CEO/Chairman Duality | Change in 1-year default probability (12/31/19 to 3/31/20) | Change in Rolling Std. Dev. in ROA (12/31/19 to 3/31/20) |
|------------------------------|-------------|-----------------|----------------------|----------------------------------------------------------|----------------------------------------------------------|
| 1: Consumer Non-Durables      | 57          | 8.74%           | 45.61%               | 0.004                                                   | 0.000                                                   |
| 2: Consumer Durables          | 29          | 4.45%           | 48.28%               | 0.008                                                   | 0.001                                                   |
| 3: Manufacturing              | 119         | 18.25%          | 33.61%               | 0.008                                                   | 0.000                                                   |
| 5: Chemicals and Allied Products | 38          | 5.83%           | 52.63%               | 0.009                                                   | -0.001                                                  |
| 7: Telephone and Television Transmission | 16          | 2.45%           | 43.75%               | 0.004                                                   | -0.001                                                  |
| 8: Utilities                  | 34          | 5.21%           | 38.24%               | 0.005                                                   | -0.001                                                  |
| 9: Wholesale, Retail, and Some Services | 127         | 19.48%          | 31.50%               | 0.010                                                   | 0.000                                                   |
| 10: Healthcare, Medical Equipment, and Drugs | 97          | 14.88%          | 34.02%               | 0.002                                                   | -0.001                                                  |
| 11: Finance                   | 135         | 20.71%          | 40.00%               | 0.010                                                   | 0.000                                                   |
| Total                        | 652         | 1.000           |                      |                                                         |                                                         |

### Panel B: Pearson Correlation Coefficients

|                          | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) | (15) | (16) |
|--------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|------|
| CEO Duality              | 1.00|     |     |     |     |     |     |     |     |      |      |      |      |      |      |      |
| Information Cost         | -0.13|1.00|     |     |     |     |     |     |     |      |      |      |      |      |      |      |
| 1 Year Default Probability | -0.14|0.47|1.00|     |     |     |     |     |     |      |      |      |      |      |      |      |
| Natural log of Board Size | 0.06|-0.21|-0.10|1.00|     |     |     |     |     |      |      |      |      |      |      |      |      |
| Board Meetings per Year  | 0.15|     |     |     |     |     |     |     |     |      |      |      |      |      |      |      |
| % Insider Shares Outstanding | -0.05|0.28|-0.26|-0.34|-0.08|1.00|     |     |     |      |      |      |      |      |      |      |      |
| Inst. Own. % Shares Outstanding | 0.18|     |     |     |     |     |     |     |     |      |      |      |      |      |      |      |
| Sh. held by CEO as % of Equit | 0.16|0.24|0.27|-0.39|-0.12|0.69|0.21|1.00|     |      |      |      |      |      |      |      |      |
| % Independent            | 0.45|-0.13|-0.09|0.35|0.05|-0.33|-0.11|-0.19|1.00|      |      |      |      |      |      |      |      |
| Natural log of Total Assets | 0.15|-0.21|-0.15|0.58|0.12|-0.60|-0.28|-0.51|0.37|1.00|      |      |      |      |      |      |      |
| Return on Assets (2019)  | 0.02|0.00|0.02|0.00|0.21|0.00|0.01|0.00|     |      |      |      |      |      |      |      |      |
| Debt/Total Assets        | -0.04|0.09|0.32|0.06|0.08|-0.06|-0.01|-0.06|0.06|0.18|-0.09|1.00|      |      |      |      |      |
| Market/Book              | 0.28|0.02|0.00|0.14|0.06|0.14|0.07|0.12|0.14|0.00|0.02|      |      |      |      |      |      |
| Capital expenditure/sales | 0.08|-0.45|-0.51|0.07|-0.17|-0.15|-0.06|-0.17|0.05|0.00|0.49|-0.14|1.00|      |      |      |      |
| Cash/Total Assets        | 0.44|0.00|0.04|0.18|0.00|-0.13|-0.08|-0.14|0.09|0.05|0.04|0.04|0.15|1.00|      |      |      |
| Coefficient of Variation of ROA | 0.67|0.23|0.28|0.61|0.64|0.45|0.86|0.85|0.58|0.76|0.20|0.12|0.47|0.91|0.96|      |
4.2. The relationship between duality, information cost, and changes in firm characteristics

We focus on the hypothesized relationship between CEO duality, information costs, and firm risk and profitability during the pandemic. In our primary regression models, we regress firm default probability, risk, or profitability measures on CEO duality, information costs, the interaction between CEO duality and information costs, controls, and industry fixed effects. We demonstrate our primary regression model in Equation (3). We denote control variables using $\gamma_i$ while $\delta_i$ indicates industry fixed effects. Our primary industry fixed effects are the Fama and French twelve industries.\footnote{We cannot use time fixed effects or firm fixed effects since our sample is a cross-section of the S&P 1500 as of the end of 2019. Since we cannot fully control for endogeneity, our results should be treated with care.} We define all our control variables in Appendix A.1.

$$\Delta \text{Def. prob.} = CEO \text{ dual.} + \beta_1 \text{Inf. Cost} + \beta_2 CEO \text{ dual.} \times \text{Inf. cost} + \gamma_i + \delta_i + \epsilon_i$$  \hspace{1cm} (3)

A linear regression of the change on various firm-level characteristics should be appropriate since the beginning of the Covid outbreak represents a true exogenous shock. We control for the firm’s default probability at the end of 2019. Each firm appears in our sample once since we focus on the exogenous shock of the pandemic. We cluster observations at the firm level.

