Board Diversity in Crisis:

'Can female directors take care of companies during the Covid-19 pandemic?'

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Abstract

This paper analyses the impact of female board representation on firm value and performance in the US market during the Covid-19 pandemic. This is done by analysing female directors in 1118 unique boards in 2020. Six selected events in the Covid-19 pandemic are used to regress female director variables on the cumulative abnormal returns of public firms. As much research on female leadership suggests positive implications for corporations, efficient markets are expected to reflect female representation in US boardrooms. Additional analysis is done into the cross-sectional effects of identified industries connected to female representation identified by Chen, Leung, Song and Goergen (2019). Overall, the results for female directors are negative or significant for the selected events. As the dynamics of the selected events differ substantially, strong conclusions on higher firm value through female representation in boards cannot be made. The paper find positive significant returns for firms with female CEOs in Covid-19. This is in line with literature on female leadership in crisis.. However, the methods in this paper and the analysed economic environment of the pandemic are limited. As female board representation continues to grow and much research do associate female directors with internal and external organisational benefits, future research into the direct relationship between diverse boards is required and has to potential to facilitate academic arguments to accelerate gender diversity in the board room.

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1. Introduction

Female representation in boardrooms is historically limited but improving. 29% of US directors in 2021 were women, up from 19% in 2014 (BoardEx, 2021). This significant increase in recent years portrays the efforts of corporations to transform female directors (FDs) from gender minority to male counterweights in board rooms. MSCI estimated in 2020 that global female representation on boards can reach 50% for the first time in 2039 (*Women on Boards: 2020 Progress Report*, 2020). Academic insights should anticipate and contribute by recognising diverse boards' corporate and cultural mechanisms. An increasing body of literature on female representation already associates FDs with positive effects on internal management, shareholder management, and corporate governance. Within organisations, female leadership is connected to mitigating employee layoffs (Matsa & Miller, 2013), increasing R&D investments (Miller & Triana, 2013), and impacting CEO behaviour (Chen, Leung, & Song, 2019). Additionally, female directors improve corporate strategy as they are associated with an improved firm reputation (Hill & Jones, 1992; Heugens et al., 2004), lower bid premiums and even are less likely to make offers in the first place (Levi, Li & Zhang, 2014). Moreover, having female directors on the board is relevant for markets, too, as FDs increase informativeness on stock prices (Gul, Srinidhi & Ng., 2011) and improve shareholder management by better reflecting shareholder interests (Rindova, 1999; Carter, 2006). As female directors are still considered a minority, it is evident that, besides ethical arguments, firms have plenty of economic incentives to pay attention to female directors.

However, gender differences do not automatically reveal causal relationships between firm performance and firm value. Female directors are still minorities on boards (Adam & Ferreira, 2009; Chen et al., 2019). According to McKinsey & Company, increasing the share of female executives and directors is challenging as the path to promotion is more difficult for junior female employees (*Women in the workplace 2021*, LeanIn.Org & McKinsey, 2021). Investors are aware of the scarcity on the executive level as finding suitable replacements can be time-consuming. Schmid and Urban (in press) present evidence supporting this as they find significant negative abnormal stock returns after female directors pass away compared to male directors. Their research is an example of a director-centred event study on gender-diverse boards. In contrast, little research investigates how the markets value diverse boards in crisis within short event windows. As the pandemic is still ongoing, it is impossible to include the whole period and analyse performance measures via reporting or market valuation (as Chen et al. did for the GFC, 2019). Therefore, this paper will be using short-term event studies to capture investor behaviour on female representation.

The Covid-19 pandemic hit the globalised world at an unparalleled level. A pandemic has spread to all corners of the world, challenging people, governments and economies. When the debate on gender diversity is more relevant than ever, such a health crisis creates an experimental situation to assess new effects of the unprecedented levels of female representation at US corporations. Leadership in crisis requires a distinctive way of people and stakeholder management. A recent paper by Chen et al. (2019)

finds a positive relationship between FDs and lower CEO overconfidence, mitigating the firm’s risk profile during the Global Financial Crisis (GFC). The relevance of these findings is highlighted by the publication by Harvard Business Review (*Research: When Women Are on Boards, Male CEOs Are Less Overconfident*, 2021). As the GFC served as the latest crisis for research on board compositions and firm performance, the ongoing Covid-19 pandemic can become highly relevant to investigating the increased female representation. Papers on the pandemic are naturally limited at this time, but reports already suggest possible distinctions between female and male leadership. For example, an extensive 360-degree review analysis published in the Harvard Business Review (*Research: Women Are Better Leaders During a Crisis*, 2020; conducted by leadership development consultancy company Zenger/Folkman) evaluated gender competencies during the Covid-19 pandemic. They present statistically significant differences between the personal competencies favouring female leadership styles during crises. The World Economic Forum even uses these findings on female leadership as a critical component for strategies in tackling climate change and future crises. These are just examples highlighting the importance and relevance of new research into diverse boards and crises. The Covid-19 crisis is a unique opportunity to analyse all-time highs of female representation. The pandemic is a exogenous shock and has affected the complete word, experimental characteristics generally not easily found in economics. This makes the Covid-19 crisis highly interesting. Gender traits could work out differently in times of high uncertainty. If female leadership appears beneficial for corporations, efficient markets should reflect higher firm values for diverse boards. Therefore, the main research question of this paper is: *"Do female directors positively impact firm value during the Covid-19 crisis?"*. This research aims to contribute to the existing literature on diverse boards in the US by investigating if female directors affect firm valuation in crisis.

To answer this research question, data on board composition is critical. Former papers include data on any female presence in their models as female directors were limited represented in board rooms. Conducting this research during the Covid-19 pandemic considers the substantial increase in female representation and will introduce a new variable. In total, three variables will be used to find any relationship between the level of female representation and the cumulative abnormal returns of firms. The analysis will be done using US S&P 1500 firms and stock data on six select events ranging from January to November 2020. The events reflect pandemic-related key dates with nationwide relevance. The first event used is the declaration of the World Health Organisation (WHO) on Covid-19 as a health emergency on January 30th. The final event is the official inauguration of US President Joe Biden on November 7th.