In Model (1) of Table 4, our dependent variable is the change in default probability from the end of 2019 to the end of the first quarter of 2020. The main effects indicate that firms with CEO duality and high information costs experience larger increases in default

| Variable | Separate roles | Dual roles | t-stat | p-value |
|----------|----------------|------------|--------|---------|
| CEO/Chairman Duality | | | | |
| Num. of Obs. | Mean | Num. of Obs. | Mean | t-stat | p-value |
| 1 year default probability (12/31/19) | 405 | 0.967% | 247 | 0.822% | 0.957 | 0.339 |
| 1 year default probability (3/31/20) | 403 | 0.994% | 247 | 0.855% | 0.910 | 0.363 |
| 1 year default probability (6/30/20) | 402 | 0.908% | 246 | 0.768% | 0.917 | 0.359 |
| 1 year default probability (12/31/20) | 401 | 0.620% | 245 | 0.491% | 1.161 | 0.246 |
| Change in 1 year default probability (12/31/19 to 3/31/20) | 405 | 0.772% | 247 | 0.650% | 1.028 | 0.304 |
| Change in 1 year default probability (12/31/19 to 6/30/20) | 403 | 0.797% | 247 | 0.683% | 0.917 | 0.359 |
| Change in 1 year default probability (12/31/19 to 9/30/20) | 402 | 0.711% | 246 | 0.615% | 0.701 | 0.483 |
| Change in 1 year default probability (12/31/19 to 12/31/20) | 401 | 0.431% | 245 | 0.339% | 0.897 | 0.370 |
| Change in Std. Dev. Of ROA (12/31/19 to 3/31/20) | 405 | 0.000% | 247 | 0.000% | 0.721 | 0.471 |
| Change in Std. Dev. Of ROA (12/31/19 to 6/30/20) | 399 | 0.003% | 243 | 0.000% | 1.945 | 0.052 |
| Change in Std. Dev. Of ROA (12/31/19 to 9/30/20) | 402 | 0.003% | 244 | 0.000% | 1.864 | 0.063 |
| Change in Quarterly ROA (12/31/19 to 3/31/20) | 399 | 0.000% | 243 | 0.000% | 1.945 | 0.052 |
| Change in Quarterly ROA (12/31/19 to 6/30/20) | 405 | 0.000% | 247 | 0.000% | 0.721 | 0.471 |
| Change in Quarterly ROA (12/31/19 to 9/30/20) | 402 | 0.000% | 244 | 0.000% | 0.721 | 0.471 |
| Change in Quarterly ROA (12/31/19 to 12/31/20) | 399 | 0.003% | 243 | 0.000% | 1.945 | 0.052 |

Panel B: Firm Characteristics by CEO-Chairman Duality

| Variable | Separate roles | Dual roles | t-stat | p-value |
|----------|----------------|------------|--------|---------|
| | Num. of Obs. | Mean | Num. of Obs. | Mean | | |
| Information Cost | 405 | 0.005 | 247 | 0.005 | 0.095 | 0.925 |
| ln(board size) | 405 | 2.256 | 247 | 2.265 | –0.514 | 0.608 |
| Board Meetings per Year | 405 | 8.232 | 247 | 7.457 | 2.530 | 0.012 |
| % Insider Shares Outstanding | 405 | 2.946 | 247 | 3.675 | –1.560 | 0.119 |
| Inst. Own. % Shares Outstanding | 405 | 100.587 | 247 | 94.484 | 4.358 | 0.000 |
| Shares held by CEO as % of Total Equity | 405 | 0.550 | 247 | 2.297 | –5.465 | 0.000 |
| % Independent | 405 | 0.753 | 247 | 0.830 | –8.532 | 0.000 |
| ln(Total Assets in $ millions) | 405 | 22.133 | 247 | 22.638 | –4.317 | 0.000 |
| Return on Assets (2019) | 405 | 4.698% | 247 | 0.956 | –2.121 | 0.034 |
| Debt/Total Assets | 405 | 0.371 | 247 | 0.356 | 0.962 | 0.337 |
| Market/Book | 405 | 3.185 | 247 | 3.760 | –2.307 | 0.021 |
| Capital expenditure/sales | 405 | 0.171 | 247 | 0.158 | 0.727 | 0.468 |
| Cash/Total Assets | 405 | 0.066 | 247 | 0.067 | –0.129 | 0.898 |
| Coefficient of Variation of ROA | 405 | 1.024 | 247 | 0.861 | –1.004 | 0.316 |

\footnote{We cannot use time fixed effects or firm fixed effects since our sample is a cross-section of the S&P 1500 as of the end of 2019. Since we cannot fully control for endogeneity, our results should be treated with care.}
Table 4
Multivariate Analysis of the Relationship between CEO-Chairman Duality and the Change in Default Probability

In this table, we examine the impact of CEO duality and information cost on firm risk. We regress our measures of default risk, volatility, and profitability on CEO duality, information cost, the interaction term, control variables, and industry fixed effects (Fama and French 12 industries). In Models (1) and (4), our dependent variables are the change in Bloomberg 1-year default probability in the first quarter and full year of 2020. In Models (3) and (4), our dependent variables are the Bloomberg default probability at the end of the first and fourth quarter of 2020. In Models (5) and (6), our dependent variables are the change in rolling standard deviation of quarterly return on assets from the end of 2019 to the end of the first quarter (Model (5)) and fourth quarter (Model (6)) of 2020. In Models (7) and (8), our dependent variables are the change in return on assets from the fourth quarter of 2019 to the first quarter of 2020 (Model (7)) and from the fourth quarter of 2019 to the fourth quarter of 2020. We winsorize all accounting variables at the 5% and 95% levels. We cluster observations at the firm level. We report p-values in parentheses below the coefficients. *, **, and *** indicate significance at the 10%, 5%, and 1% levels.