The paper is constructed as follows. First, an extensive literature review in Section 2 will present historical findings on governance, its relation to performance, how gender can impact top-level management and the mechanisms of financial markets. Secondly, Section 3 will elaborate on what data and methods are used to construct models and derive results to find support for expectations. Thirdly, the results are presented and include additional cross-sectional analyses (Section 4). Fourth, in Section 5, there is a discussion of the implications of the findings, possible explanations for results, the papers' limitations and suggestions for further research. Lastly, the conclusion is presented in Section 6.

2. Literature Review

This chapter highlights the academic context relevant to constructing and answering the research questions. Corporate governance, firm performance, and gender diversity in the US are highly researched topics in academic literature and offer a solid base of scientific and economic intelligence to continue discovering drivers of corporate governance and investor behaviour. This paper will answer the research question: *"Do female directors positively impact firm value during the Covid-19 crisis?"*. The findings contribute to governance and gender diversity by analysing firm valuation and financial performance in crises. The remaining part of this section is as follows. First, the academic background of this subject will be discussed in three main themes: Corporate Governance & Firm Performance, Female Directors, and Financial Markets & Investors. Following, after exploring these themes in-depth, the hypotheses will be constructed and selected events will be discussed.

2.1 Corporate Governance & Firm Performance

Boards are key organs of corporate organisations as they monitor and provide resources to the firm (Hillman & Dalziel, 2003; Williamson, 1983, 1984). In the US, the American Bar Association has defined the responsibilities of boards as supervisors of executive management. Following their definition, the function and focus of a board should be in the best interest of the firm and include recruitment, delegation and evaluation of day-to-day leadership, managing idiosyncratic risks, and overseeing strategy and reputation (American Bar Association, 2009). However, a boards' effectiveness is often explained by factors such as board size (Coles et al., 2008; Conyon & Peck, 1998; Guest, 2009; Harris & Raviv, 2006; Kini et al., 1995), director independence (Agrawel & Knoeber, 1996; Fama, 1980; Fama & Jensen, 1983; Harris & Reviv, 2006; Klein, 1998), director expertise (Baysinger & Hoskisson, 1990; Coles et al., 2008; Drobetz et al., 2018; Hermalin & Weisbach, 1991), and level of busyness (Fich & Shivdasani, 2012; Hauser, 2018).

Further, the corporate environment in the US follows a shareholder model, with directors acting in the interest of shareholders to maximise shareholder value. However, the extent of misalignment is known as agency costs. The agency theory describes agency costs as the economic miscalibration between the incentives of shareholders, directors and executive management (Eisenhardt, 1989; Fama, 1980). Independent directors are positively associated with performance and lower agency costs through balancing inside directors, which are biased in their perception of firm performance and interpersonal relations with employees (Agrawal & Knoeber, 1996; Fama & Jensen, 1983). On the other hand, overcoming the information asymmetry will determine if independent directors are effective leaders (Dutchin et al., 2010) instead of limiting innovation (Haunschild & Backman, 1998). As inside directors contribute to the firm with crucial information on finances and investments (Fama & Jensen, 1983; Klein, 1998), the level of board independence has become a trade-off for shareholders.

Additionally, if firms hold directors who are considered busy, defined by having three or more board seats (Ferris & Pritchard, 2003; Fich & Shivdasani, 2012; Jiraporn, Kim & Davidson, 2008), the quality of monitoring can decrease affecting profitability and growth potential (Fich & Shivdasani, 2012). Furthermore, they also find that if independent directors are considered busy, the CEO is less likely to be removed due to poor performance. Reducing a directors' number of board seats improves profitability and growth potential (Hauser, 2018). Furthermore, excess monitoring of boards is associated with lower firm valuation (Adams & Ferreira, 2007; Almazan & Suarez, 2003). Smaller groups are more efficient in decision-making and experience less director free-riding (Jensen, 1993; Lipton & Lorsch, 1992). In contrast, more complex firms may benefit from having larger boards through the relevant expertise of inside directors. Higher levels of inside directors are positively associated with Tobin's Q at R&D intense firms (Coles et al., 2005). Complementary to these findings are the results of Drobetz et al. (2018), suggesting higher firm valuations for boards in specific industries are associated with the overall number of experienced directors.

2.1.1 Boards in crisis

During times of economic downturn, governance becomes increasingly relevant as risks increase and the economic environment becomes uncertain. As the Covid-19 pandemic is currently still testing the global economy, research of past crises already provides relevant insights on boards' behaviour in these periods.

A crisis has double materiality on companies, as the economy becomes uncertain for business models and increases the burden on its employees and leaders. Research by Borgschulte Guenzel, Liu and Malemendier (2021) estimated the burden of exposure to distress after the Global Financial Crisis (GFC) for CEOs to be effectively ageing one year in the decade following the distress.

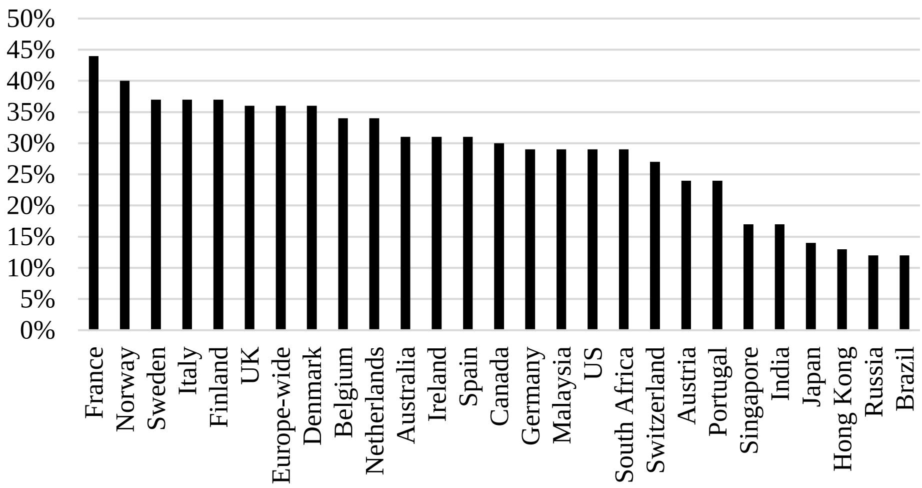
Furthermore, larger boards in the Greece sovereign debt crisis have been associated with weaker debt levels. In contrast, the number of independent directors on the board would have increased the chance of having adequate credentials for higher debt usage (Kyriazopoulos, 2017). Firms should prioritise governance in times of crisis as good governance is negatively related to the cost of capital (AlHares, 2020), lowering the chances of high costs of capital turning into a financial burden and eventually financial distress (Kraus & Litzenberger, 1973). Firms with weaker governance are more exposed in times of economic turmoil and have higher chances of financial distress (Lee & Yeh, 2004).

Additionally, during the GFC, firms' high corporate social responsibility intensity is significantly positively related to stock returns (Lins, Servaes & Tamayo, 2017). The researchers connect the positive stock returns with trust between shareholders and the firm in times when overall trust is low. Good governance, or the lack thereof, can contribute to a crisis too. An analysis of US boards in the period leading to the GFC found structural differences in the composition of boards engaging in subprime lending recognised as a cause of the GFC (Muller-Kahle & Lewellyn, 2011). More importantly, firms involved in subprime lending were monitored by busier boards and were more likely to be male-dominated. Moreover, the level of gender diversity in boards is also investigated by Chen et al. (2019). They find that higher levels of female representation mitigate the shock on firm performance during the GFC through their cultural attribution on the board.

2.2 Female Directors

Gender diversity is a topic many companies have dealt with in the past decades. According to BoardEx (*Global Gender Balance Report 2021*, 2021), a renowned database on worldwide board data, it appears that Western countries like the US, Europe and Australia are relatively progressive in having diverse boards, with 29%, 34% and 31% being female directors (Figure 1), respectively. This is not the case in large developing economies, such as India, Russia and Brazil, as average female board representation is only 17%, 12% and 12%, respectively. The US made significant progress in increasing female directors on boards from 19% in 2014 to 29% in 2021 (BoardEx, 2021). Although the gender ratio is not balanced yet, the relatively high representation of women in US boards creates a setting to analyse a financial market perception of the presence of female directors. The following subsections will elaborate on research into female board representation and what gender differences might influence the quality of directorships.

Figure 1: Average percentage of female directors worldwide



Source: BoardEx Global Gender Balance Report 2021

2.2.1 Female Board Representation

In 2000, just 12.5% of directors in US Fortune 500 companies were female (Catalyst, 2000). In 2020, this number increased to 26.5%. Regarding CEOs in 2000, just two (0.4%) Fortune 500 companies were led by women (Catalyst, 2000). Last year noted an unprecedented 41 female CEOs (8.2%) responsible for a Fortune 500 company (Fortune, 2021). Overall, female participation has increased in the past decades due to several measures worldwide. Imposing a quota is one example. Although quotas effectively increase gender diversity on boards, it is not always accompanied by the desired effects. As Wang and Kelan (2012) investigate the impact of the female director quota in Norway, they find that the gender gap for directors has not significantly been affected after full compliance. A growing understanding of board and gender dynamics contributes to adjusting board environments accordingly to effectively improve governance through gender.

First of all, according to the definition of corporate governance (American Bar Association, 2009), monitoring executive management as a director includes a wide range of responsibilities. To be deemed fit as a director at a listed company, organisations seek strong personal characteristics to ensure capable directors are in place to monitor the firm (Agrawal & Knoeber, 2001; Hermalin & Weisbach, 1988). In the 1990s, FDs were selected for increasing diversity at firms instead of capabilities (Farrel & Hersch, 2005). The use of a female to increase diversity is also described as tokenism (Branson, 2006; Bourez, 2005). This trend has shifted as inexperienced FDs are not well-received by shareholders (Ahern & Dittmar, 2012). Women need access to similar education and job opportunities to compete with male candidates. The development of female students and workers has improved in the past decades. In US education, around 60% of 2021 college students are female (Wall Street Journal, 2021), making a possible gender gap non-existent. However, the gender ratio of graduates has a lagged effect on available female directors and female representation. If we look at the dataset of Adams and Ferreira (2009, p. 294), a director was at least 49.2 years when selected (average director age minus the average director tenure, 58.9 years and 9.7 years, respectively. The fact that female representation increases make conducting new research relevant as ratios at this level could not have been researched before.

As previous research predominately investigated the effect of any female representation or just the ratio, the higher levels of representation (Figure 1) might require new research to consider alternative measures of gender diversity to capture relationships in the board settings of today. Such an alternative can be the “Critical Mass” of Kramer, Konrad and Erkut (2006). They aim to establish the minimal number of FDs required to affect board behaviour significantly. A qualitative analysis based on interviews with executives from Fortune 1000 companies. Their research suggests that at least three female directors are required to impose a change in the boardroom. In their findings, three FDs improve decision-making by including more stakeholders' concerns and increasing the ease of discussing complex topics in the board room. Additionally, the team dynamics of the board seem to be improving, with better expectation management between the board and management (Kramer et al., 2006). Aligned with these implications is the research of Schwartz-Ziv (2017). The author finds that boards with three directors of both genders are at least 79% more active during board meetings and present significant relationships with the presence of female directors.

As experienced FDs remain scarce (McKinsey, 2021), larger firms have larger boards and more seats available for female directors. Moreover, experienced directors are directly linked to several performance metrics of public firms. Ahern and Dittmar (2012) found significant evidence of this as they researched the 2003 gender quota in Norway. The quota of 40% FDs on boards of listed firms was introduced at a time when on average, 9% of Norwegian directors were female. The introduction led to the sharp increase of inexperienced female directors. Their results suggest that investors value experience as sharp stock declines have been linked to the quota.

In addition, the relationship between firm performance and gender diversity on the board has different effects on companies with weaker shareholder rights. If shareholder protection is low, Adams and Ferreira (2009) find a positive relationship between firm performance and gender diversity. Furthermore, early gender board research suggests the size of companies is positively related to female representation (Harrigan, 1981; Agrawal & Knoeber, 2001; Carter, Simkins & Simpsons, 2003). Besides, Farrel and Hersch (2005) find that female directors are more likely to serve at firms that perform better

The indirect effect of female representation on the board is also researched. Chen et al. (2019) investigate the mitigating impact of FDs on CEO overconfidence. They find that female directors offer extra insights and perspectives to the CEO in strategic decision-making. Moreover, their results suggest that female representation lowers CEO overconfidence in industries where CEO overconfidence is traditionally high. Mitigation of overconfidence is linked to lower risk-taking in investment strategies, higher levels of financial performance and improved decision-making in M&A.