|                         | (1)                        | (2)                        | (3)                         | (4)                         | (5)                         | (6)                         | (7)                         | (8)                         |
|-------------------------|----------------------------|----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|
| Δ 1 yr default          | 0.270**                    | 0.094                      | 0.003**                     | 0.001                       | 0.000                       | 0.000                       | −0.029                      | −0.090**                    |
| probability (Q4 19 to   | (0.015)                    | (0.446)                    | (0.015)                     | (0.446)                     | (0.383)                     | (0.799)                     | (0.341)                     | (0.038)                     |
| Q1 20)                  |                            |                            |                             |                             |                             |                             |                             |                             |
| Δ 1 yr default          | 14.070**                   | −1.035                     | 0.141**                     | −0.010                      | −0.029                      | −0.126                      | −6.079                      | −17.121                     |
| probability (Q4 19 to   | (0.036)                    | (0.900)                    | (0.036)                     | (0.900)                     | (0.294)                     | (0.416)                     | (0.197)                     | (0.111)                     |
| Q4 20)                  |                            |                            |                             |                             |                             |                             |                             |                             |
| 1 yr. Default Probability (3/31/2020) | −40.509***                | −18.418*                   | −0.405***                   | −0.184*                     | −0.098***                   | −0.579***                   | 10.568***                   | 20.120*                     |
| 1 yr. Default Probability (12/31/2020) | (0.003)                    | (0.057)                    | (0.003)                     | (0.057)                     | (0.000)                     | (0.000)                     | (0.036)                     | (0.073)                     |
| Δ Std. Dev. Of ROA     | 91.410***                  | −11.752                    | 1.914***                    | 0.882***                    | −0.004                      | 0.968                       | −7.241                      | −6.608                      |
| (12/31/19 to 3/31/20)   | (0.691)                    | (0.000)                    | (0.000)                     | (0.003)                     | (0.953)                     | (0.156)                     | (0.164)                     | (0.902)                     |
| Δ Std. Dev. Of ROA     | −0.394                     | −0.453                     | −0.004                      | −0.005                      | −0.000                      | −0.007*                     | 0.070                       | 0.024                       |
| (12/31/19 to 12/31/20)  | (0.191)                    | (0.149)                    | (0.149)                     | (0.101)                     | (0.800)                     | (0.085)                     | (0.334)                     | (0.684)                     |
| Δ Quarterly ROA        | 0.013                      | −0.005                     | 0.000                       | −0.000                      | 0.000                       | −0.000                      | 0.000                       | 0.001                       |
| (12/31/19 to 3/31/20)   | (0.466)                    | (0.466)                    | (0.763)                     | (0.763)                     | (0.420)                     | (0.818)                     | (0.923)                     | (0.673)                     |
| Δ Quarterly ROA        | 0.024**                    | 0.018*                     | 0.000*                      | 0.000*                      | 0.000                       | 0.000                       | 0.001                       | −0.001                      |
| (12/31/19 to 3/31/20)   | (0.029)                    | (0.051)                    | (0.029)                     | (0.051)                     | (0.530)                     | (0.293)                     | (0.478)                     | (0.495)                     |
| % Insider Shares       | 0.005                      | 0.006                      | 0.000                       | −0.000*                     | 0.000                       | 0.000                       | 0.000                       | 0.000                       |
| Outstanding           | (0.051)                    | (0.029)                    | (0.051)                     | (0.051)                     | (0.530)                     | (0.293)                     | (0.478)                     | (0.495)                     |
| Inst. Own. % Shares    | 0.207                      | 0.187                      | 0.207                       | 0.187                       | 0.094                       | 0.505                       | 0.456                       | 0.802                       |
| Outstanding           | (0.213)                    | (0.150)                    | (0.213)                     | (0.213)                     | (0.618)                     | (0.297)                     | (0.557)                     | (0.089)                     |
| Shares held by CEO as  | −0.017                     | −0.012                     | −0.000                      | −0.000                      | −0.000                      | −0.000                      | −0.001                      | 0.003*                      |
| % of Tot. Eq. Equity   | (0.150)                    | (0.213)                    | (0.150)                     | (0.213)                     | (0.618)                     | (0.297)                     | (0.557)                     | (0.089)                     |
| % Independent         | 0.022                      | 0.172                      | 0.000                       | 0.002                       | 0.004                       | −0.090                      | −0.031                      | (0.652)                     |
| (0.938)                | (0.587)                    | (0.938)                    | (0.587)                     | (0.938)                     | (0.587)                     | (0.120)                     | (0.460)                     | (0.204)                     |

(continued on next page)
### Table 4 (continued)

|                | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
|----------------|-----|-----|-----|-----|-----|-----|-----|-----|
| Δ 1 yr default |  Δ 1 yr default | 1 yr. Default | Δ Std. Dev. Of ROA | Δ Std. Dev. Of ROA | ΔQuarterly ROA | ΔQuarterly ROA |
| probability (Q4 19 to Q1 20) | probability (Q4 19 to Q4 20) | Probability (3/31/2020) | (12/31/19 to 3/31/20) | (12/31/19 to 12/31/20) | (12/31/19 to 3/31/20) | (12/31/19 to 3/31/20) |
| Natural log of Total Assets (in $ million) | –0.025 | 0.014 | –0.000 | 0.000 | –0.000 | 0.001 | 0.009 | 0.003 |
| Return on Assets (2019) | –4.687*** | –3.455*** | –0.947*** | –0.035*** | –0.006 | –0.050* | 0.182 | –0.470* |
| Debt/Total Assets | 1.947*** | 0.897*** | 0.019*** | 0.009*** | 0.000 | 0.004 | –0.148* | –0.058 |
| Market/Book | –0.038*** | –0.025*** | –0.000*** | –0.000*** | 0.000 | –0.000 | 0.001 | –0.001 |
| Capital expenditure/ sales | –0.524*** | –0.564*** | –0.005*** | –0.006*** | 0.001 | –0.005 | 0.043 | 0.044 |
| Cash/Total Assets | –0.604 | –0.678 | –0.006 | –0.007 | 0.002 | 0.006 | 0.154 | 0.035 |
| Coefficient of Variation of ROA | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000** | –0.000 | –0.000 |
| Constant | 0.935 | 0.434 | 0.009 | 0.004 | 0.005 | –0.001 | –0.354 | –0.018 |
| R² | 0.441 | 0.126 | 0.661 | 0.248 | 0.178 | 0.151 | 0.150 | 0.327 |
| Num. of Obs. | 652 | 646 | 652 | 646 | 652 | 642 | 652 | 642 |
| Industry F.E. (FF12) | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Firm Clustering | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| F-stat | 10.06 | 5.97 | 19.05 | 6.19 | 3.93 | 2.33 | 1.57 | 0.64 |
| Average VIF | 1.96 | 2.04 | 1.96 | 2.04 | 1.96 | 1.97 | 1.96 | 1.97 |
| Max VIF | 3.05 | 3.98 | 3.05 | 3.98 | 3.05 | 3.03 | 3.05 | 3.03 |
| Adjusted R² | 0.418 | 0.089 | 0.647 | 0.216 | 0.144 | 0.115 | 0.115 | 0.299 |
In this table, we examine the impact of firms adding CEO duality during the year. We match observations in which the firm gained CEO-chairman duality in the quarter of 2020. In Models (4)–(6), our dependent variable is the change in Bloomberg default probability of 1-year default from the end of 2019 to the end of the fourth quarter of 2020. We Winsorize all accounting variables at the 5% and 95% levels. We cluster observations at the firm level. We report p-values in parentheses below the coefficients. *, **, and *** indicate significance at the 10%, 5%, and 1% levels.