2.2.2 Gender differences

In June 2020, a few months into the Covid-19 pandemic, Johnson and Williams (2020) state in the Journal of Politics & Gender that the coverage of female leadership has positively improved. They conclude that female political leaders have strategically used their feminine protectionism (related to the traditional role of a household caretaker) in the political environment. Celis et al. (2013) describe a gender-based distinction between the private sphere at home (feminine) and the public sphere in politics (masculine). In this context, Johnson and Williams (2020) connect failed protection of citizens and masculine political leadership. Moreover, Garikipati and Kambhampati (2021) analyse the gender of Covid-19 outcomes due to national policies worldwide. They find significant results on systemically better Covid-19 outcomes for female-led countries. These dynamics offer the first perspective on female leadership (governance) and appropriate behaviour (firm performance and value) during the Covid-19 pandemic.

As listed companies are, per definition, more exposed to the world, leadership at public firms comes with different dynamics. Ryan et al. (2016) find that perceived female leadership is valued more in times of crisis. Additionally, in more violent situations, such as war and dictatorships, research found that female leaders benefit from having empathy and conciliation, predominantly feminine skills (Franceschet et al., 2017; Thomas & Adams., 2010). Overall, male leadership is still preferred in crisis conditions (Dulan & Lynch, 2016). Nevertheless, as the Covid-19 crisis is a pandemic, corporate leadership might value female protectionism.

Previous research into female directors and firm performance has presented mixed results regarding corporate leadership and firm performance. Ahern and Dittmar (2012) have found a negative relationship between increased female representation and performance. Their research is conducted in progressive Sweden, being the first to impose a gender quota on boards, where 9% of directors were female at the time. Further, Farrel and Hersch (2005) cannot significantly link gender diversity in boards to financial performance. They conclude that firms initially selected female directors as a response to calls for diversity instead of capability-based recruitment. On the other hand, Campbell and Mingquez-Vera (2008) and Liu, Wei and Xie (2014) can associate gender diversity in boards with improved firm performance, even though these findings concern Spanish and Chinese firms. One of the first papers to present empirical evidence on board diversity and firm value is from Carter et al. (2003). They show significant positive results on the board diversity, measured by the ratio of female directors and ethnic minorities, and firm value, measured by Tobin's Q, at Fortune 1000 companies. Their implications highlight the relevance of board diversity and shareholder value.

Furthermore, female representation can have implications within boards as well. Research by Adams and Ferreira (2009) finds that FDs are less likely to have attendance problems than male directors. An attendance problem is attending less than 75% of board meetings per director per year. Additionally, this research suggests that FDs tend to take more committee roles with monitoring responsibilities. This implies that the dynamics of corporate governance are affected by female board representation. A recent paper by Chen et al. (2019) finds a positive effect of female board representation on firm performance in the GFC connected with board culture. Their findings suggest that companies experience less harmful effects on performance during the crisis due to lower risk-taking in the prior period. The lower levels of risk are found connected to the presence of FDs and their mitigating effect on the overconfidence of CEOs. This would make the firm financially less fragile in times of crisis.

Concluding, current research strongly implies improved governance through gender-diverse boards and suggests female directors can have a role in governance during times of crisis. As a result, financial markets should efficiently incorporate the representation of FDs in share prices.

2.3 Financial Markets & Investors

Financial markets reflect companies' value and their relation to investors. The market of corporate assets is driven by the investors' interpretation of value relative to corporate performance and growth potential. For this research, an essential theory on financial markets is commonly described as the Efficient Market Hypothesis (EMH). This theory is simultaneously explored by Fama (1963, 1965) and Samuelson (1965) and includes three states of efficiency in financial markets. In totally efficient markets, investors cannot earn abnormal returns on average. Besides, the market is perceived as less efficient if new information is not immediately incorporated into prices. The divergence of rational expectations can expose investor biases or model errors. The latter is described as the joint hypothesis problem in financial academic literature (Cuthbertson, 1996; Campbell et al., 1997; Lo & MacKinley, 1999). Moreover, the EMH is built on the Rational Choice Theory (RCT), a product of utilitarianism by philosopher John Stuart Mill (1806-1873), and neoclassical economic theories. The fundamental concept of the EMH and RCT is that investors are rational and correct prices in the market based on available information. The rationality of investors is an essential assumption in this paper to test relations between firm value and diverse corporate governance. However, despite the market reaction having logical arguments, it does not have to exclude the absence of investor biases.

2.3.1 Financial Markets in turmoil

In times of economic crisis, the economy becomes more challenging for companies. Good corporate governance in these times is critical to ensure the continuation of operations. Adjusting strategy is often necessary as the dynamic economic environment change in crises. Research by Chung and Beamish (2005) finds that multinational organisations use their global presence to increase the chances of survival. By being flexible in operations between international subsidiaries, the economic downturns in home markets are mitigated. Multinational operations require scale, and company size is positively related to going public (Pagano, Pennetta & Zingales, 2002). Performing less bad than competitors can improve competitiveness when the crisis ends and enhance the chances of survival. Furthermore, Lins et al. (2017) investigate the relationship between social capital and the performance of companies in the GFC. They find that firms with higher levels of social capital have a significant positive relationship with their stock performance. Chen et al. (2019) research firm performance in relation to female directors. Their results suggest that the performance of firms with female directors is less affected by the GFC compared to firms without female directors. This relationship is found through the mitigated risk-taking of the overconfident CEOs connected to female board representation.

The research currently suggests a positive relationship between improved governance by female directors and firm value of rational expectation. As improved governance leads to better performance and higher firm value (Adams & Ferreira, 2009), and if female directors improve governance and firm performance, efficient markets should incorporate the presence of female directors in the stock price if this is the case. This paper investigates the market reaction to female representation during the Covid-19 pandemic. Since Chen et al. (2019) and Lins et al. (2017) already found a positive relationship between socially diverse boards on firm performance during crisis, female leadership in the Covid-19 pandemic could improve the firm value well.

However, prior research exposes investor differences related to gender within behavioural finance on investor behaviour. For example, the paper of Schmid and Urban (2021) looks into investor behaviour surrounding the death of female directors worldwide. They find an excess stock price decrease of approximately 2% compared to the passing of male directors. This significant depreciation of stocks prices is linked to the challenge of successfully replacing female directors with other suitable females. However, Schmid and Urban cannot completely accredit the share price drop to director characteristics related to experience and education and expect it could be attributed to gender differences.

2.3.2 Economic beliefs about gender

As rationality has been a foundation for classic economic theory, the divergent results, in reality, have economists reassess their views. A recent development in financial-economic academic research is increased behavioural analysis of market participants. Where rationality remains the first perspective to derive expectations from, behavioural finance is complementary to rationality as it considers human nature, personal preferences and beliefs. The following subsection will discuss what investor behaviour can be linked to stock returns in times of crisis to understand market sentiment.

First, gender perception is a product of society and culture, eventually reflected in corporate settings. Brown, Alasdair, Yang and Fuyu (2015) analyse society's perception of gender performance via market-making in horse-race betting, testing for mistake-based discrimination. Overall, female jockeys tend to be slightly underestimated based on bets and the realised wins. However, their results are not easily extrapolated to corporate settings as horse racing is a physical activity and white-collar jobs require mental capabilities. Nevertheless, the relative losses in betting make discrimination very costly. Therefore, Brown et al. (2015) expect any gender discrimination in other professions to be more persistent as these costs appear to be less imminent.

Further, the beliefs about males and females are connected to stereotypes (Bordalo, Coffman, Gennaioli & Shleifer, 2019). They address gender differences in overconfidence as a cause for gender stereotypes. Both genders underestimate females in areas where males are dominant. In contrast, female capabilities are overestimated by both genders in female-dominated areas. Over time, Bordalo et al. (2019) expect less extreme stereotypes as the actual differences in gender capabilities are smaller than the perception. Bordalo et al. (2019) also state that stereotypes have contributed to the perception of economics and finance being male-dominated fields. In this perspective, academic research on the effects of gender diversity in corporate settings contributes to 'normalising' such stereotypes and fully understanding the economic implications of gender.

2.4 Hypotheses

The discussed literature suggests benefits to firms and governance through the presence of female directors. Research is not able to provide a uniform answer on these benefits. The Covid-19 pandemic offers a new period to investigate the relationships between female directors and firm value. At the same time, current levels of female representation are unique and yet to be further investigated. This offers a new environment for this paper to research market behaviour on diverse boards. Three hypotheses are tested to answer the main research question, "Do female directors positively impact firm value during the Covid-19 crisis?".

As earlier discussed, governance in times of economic turmoil is essential to stay financially stable (Lee & Yeh, 2004). Female directors appear to be improving corporate governance through several mechanisms, such as committee memberships and improving director attendance (Adam & Ferreira, 2007). In times of crisis, Chen et al. (2019) already present results on the mitigating effect of female directors on the risk-taking of CEOs and therefore lowering risks during the Global Financial Crisis. These findings form the basis for the positive expectations about the level of FDs and firm value. In contrast with prior literature on board diversity, this paper does not measure female representation through the presence of at least one FD. Current levels of diversity make the group without any FD statistically too small. Female representation is measured with two variables. First, FemaleRatio is the percentage of female directors on the board. Second, Min3FDs is a dummy variable which denotes 1 if the board has at least three female directors, described as 'Critical Mass' by Kramer et al. (2006). As female directors appear to improve governance and are lowering the risk profile of firms in crisis, diverse boards in covid-19 should perform better than non-diverse boards. Efficient markets would valuate these aspects in the stock price and drive a positive relationship between FDs and firm value. The first hypothesis includes the ratio of FDs, while the second uses the threshold as the main explanatory variable. They state as follows:

Hypothesis 1:

H0: The ratio of female directors during Covid-19 is not associated with firm value

H1: The ratio of female directors during Covid-19 is positively related to firm value

Hypothesis 2:

H0: Having a minimum of three female directors during Covid-19 is not associated with firm value

H1: Having a minimum of three female directors during Covid-19 is positively related to firm value

In addition to female board representation, Garikipati and Kambhampati (2021) show that female leadership in the pandemic systematically performs male leadership regarding Covid-19 policies. This suggests that a female leader can steer in the uncertainty of the pandemic and might also apply to the corporate setting. The third hypothesis expects a positive relationship between firms with a female CEO and the firm value around events in the pandemic and is as follows:

Hypothesis 3:

H0: Female CEOs during Covid-19 are not associated with firm value

H1: Firms with female CEOs during Covid-19 are positively related to firm value

These hypotheses align with the expectations of improved governance due to female directorship and leadership. Rejecting the null hypotheses implies that investors punish firms for female representation on boards. Insignificant results suggest that shareholders do not value the level of gender diversity on boards in the short term during Covid-19.

2.5 Selected Events

The shock resulting from the Covid-19 pandemic can be classified as exogenous, as it originates from outside the economy. This makes the Covid-19 crisis different from the Global Financial Crisis, sparked by the financial collapse in the banking industry. While the effects on industries can be very different, the independent cause of Covid-19 creates an economic environment where the effects are uncertain. Especially at the pandemic's beginning, implications of lock-downs and health measures were just estimations instead of expectations based on historical events. This paper takes six events in the US between 30 January 2020 and 7 November 2020. The events are selected based on the macroeconomic relevance and relevance for public US companies. The presence of the event's implications has to be certain to assess market behaviour, although not still uncertain on the exact effects.

The first event is on 30 January 2020 and notes the day that the World Health Organisation (WHO) classifies the developments of Covid-19 as a Public Health Emergency of International Concern

(PHEIC). In this paper, it is named as Health Emergency Date (HED). The health warning is the 6th time the WHO has declared such concern since the introduction of the regulation in 2005. The event is selected as investors can be expected to consider their first economic concerns on the US stock market.

The second event is Peak Market Date on 19 February 2020 or PMD. This date is based on Yahoo Finance's historical data of the S&P500. The S&P 500 closed on an all-time high (3.386) on this date, whereas it also marks the day before a substantial decline due to Covid-19 concern among investors. This sell-off ended on 23th of March 2020, closing the S&P500 index at 2.237, a 33% decline compared to PMD. The event was selected to capture investors' initial reaction when financial markets expressed severe concerns about Covid-19.