| Variable | Num. of Obs. | Coef. | Std. Err. | z-stat | p-value |
|----------|--------------|-------|-----------|--------|---------|
| Change in 1 year default probability (12/31/19 to 3/31/20) | 392 | -0.490% | 0.112 | -4.380 | 0.000*** |
| Change in 1 year default probability (12/31/19 to 12/31/20) | 388 | -0.169% | 0.096 | -1.760 | 0.078* |
| 1 Year Default Probability (3/31/20) | 392 | -0.006% | 0.001 | -4.810 | 0.000*** |
| 1 Year Default Probability (12/31/20) | 388 | -0.0003% | 0.001 | -3.020 | 0.003*** |
| Change in Std. Dev. Of ROA (12/31/19 to 3/31/20) | 392 | 0.000 | 0.000 | 0.800 | 0.422 |
| Change in Std. Dev. Of ROA (12/31/19 to 12/31/20) | 387 | 5.551% | 0.000 | 2.220 | 0.026*** |
| Change in Quarterly ROA (12/31/19 to 3/31/20) | 387 | 1.985% | 0.021 | 0.950 | 0.344 |

Table 6
Nearest Neighbor Matching of Firms Gaining CEO-Chairman Duality
In this table, we examine the impact of firms adding CEO duality during the year. We match observations in which the firm gained CEO-chairman duality during the year to observations where the firm has separate CEO and chairman roles. We use nearest neighbor matching to match observations in the same industry using Equation (3). We Winsorize accounting variables in the propensity scoring model at the 1% and 99% levels.
effects. The default probability is a strong predictor of future default probability. We also find a negative coefficient on the interaction economic conditions.

In Models (2) and (6), our dependent variable is the change in default probability throughout 2020. We again find a negative relationship between the interaction term (CEO duality * information cost) and the change in default probability.

Table 7
Cumulative Abnormal Returns of Firms Around the Outbreak of Covid-19

In this table, we examine the relationship between CEO duality, information cost, and the abnormal return around the outbreak of Covid-19 in the US. We regress the cumulative abnormal return around the US shutdown due to Covid-19 on CEO duality, information cost, the interaction term, control variables, and industry fixed effects. We cluster observations at the firm level. We calculate value-weighted CARs using the Fama and French 3-factor model with momentum. In Models (1) and (5), our dependent variable is the (−1, 1) CAR. In Models (2) and (6), our dependent variable is the (−3, 3) CAR. In Models (3) and (6), our dependent variable is the (−5, 5) CAR. In Models (4) and (8) our dependent variable is the (−7, 7) CAR. We Winsorize all accounting variables at the 5% and 95% levels. We cluster observations at the firm level. We report p-values in parentheses below the coefficients.

* *, **, and *** indicate significance at the 10%, 5%, and 1% levels.

| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
|-----|-----|-----|-----|-----|-----|-----|-----|
| (−1, 1) | (−3, 3) | (−5, 5) | (−7, 7) | (−1, 1) | (−3, 3) | (−5, 5) | (−7, 7) |
| CEO Duality | −1.514*** | −0.672 | −1.277* | −1.114 | −1.187*** | −0.541 | −0.716 | −0.959 |
| Information Cost | (0.000) | (0.200) | (0.057) | (0.165) | (0.001) | (0.280) | (0.246) | (0.186) |
| CEO Duality * Information Cost | 122.181** | 128.115** | 114.560* | 97.427 | 138.245*** | 137.921*** | 132.537** | 112.619** |
| 1 Year Default Probability (12/31/2019) | 98.440 | 62.602 | 102.583 | 136.477 | 98.440 | 62.602 | 102.583 | 136.477 |
| Natural log of Board Size | −0.103 | −2.507* | −3.957** | −0.379 | −0.103 | −2.507* | −3.957** | −0.379 |
| Board Meetings per Year | −0.094 | −0.054 | −0.101 | 1.03 | −0.094 | −0.054 | −0.101 | 1.03 |
| % Insider Shares Outstanding | −0.035 | −0.021 | −0.027 | 0.021 | −0.035 | −0.021 | −0.027 | 0.021 |
| Inst. Own. % Shares Outstanding | 0.002 | −0.019 | −0.027 | 0.025 | 0.002 | −0.019 | −0.027 | 0.025 |
| Shares held by CEO as % of Total Equity | 0.079** | −0.003 | 0.028 | 0.040 | 0.079** | −0.003 | 0.028 | 0.040 |
| % Independent | 4.298*** | 1.381 | 3.803 | 6.023* | 4.298*** | 1.381 | 3.803 | 6.023* |
| Natural log of Total Assets (in $ million) | −0.016 | −0.013 | 0.180 | 0.135 | −0.016 | −0.013 | 0.180 | 0.135 |
| Return on Assets (2019) | 7.112 | 2.947 | 19.733*** | 15.061* | 7.112 | 2.947 | 19.733*** | 15.061* |
| Debt/Total Assets | −0.076 | 0.697 | −3.022 | −0.766 | −0.076 | 0.697 | −3.022 | −0.766 |
| Market/Book | −0.124* | −0.031 | −0.029 | −0.214* | −0.124* | −0.031 | −0.029 | −0.214* |
| Capital expenditure/sales | 2.974*** | 3.640** | 6.829*** | 7.060*** | 2.974*** | 3.640** | 6.829*** | 7.060*** |
| Cash/Total Assets | 1.918 | −3.774 | 1.974 | 13.265*** | 1.918 | −3.774 | 1.974 | 13.265*** |
| Coefficient of Variation of ROA | −0.011*** | −0.015*** | −0.037*** | −0.037*** | −0.011*** | −0.015*** | −0.037*** | −0.037*** |
| Constant | −2.864 | 5.276 | 2.372 | −14.236* | −2.864 | 5.276 | 2.372 | −14.236* |
| R² | 0.196 | 0.113 | 0.119 | 0.119 | 0.196 | 0.113 | 0.119 | 0.119 |
| Num. of Obs. | 652 | 652 | 652 | 652 | 652 | 652 | 652 | 652 |
| Industry F.E. (FF 12) | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Firm Clustering | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| F-stat | 4.27 | 3.79 | 3.79 | 5.03 | 4.27 | 3.79 | 3.79 | 5.03 |

probability. However, the negative coefficient on the interaction term indicates that firms with CEO-chairman duality and high informational opacity experience smaller default probability increases than other firms over the first quarter of 2020. For example, the coefficient on CEO duality in Model (1) indicates that firms with CEO duality experience a 0.27% larger increase in default probability over the first quarter of 2020. However, CEO duality reduces the probability of default by 0.003% for a firm with the average information cost. In Model (2), our dependent variable is the change in default probability throughout 2020. We again find a negative relationship between the interaction term (CEO duality * information cost) and the change in default probability.

In Models (3) and (4) of Table 4, our dependent variables are the lagged firm default probability. In Model (3), we use the default probability at the end of Q1, while in Model (4), our dependent variable is the default probability at the end of Q4 of 2020. In each case, we regress the dependent variable on CEO duality, information cost, the interaction between the two, controls, and industry fixed effects. The default probability is a strong predictor of future default probability. We also find a negative coefficient on the interaction term, indicating that when information costs are high, firms benefit from having a powerful CEO who can rapidly respond to changing economic conditions.

In Models (5) and (6), our dependent variables are the change in the volatility of ROA from the end of 2019 to the end of the first and fourth quarters of 2020. We find a negative and significant relationship between the interaction coefficient of CEO duality and
information costs, indicating that firms with CEO duality and high information costs experienced smaller increases in volatility at the start of the pandemic. Our results are robust to different calculations of rolling standard deviation and various measures of the coefficient of variation based on quarterly ROA.

Finally, we regress the change in quarterly ROA on our variables of interest. The positive coefficient on the interaction term indicates that during the pandemic, informationally opaque firms with powerful CEOs were more effective than competitor firms at generating or maintaining profitability. Our findings in Models (7) and (8) are robust to using return on equity instead of quarterly return on assets.

We examine the robustness of our findings in Table 5. We focus on the change in default probability over the first quarter of 2020 in Models (1) through (3) and the change in default probability over the entirety of 2020 in Models (4) through (6). In Model (1), we use 2-digit SIC codes as industry fixed effects instead of the Fama and French twelve industries. We find a positive relationship between CEO duality and the change in default probability, a positive relationship between information cost and the change in default probability, and a negative coefficient on the interaction between the two. This finding suggests that while firms with CEO power and high opacity moved closer to default than other firms, firms with both CEO duality and high informational opacity likely benefitted from the ability of high-powered CEOs to respond to the new environment. In Model (2), we find results quantitatively similar to those in Table 8.

Table 8
CARs for Firms that Maintain CEO-Chairman Duality Throughout the Start of the US Covid Shutdown

In this table, we examine the investor response of firms with CEO duality around the initial US Covid-19 shutdown. We regress the cumulative abnormal return (CAR) on our CEO-chairman duality variable, information cost, the interaction term, control variables, and industry fixed effects. Our primary independent variable is an indicator for whether the firm had CEO-chairman duality in both 2019 and 2020. We use Fama and French 12 industries as our industry fixed effects. In Model (1), our dependent variable is the (1, 1) CAR. In Model (2), our dependent variable is the (3, 3) CAR. In Model (3), our dependent variable is the (5, 5) CAR. In Model (4) our dependent variable is the (7, 7) CAR. We Winsorize all accounting variables at the 5% and 95% levels. We cluster observations at the firm level. We report p-values in parentheses below the coefficients. *, **, and *** indicate significance at the 10%, 5%, and 1% levels.

| Variable                              | (1)               | (2)               | (3)               | (4)               |
|---------------------------------------|-------------------|-------------------|-------------------|-------------------|
| Duality in Both Years                 | −1.722***         | −0.829            | −1.404***         | −1.285            |
| Information Cost                      | −31.175           | −42.048           | −58.110           | −28.300           |
| Duality in Both Years * Information Cost | 129.364**        | 130.147**         | 124.302*          | 110.346*          |
| 1 Year Default Probability (12/31/2019) | 75.155            | 63.915            | 93.423            | 100.806           |
| Natural log of Board Size             | 0.082             | −2.375            | −3.333*           | 0.219             |
| Board Meetings per Year               | −0.109            | −0.085            | −0.134            | 0.031             |
| % Insider Shares Outstanding          | −0.024            | −0.004            | −0.045            | 0.030             |
| Inst. Own. % Shares Outstanding       | 0.002             | −0.017            | −0.205            | 0.023             |
| Shares held by CEO as % of Total Equity | 0.081**          | 0.002             | 0.077             | 0.062             |
| % Independent                         | 5.057***          | 2.446             | 3.584             | 6.655**           |
| Natural log of Total Assets (in $ million) | 0.004             | −0.012            | 0.127             | 0.071             |
| Return on Assets (2019)               | 7.571             | 10.589            | 19.185**          | 13.874            |
| Debt/Total Assets                     | −0.057            | 0.793             | −3.020            | −0.302            |
| Market/Book                           | −0.140**          | −0.033            | −0.006            | −0.173            |
| Capital expenditure/sales             | 2.759***          | 3.768**           | 6.457***          | 6.676***          |
| Cash/Total Assets                     | 2.541             | −3.460            | 2.511             | 15.457**          |
| Coefficient of Variation of ROA       | −0.011***         | −0.015***         | −0.037***         | −0.038***         |
| Constant                              | −4.311            | 3.905             | 2.584             | −14.103*          |
| R²                                    | 0.198             | 0.121             | 0.124             | 0.116             |
| N                                     | 594               | 594               | 594               | 594               |
| Industry F.E. (FF 12)                 | Yes               | Yes               | Yes               | Yes               |
| Firm Clustering                       | Yes               | Yes               | Yes               | Yes               |
| F-stat                                | 4.23              | 3.85              | 3.67              | 5.01              |
of Model (1). We cluster observations at the industry level (Fama and French twelve industries). In Model (3), we do not include fixed effects and instead simply cluster observations at the industry level. Our findings again indicate that both CEO duality and information costs relate positively to the change in default probability, while firms with high informational opacity benefit from CEO duality.