The third event is the Pandemic Start Date on 11 March 2020 or PSD. This event marks the date WHO officially declares the Covid-19 developments a pandemic. This significant increase of concern regarding the HED officially marks the pandemic's start and is an exogenous shock to investors and public US firms.

The fourth event is the Peak Unemployment Date on 11 May 2020, or PUD. The date includes the first trading day (Monday) after the publication of the US Bureau of Labor Statistics on May 8th 2020 (Friday). The unemployment rate in April 2020 reached a record high of 14.7% as a result of the Covid-19 pandemic and measures to control it, as described by the U.S. Bureau of Labor Statistics (2020, May 13). The unprecedented level of unemployment ripples through the US economy and is the reason for selecting the event. Female leadership could impact the reaction to labour shortages.

The fifth event is the Recession Start Date on 8 June 2020 or PSD. Another important date at the pandemic's start is when the National Bureau of Economic Research (NBER) declares the US economy in its first recession since June 2009 (NBER; June 8, 2020).

The sixth event is the Joe Biden Date on 7 November 2020, or JBD. This is the date Joe Biden is officially declared president of the United States. Generally, presidential elections are significant political moments which much economic relevance. Additionally, this date is chosen because of the contrasting perspective on Corona by Joe Biden's predecessor Donald Trump and Biden's proactive political standpoint on gender equality (Biden for President, 2020).

Concluding, the six events described above are selected based on their macroeconomic relevance and their occurrence during the start of the Covid-19 pandemic. Later events are not included as investors possibly perceive and respond differently to Covid-19 events over time. The first events in the eight months are selected to capture a pure market reaction. All events force firms to respond to and anticipate the Covid-19 developments. The impact of female directors can be captured by analysing the abnormal returns of investors around these dates. As the events impact the economy, gender differences in boards might be valued differently in markets.

3. Data and Methodology

In the next part, the data collection and variables used in the quantitative methods are discussed. Part 3.1 describes what criteria data for firms' boards and directors are selected. Part 3.2 elaborates why certain variables are considered when analysing the relations between corporate governance and firm performance. Part 3.3 contains the descriptive statistics of the sample set. Lastly, 3.4 demonstrates the regression models and regression specifications.

3.1 Data Collection

To establish possible relations between the gender diversity of boards and the performance of firms, firm and stock data is collected from ISS Directors, Compustat, CRSP, and Fama-French Portfolios and Factors database. The whole sample used for this study exists of US directors and firm data between 2016 and 2020. The main focus is firm performance during the pandemic in 2020. However, the firm characteristics in 2016-2019 are used for comparison.

Director details are collected from the Institutional Shareholder Services – Directors database (ISS – Directors, formerly RiskMetrics) for governance data and include yearly data on directors at S&P 1500 companies in the US. As director data is only available for the S&P 1500 companies, merging director and firm data will exclude firms outside the S&P 1500. Director variables include gender, age, tenure, company, committee memberships and board seats at other companies. The ISS Directors database has been widely used to research gender relations within governance (e.g. Adams & Ferreira, 2009; Chen et al., 2019). The initial sample includes 85,422 unique directorships between 2015 and 2020. Aggregated director observations are used to construct yearly board data per firm.

Furthermore, firm data is retrieved from the Compustat database and includes quarterly data on US publicly traded firms between January 2015 and December 2020. As the pandemic starts in the first quarter of 2020, the choice of quarterly data is essential. At the moment of this research (Q1 2022), the Covid-19 pandemic is ongoing and reported data on firms is still limited. To assess the relationship between firm variables and daily stock returns in a crisis period, quarterly data can provide a more accurate development of a firm's financial variables for a smaller window than yearly data [add research?]. Director data is only available yearly and is therefore matched with the corresponding quarters each year.

Companies in the S&P 1500 reporting in Canadian Dollars are excluded. Financial firms are excluded as they use significantly different performance metrics and are have systematically different boards due to intense financial regulation (Baysinger & Zardkoohi, 1986; Subrahmanyam, Rangan & Rosenstein, 1997). Firm observations are excluded if they miss financial data for the variables sales, assets, return on assets (ROA), return on equity (ROE), Tobin's Q and market capitalisation.

Additionally, stock data for US companies in 2020 is collected from the CRSP database. This data is first merged with data from the Fama-French Portfolio and Factors database, sourced from the Kenneth R. French - Data Library at Dartmouth (2022). The data includes the factor loadings used for calculating abnormal returns. Besides a company's covariance with the market, the factors also include the exposure of firms with market perceptions on size differences, Small Minus Big, and growth captured in high vs low book-to-value ratios (High Minus Low). This method is based on the research of Fama and French on categorial variation in stock and bond return (1983). The abnormal return of a company's stock differs from the historically expected return based on the assigned factor loadings.

The events used in this study are all in 2020. In this year, the Covid-19 virus started to make a global impact and reached the US in January 2020. Six days have been selected based on their relevance to the US economy. Their general relation to the US economy offers an exogenous effect to firms, making the event statistically suitable to capture market perceptions. The event study is focused on six days in 2020. The first event date is the declaration of a Health Emergency by the WHO on January 30 2020 (HED), followed by the day which notes, at the time, the peak of the S&P 500, 19 February 2020 (Peak Market Date or PMD). The third event is the start of the pandemic, marked by the official pandemic declaration of the WHO on 11 March 2020. The fourth and fifth events are the unemployment publication date by the Bureau of Labour Statistics in the US, 11 May 2020, and the start of the first US recession in 11 years, 8 June 2020, denoted as PeakUnemploymentDate (PUD) and RecessionStartDate (RSD), respectively. Lastly, the day where Joe Biden is officially declared President of the United States of America is used as JoeBidenDate (JBD) on 7 November 2020.

3.2 Variable definitions

This research uses three main explanatory variables. First, FemaleRatio, which is the % of female directors relative to board size. Second, Min3FDs is a dummy variable which is 1 for boards that have at least three female directors (FDs) on the board per year, and 0 otherwise, based on governance research by Kramer et al. (2006). Lastly, FemaleCEO is a dummy variable which is 1 for boards that have a female CEO, and 0 otherwise.