In Model (4), our results indicate that the interaction of CEO duality and high informational costs is negatively associated with the annual change in default probability over 2020. However, the default probability at the end of 2019 does not predict default probability. Instead, more profitable firms with smaller boards experience a smaller increase in default probability. These findings are consistent with prior empirical research. Firms with smaller boards are likely to be more effective at making timely changes to operations.

In contrast, firms with the ability to generate accounting profits are more likely to sustain themselves than firms that were less profitable (or unprofitable) before the pandemic. Our results in Model (5) are consistent with those of Model (4). In addition, we include industry clustering instead of firm clustering. Firms with greater capital expenditure and lower debt ratios experience a smaller increase in default probability. Finally, in Model (6), we do not include any fixed effects and instead only cluster by industry. Our results are quantitatively similar to those in Models (4) and (5).

4.3. robustness tests

A variety of firm-specific factors could be overlooked in OLS regression. To increase the certainty that CEO-chairman duality is directly associated with the changes tested in prior tables, we examine the change in each characteristic for firms that gained CEO-chairman duality in 2020. These firms had separate CEO and chairman roles in 2019. We match observations where the firm gained CEO duality to observations in which those roles were separate in 2019 and 2020.

We match each observation where CEO duality was gained in 2020 to three observations with CEO-chairman separation using Equation (4). We do not include observations where the firm had CEO duality in both years. We also drop observations where the firm lost duality in 2020. Instead, we rely on nearest neighbor matching.

\[
\text{CEO duality} = \text{Information cost}_i + \ln(\text{board size})_i + \text{default prob}_i + \ln(\text{total assets})_i + \text{roa}_i + \frac{\text{debt}}{\text{total assets}}_i + \frac{\text{market}}{\text{book}}_i + \frac{\text{cash}}{\text{total assets}}_i + \text{coef. of var.} + \epsilon_i
\]

(4)

We detail our results in Table 6. Firms that add CEO-chairman duality in 2020 experience a smaller (−0.49%) increase in 1-year default probability from the end of the fourth quarter of 2019 to the end of the first quarter of 2020. These change from the end of 2019 to the end of 2020 is also smaller for firms that achieve CEO duality in 2020 after not having it in 2019 versus firms that have separate CEO and chairman roles in both 2019 and 2020. Our results are statistically significant, though the significance weakens over the full year. These results are supported by our comparison of the default probability level for our two samples at the end of the first and fourth quarters of 2020. We find that firms that add duality have default probabilities 0.6 (0.3) basis points lower than those of comparable firms without duality in the first (fourth) quarter.

Firm volatility and profitability also significantly change for firms that add CEO duality in 2020. While we do not find a significant difference in the change in firm volatility in the first quarter of 2020, volatility increases over the year. Firms that gain CEO-chairman duality experience changes in quarterly ROA that are 5.6% larger than those of comparable firms in the first quarter of 2020 and 2.0% larger from the fourth quarter of 2019 to the fourth quarter of 2020.

4.4. the investor response to the outbreak

Investor expectations should differ for firms depending on their characteristics, value proposition, and ability to adapt to lockdown at the start of the pandemic. Firms perceived as being able to adapt to changes should have outperformed those whose sales or cash flows would be nearly eliminated due to lockdown requirements. CEO duality concentrates a large amount of power in the hands of one individual. It reduces the oversight costs the CEO will have to bear because of rapid changes to the business model during the pandemic.

We measure the investor response to the outbreak of Covid-19 using cumulative abnormal returns (CARs). We present our findings in Table 7 using value-weighted CARs. We construct four CAR windows: three days, seven days, eleven days, and fifteen days. We select February 19, 2020 as the announcement date since this was when investors began selling off shares due to pandemic fears. It was also the date that many organizations began implementing Covid restrictions. We regress CARs on CEO duality, information cost, the interaction term, firm-level controls, and industry fixed effects. Finally, we cluster observations at the firm level.

In Models (1) and (5), our dependent variable is the (−1, 1) CAR. We find a negative relationship between CEO duality and the investor response but a positive relationship between the interaction term and the investor response. This finding indicates that while CEO duality was viewed negatively at the start of the pandemic, it was viewed positively by investors when information costs were high. For example, firms with the minimum information cost and CEO duality would have experienced a −1.514% CAR, but having the mean information cost (0.005) would reduce the magnitude of this negative return by 61 basis points. In Models (2) and (6), our dependent variable is the (−3, 3) CAR window. We find no direct relationship between CEO duality and the investor response but a positive coefficient on the interaction term. This finding supports that of Model (1).

Our results in Models (3), (4), (7), and (8) provide further support for our investor response hypothesis. We find a positive coefficient on the interaction term, although the statistical significance of the coefficient is only marginal in Model (3). The statistical significance weakens further in Model (4), where we use a fifteen-day window (−7, 7). The fact that our significance weakens as our
window widens indicates that we are unlikely to be picking up events that are unaccounted for. In Models (5) through (8), we test the robustness of our results by removing the control variables from our model. The statistical significance of our interaction of interest remains high, supporting our stewardship hypothesis (H3a) that investors value CEO duality when information costs are highest.