Moreover, gender is captured in the dummy variable FemaleDummy, which equals 1 if the director is female, and 0 otherwise. For FemaleCEODummy, the dummy variable equals 1 if the director is female and the company's CEO. Tenure is calculated as the number of years since the director has started on the board. The variable CommitteeMember denotes 1 if a director is a member of an audit, nomination, compensation or corporate governance committee, and 0 otherwise. A director is classified as busy if they are attending three boards or more simultaneously, measured by the dummy variable BusyDirector. According to the ISS- Directors database, directors are perceived as independent if they have no family or (historical) business relationship with the firm. A dummy variable equals 1 for directors classified as independent, and 0 otherwise. The ISS – Directors database provides data on directors who have attended less than 75% of the board meetings in a year.

Next, the director level observations are used to construct board variables per firm and year. For Age, Tenure, FemaleDummy, CommitteeMember, IndepDir, BusyDirector and AttendanceProblem, the average of the variable per board per year is calculated to obtain firm-level variables. FemaleCEO is now a dummy variable equal to 1 if the board holds a female CEO, and 0 otherwise. OnlyOneFemale is a dummy variable equal to 1 if only one female director sits on the board, and 0 otherwise. This variable is commonly used in gender-governance research, such as Adams & Ferreira (2009) and [RESEARCH]. Other boards seats (OBS) per director is calculated as the average of other board seats per director. The variables OBSbyMaleDirectors and OBSbyFemaleDirectors are constructed with the same approach. However, they are split by gender.

Lastly, several firm characteristics are constructed and used as control variables. LnSales is calculated as the natural logarithm of a company's total sales in a specific quarter. Return on assets (ROA) equals quarterly net income divided by the total assets at the end of the quarter. Return on equity (ROE) is calculated as net income divided by shareholder's equity per quarter. Leverage is long-term debt divided by total assets. Tobin's Q is the market value of the company at the end of the quarter divided by total assets reported in the same quarter. The market value equals the sum of total assets and the market capitalisation minus the book value of shareholders' equity.

3.3 Descriptive Statistics

Table 1 shows the summary statistics for the sample divided into two periods: 2016-2019 and 2020. Over the past years, female representation at executive levels has been growing (Fortune, 2021). My sample shows in Panel A that 98.4% of boards include at least one woman in 2020. There is a notable difference with the 89.5% recorded in US boards' 2016-2019 statistics (Panel B). Earlier research by Adams and Ferreira (2009) presented statistics on a sample of US boards and only found 61% of boards having any female director from 1996-2003. This trend shows that public firms and boards are engaged in more diverse environments than before. A critical development for gender diversity in boards and research into governance is the increase of firms having more than one female director. Adams & Ferreira conducted research with a sample from 1996 – 2003 and noted a huge percentage difference between companies with just one female director and companies with more than one female director. A phenomenon marked as tokenism (Branson, 2006; Bourez, 2005). In this context, tokenism is using a single female director due to increasing diversity levels and less to the extent of hiring capable directors. Furthermore, as gender diversity has received more attention since the data of Adams & Ferreira (2009), this trend is reflected in the statistics of my sample. In 2020 (2016-2019), 98.4% (89.5%) of public US companies have female directors, whereas only 18.2% (32.1%) of those companies have just one FD. In comparison with Adams and Ferreira (2009), 61% of companies have female directors, but in contrast, 66% of those companies have just one. The inclusion of female directors is also well reflected in the average percentage of FDs (FemaleRatio), which is 25.6% (19.5%) in 2020 (2015-2019) versus 8.5% in 1996-2003 (Adams & Ferreira, 2008).

The average board size for companies in this sample is 9.4 (9.3) directors in 2020 (2016-2019). In both windows, these directors are approximately 62 years old and have been at the board over eight years, on average. In 2020 (2016-2019), 81.2% (81.7%) of the board consists of independent directors, with 61.3% (75.7%) of all directors in a board being a committee member too. Based on this sample includes less committee memberships per director in 2020 than the three years before, while the size has not changed substantially. On average, female directors have more other boards seats in 2020 (0.93 seats per FD) compared to male directors (0.70 seats per director). Serving in multiple boards could be a distraction in times of crises. The average AttendanceProblem per board is low, with 0.4% being the board percentage of directors marked as attending less than 75% of board meetings the previous year.

The performance of the companies the directors govern has decreased in 2020 compared to the period before. Return on assets has decreased from 5% in 2016-2019 to 2.9%. Return on equity lowered from 11.1% to 6.1% in 2020. Leverage increased from 26.2% to 29.9% in the year of the pandemic. Both trends are understandable as Covid-19 had a strong negative impact on the economy and levels of uncertainty, lowering profitability and increase debt levels to ensure liquidity and business continuity on the short term. The average abnormal returns (AAR) around the events in a [-20d,+20d] window are presented in Figure 2 (Appendix) for firms grouped by Min3FDs and FemaleCEO. Overall, the AAR of the groups do not have strong diverging patterns. This could make it more difficult to establish strong results on the groups discrepancies.

Lastly, the pair-wise correlations are presented in Table 8 (Appendix). The correlations are considered to detect any relationships between the included variables and prevent biased effects in the regressions. The table presents strong correlation for pairs which ought to be correlated. Besides being strongly correlated with each other (0.524), the variables FemaleDirectors and FemaleInBoard are strongly correlation with FemaleRatio too. The number of FDs in the board is also strongly correlated with BoardSize. Furthermore, the size of the board moves together with size of the company (0.580), captured in the variable LnSales. Based on this table, the variables for female representation do not appear to be correlation with return (ROA) and market valuation (TobinsQ). Only moderate correlation is found for the number of FDs (FemaleDirectors) and LnSales.

Table 1: Summary Statistics

All variable data are from 2016-2019 (Panel B) and 2020 (Panel A), and include US-listed S&P 1500 firms, but exclude financial firms. Statistics on the whole period is provided in the Appendix, Table 7. FemaleRatio is the percentage of female directors relative to total board size. Min3FDs is a dummy variable, which equals 1 if at least three female directors sit on a board, and 0 otherwise. FemaleCEO is a dummy variable, which equals 1 if a firms' CEO is female. All variable definitions and sources are provided in Appendix, Table A. Continuous variables are winsorised at the 5% level.