We provide further robustness to our analysis of investor expectations by examining the relationship between duality, information cost, and CARs when firms do not gain or lose CEO duality during 2020. First, we drop all observations where the firm added or lost CEO duality in 2020 to ensure our subsamples are distinct from one another. We then rerun Models (1) through (4) from Table 7.

We report our findings in Table 8. Our results are consistent with those in Table 7. Our findings in Models (1) and (3) indicate that investors respond more negatively to firms with CEO-chairman duality in both 2019 and 2020. However, information costs do not impact the investor response over any return window. We find a positive and significant coefficient on each interaction term in Table 8. These findings indicate the robustness of the relationship between duality, information cost, and investor response. Investors value duality when accurate information is difficult to obtain. Our findings weaken over the longer windows in Models (3) and (4), but the relationship is evident. These findings provide support for H3a, indicating that investors recognize the value of CEO duality during crisis periods, particularly when the cost of gathering information is high.

5. Conclusions

5.1. Summary of our findings

In this paper, we use the outbreak of COVID-19 as an exogenous shock to examine whether the agency theory or stewardship theory expectations with respect to CEO duality and firm performance have more support. We examine how S&P 1500 firms fared in the initial year of the Covid-19 outbreak (2020). Firms with CEO duality exhibit greater increases in firm risk over the first year of the pandemic, but these increases were smaller when the firm had high information costs. CEO duality is also positively related to firm profitability in the presence of information costs. High information costs proxy for high economic asymmetry. CEO duality allows firms with high economic asymmetry to quickly respond during crisis periods. Firms with CEO duality outperformed their competitors during the first year of the coronavirus outbreak.

Our findings indicate that CEO duality has benefited firms with high information costs during the coronavirus outbreak even after controlling for other firm-specific and industry-specific factors. Firms with CEOs with a stronger connection to the board appear to have been more effective at managing the coronavirus outbreak, even after controlling for other corporate governance measures. We control for the factors previously found to be significant. Using lagged change variables mitigates endogeneity concerns since the coronavirus can be viewed as an exogenous shock.

Investors appear to recognize the value of CEO duality for firms with high information-gathering costs. CARs are less negative around the outbreak for firms with CEO duality, assuming average information costs. Our study indicates that CEO duality offers value, especially during crises when uncertainty is highest. While this evidence supports stewardship theory, it is important to note that we examine firm performance during a crisis when quick action is needed. Consistent with Petajisto (2013), who shows that mutual funds with greater active share outperformed other funds during the 2008 crisis, we find firms with active, powerful management outperform competitors when uncertainty is highest. The greater the ability of a CEO to develop and execute firm strategy, the more valuable they become when quick decision-making is vital to that firm’s survival.

5.2. Possible extensions

Our finding that powerful CEOs provide significant value to firms with high information-gathering costs at the start of the pandemic leads to several possible extensions. The most obvious extension would be to examine whether these firms take advantage of their around the outbreak for firms with CEO duality, assuming average information costs. Our study indicates that CEO duality offers value, especially during crises when uncertainty is highest. While this evidence supports stewardship theory, it is important to note that we examine firm performance during a crisis when quick action is needed. Consistent with Petajisto (2013), who shows that mutual funds with greater active share outperformed other funds during the 2008 crisis, we find firms with active, powerful management outperform competitors when uncertainty is highest. The greater the ability of a CEO to develop and execute firm strategy, the more valuable they become when quick decision-making is vital to that firm’s survival.

Firms with CEO duality could alter their internal investment behavior after the pandemic. Just as Schoar and Luo (2017) demonstrate that CEOs who graduate during recessionary periods exhibit more conservative behavior, CEOs who managed their firm through the pandemic could become more conservative in their decision-making. This could involve making fewer capital investments, divesting unprofitable operations, and exercising fewer real options.

The behavior of the CEOs themselves could change because of the pandemic. A CEO who has led their firm successfully through the pandemic could find themselves in a stronger position within their organization than before the pandemic since they would have built goodwill and demonstrated their abilities. This could lead a CEO with little oversight to begin exhibiting greater perquisite consumption or negotiating greater compensation post-pandemic.

CEO duality has implications for firm accounting and the value relevance of accounting figures and earnings management. Cimini (2022) identifies a positive relationship between female board representation and value relevance of accounting statements. Cimini notes the positive relationship between female representation and board monitoring. Saona, Muro, and Alvarado (2020) note that the voting rights of the controlling shareholder negatively impact earnings management. If female board representation and controlling shareholder voting rights could increase monitoring ability and value relevance of financial statements, separated CEO and chairman roles could have a similar effect. As we’ve shown in this paper, this relationship might not hold during crisis periods or at firms with high information costs, where powerful, insightful leadership is needed. At firms with high information costs, CEO duality could reduce the information asymmetry between the board and management, leading to more discussion of the financial statements, greater
value relevance, and lower earnings management.

Given powerful CEOs’ ability to lead firms more effectively during crisis periods, an interesting extension of this paper could involve examining the behavior of firms with CEO duality or CEO power during periods of industry uncertainty. Chang, Lee, and Shim (2019) find CEO power is more positively associated with firm performance during periods of economic policy uncertainty. However, many actions can take years to fully manifest in a firm’s share price. These actions include large capital budgeting projects, adjustments to R&D activity, realignment of a firm’s objectives, reassignment of employees, and adjustments to financial policy. Based on our findings, one could expect firms with CEO duality to behave more proactively during periods when their competitors are risk averse. CEOs facing more oversight of their activities are likely to be more constrained when taking advantage of opportunities during periods of high economic policy uncertainty.

CRediT authorship contribution statement

M. Kabir Hassan: Methodology, Project administration, Writing – review &. Reza Houston: Conceptualization, Formal analysis, Methodology, Writing – review & editing. M. Sydul Karim: Data curation, Formal analysis, Conceptualization, Writing – original draft. Ahmed Sabit: Data curation, Conceptualization, Formal analysis, Writing – review & editing.

Declaration of competing interest

The authors whose names are given below certify that they have no connections with or involvement in any organisation or institution that has a financial or non-financial interest in the subject matter or materials covered in this manuscript.

Data availability

Data will be made available on request.

Appendix A.1. Variable Definitions

| Variable | Definition | Data Source |
|----------|------------|-------------|
| 1 Year Default Probability (12/31/2019) | Probability of firm default over the next year. Calculated using a proprietary model from Bloomberg. | Bloomberg |
| Change in 1 year default probability (12/31/19 to 3/31/20) | 1-year default probability in Q2 2020 minus 1-year default probability in Q1 2019 | Bloomberg |
| Change in 1 year default probability (12/31/19 to 6/30/20) | 1-year default probability in Q4 2020 minus 1-year default probability in Q4 2019 | Bloomberg |
| Change in 1 year default probability (12/31/19 to 9/30/20) | 1-year default probability in Q1 2020 minus 1-year default probability in Q4 2019 | Bloomberg |
| Change in 1 year default probability (12/31/19 to 12/31/20) | 1-year default probability in Q4 2020 minus 1-year default probability in Q4 2019 | Bloomberg |
| Rolling Std. Dev. Of ROA | Standard deviation of the quarterly return on assets, based on quarterly ROA from quarter t-7 to quarter t. If there are fewer than five observations, we drop this observation. | Compustat |
| Change in Std. Dev. Of ROA (12/31/19 to 3/31/20) | Rolling standard deviation in ROA as of Q1 2020 minus rolling standard deviation in ROA as of Q4 2019. | Compustat |
| Change in Std. Dev. Of ROA (12/31/19 to 6/30/20) | Rolling standard deviation in ROA as of Q2 2020 minus rolling standard deviation in ROA as of Q4 2019. | Compustat |
| Change in Std. Dev. Of ROA (12/31/19 to 9/30/20) | Rolling standard deviation in ROA as of Q3 2020 minus rolling standard deviation in ROA as of Q4 2019. | Compustat |
| Change in Std. Dev. Of ROA (12/31/19 to 12/31/20) | Rolling standard deviation in ROA as of Q4 2020 minus rolling standard deviation in ROA as of Q4 2019. | Compustat |
| Quarterly ROA (12/31/2019) | Quarterly ROA (net income/total assets) | Compustat |
| Change in Quarterly ROA (12/31/19 to 3/31/20) | Quarterly ROA in Q1 2020 minus quarterly ROA in Q4 2019. | Compustat |
| Change in Quarterly ROA (12/31/19 to 3/31/20) | Quarterly ROA in Q2 2020 minus quarterly ROA in Q4 2019. | Compustat |
| Change in Quarterly ROA (12/31/19 to 3/31/20) | Quarterly ROA in Q3 2020 minus quarterly ROA in Q4 2019. | Compustat |
| Change in Quarterly ROA (12/31/19 to 3/31/20) | Quarterly ROA in Q4 2020 minus quarterly ROA in Q4 2019. | Compustat |
| Cumulative Abnormal Return (−1, 1) | 3-day value-weighted cumulative abnormal return around February 19, 2020. | CRSP |
| Cumulative Abnormal Return (−3, 3) | 7-day value-weighted cumulative abnormal return around February 19, 2020. | CRSP |
| Cumulative Abnormal Return (−5, 5) | 11-day value-weighted cumulative abnormal return around February 19, 2020. | CRSP |
| Cumulative Abnormal Return (−7, 7) | 15-day value-weighted cumulative abnormal return around February 19, 2020. | CRSP |
| Natural log of Total Assets (in $ million) | ln(total assets/1,000,000) | Compustat |
### Table

| Variable                                | Definition                                                                 | Data Source |
|-----------------------------------------|---------------------------------------------------------------------------|-------------|
| Total Assets ($ million)                | total assets/1,000,000                                                    | Compustat   |
| Return on Assets (2019)                 | net income/total assets                                                  | Compustat   |
| Debt/Total Assets                       | Total debt/total assets                                                  | Compustat   |
| Market/Book                             | Market capitalization/book equity. We set this variable to zero if it is negative. | Compustat   |
| Capital expenditure/sales              | Quarterly capital expenditure/quarterly sales.                           | Compustat   |
| Cash/Total Assets                       | Quarterly cash/quarter-end total assets                                   | Compustat   |
| Coefficient of Variation of ROA         | Rolling standard deviation of ROA (t-7 to t)/average ROA over the period (t-7 to t) | Compustat   |
| Number of Employees                     | Number of firm employees                                                  | Bloomberg   |
| CEO Duality                             | Indicator for whether the same individual is both CEO and chairman       | Bloomberg   |
| Information Cost                        | absolute value of (expected earnings - actual earnings)/(average share price at the end of quarters t-1 and t) | Compustat   |
| % Insider Shares Outstanding            | Percent of shares held by corporate insiders.                            | Bloomberg   |
| Inst. Own. % Shares Outstanding         | Percent of shares held by institutional shareholders.                     | Bloomberg   |
| Shares held by CEO as % of Total Equity| Percent of shares outstanding owned by the CEO.                           | Bloomberg   |
| % Independent                           | Percent of independent board members.                                     | Bloomberg   |
| Board Size                              | Number of board members                                                  | Bloomberg   |
| Natural log of Board Size               | ln(number of board members)                                              | Bloomberg   |
| Board Duration                          | Length of board term                                                     | Bloomberg   |
| Board Average Age                       | Average age of board members                                             | Bloomberg   |
| Board Meeting Attendance %             | Attendance percentage at each board meeting.                             | Bloomberg   |
| Board Meetings per Year                 | Number of board meetings per year                                         | Bloomberg   |
| % Employees Unionized                   | Percentage of employees unionized                                        | Bloomberg   |
| Independent Directors                   | Number of independent directors                                           | Bloomberg   |
| % Women Employees                       | Percent of women employees                                                | Bloomberg   |

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