Panel A: 2020	**N**	**Mean**	**SD**	**Min**	**Max**
LnSalesYearly	1118	7.757	1.447	4.392	10.731
ROA Year	1118	.029	0.075	-.123	.16
ROE Year	1118	.061	0.267	-.561	.638
Leverage	1112	.299	0.179	0	.728
TobinsQ	1118	2.368	1.601	.826	6.936
FemaleRatio	1118	.256	0.099	0	.455
Min3FDs	1118	.436	0.496	0	1
FemaleCEO	1118	.112	0.315	0	1
FemaleDirectors	1118	2.443	1.115	0	5
OnlyOneFemale	1118	.179	0.383	0	1
FemaleInBoard	1118	.984	0.126	0	1
BoardSize	1118	9.352	1.831	6	13
Age	1118	62.323	3.398	55	69.714
Tenure	1118	8.321	3.514	2.25	17.667
BoardIndependenceRatio	1118	.817	0.095	.556	.917
AttendanceProblem	1118	.004	0.019	0	.1
CommitteeMemberRatio	1118	.613	0.170	.3	.909
OtherBoardsPerDirector	1118	.768	0.413	0	1.75
OBSbyMaleDirector	1118	.703	0.428	0	1.75
OBSbyFemaleDirector	1118	.93	0.742	0	3
Total Compensation	1053	235.82	74.427	86.059	434.884
Cash Compensation	1053	87.232	32.778	22.5	163.833
Non-Cash Compensation	1053	147.605	66.292	22.672	346.878
Non-Cash Comp. Ratio	1051	.595	0.137	.19	.875
Panel B: 2016 - 2019	**N**	**Mean**	**SD**	**Min**	**Max**
LnSalesYearly	4326	7.742	1.469	4.392	10.731
ROA Year	4326	.05	0.064	-.123	.16
ROE Year	4326	.111	0.223	-.561	.638
Leverage	4303	.265	0.180	0	.728
TobinsQ	4326	2.18	1.339	.826	6.936
FemaleRatio	4326	.195	0.109	0	.455
Min3FDs	4326	.259	0.438	0	1
FemaleCEO	4326	.096	0.295	0	1
FemaleDirectors	4326	1.875	1.156	0	5
OnlyOneFemale	4326	.287	0.452	0	1
FemaleInBoard	4326	.895	0.306	0	1
BoardSize	4326	9.273	1.856	6	13
Age	4326	62.33	3.412	55	69.714
Tenure	4326	8.664	3.582	2.25	17.667
BoardIndependenceRatio	4326	.812	0.097	.556	.917
AttendanceProblem	4326	.004	0.019	0	.1
CommitteeMemberRatio	4326	.757	0.130	.3	.909
OtherBoardsPerDirector	4326	.795	0.436	0	1.75
OBSbyMaleDirector	4326	.763	0.450	0	1.75
OBSbyFemaleDirector	4326	.833	0.803	0	3

Total Compensation	4256	233.407	75.869	86.059	434.884
Cash Compensation	4256	88.779	30.679	22.5	163.833
Non-Cash Compensation	4256	143.934	67.264	22.672	346.878
Non-Cash Comp. Ratio	4252	0.582	0.133	.19	.875

3.4 Methodology

The main goal of this paper is to capture the effect of investors on gender diverse governed companies in the US during the worldwide Covid-19 crisis. The approach includes several models. The paper will start with a univariate analysis to detect any differences between firms that hold a diverse board and firms which do not. Additionally, an event study with a regression analysis will be conducted to isolate possible relationships between board diversity and firm value. Lastly, several cross-sectional regression analyses will be conducted to define any relationships further.

Firstly, the univariate analysis will be done using a two-sample Welch t-test. A two-sample t-test effectively tests if the difference of means between two groups is significantly different from zero. Using the Welch type of t-test is appropriate as the sample sizes between the group of diverse firms are unequal (Welch, 1947). Where a Student's t-test is often used, I follow Declare, Lakens and Leys (2017) and Welch (1947) in their statistical papers on the use of t-tests in research. To use the Student t-test, underlying assumptions of normality and variance make the test effective (Student, 1908). However, these assumptions do not hold for my sample, where the Welsch t-test is a strong alternative as it remains robust compared to the Student t-test. The analysis will include the firm observations in 2020 and compare diverse firms on financial performance during the Covid-19 pandemic. Differences in means will be tested for the firm financial variables; LnSales, ROA, ROE, Leverage Tobin's Q, and firm governance variables; BoardSize, Age, Tenure, OtherBoardsPerDirector, BoardIndependenceRatio and TotalCompensation. The univariate analysis contributes to answering the research questions by possibly highlighting statistically significant differences in firms with a higher degree of gender diversity on their board. However, besides offering a clear comparison of groups, the results of this test will not be sufficient on their own to accept new economic relations. The following model is used for t-tests;

(1)

$$t = \frac{\overline{X_1} - \overline{X_2}}{\sqrt{s^2_{\overline{X_1}} + s^2_{\overline{X_2}}}}$$

$$\text{with } s_{\overline{X_1}} = \frac{s_i}{\sqrt{N_i}}$$

- t is the t-statistics
- $\overline{X_i}$ is the mean of sample i
- $s_{\overline{X_1}}$ is the standard error of sample i
- N_i is the total number of observations of sample i

Following is an event study to analyse the market reaction due to new information available. An event study is a suitable method based on research to assess the isolated relation of market efficiency to companies' valuations (Arya & Zhang, 2009; Boehmer, 1991). The two main event windows are set on [-1d,+1] and [-3d,+3d] to investigate direct market implications during the selected events. For both these windows, cumulative abnormal returns are calculated per company. In assessing abnormal stock performance, I follow the methods of Fama and French (1993), using the Fama-French Three-Factor model (FF3F). This model is an extension of the well-known CAPM model. It uses additional coefficients for the exposure of the stock to market behaviour and the stock's relative characteristics in company size (SmallMinusLarge factor) and book-to-market ratios (HighMinusLow factor). To capture company-specific drivers of stock value, stock performance has to be segregated from market performance. The daily return will be benchmarked against the expected return to compare the stock's performance. These expected returns are empirically calculated per day and based on 281 trading days before the event date. The expected return is calculated using model (2.1):

(2.1)

$$E(R)_{i,t} = \alpha + rf_t + \beta_{m,i}\left(R_{m,t} - rf_t\right) + \beta_{s,i}\,SMB_t + \beta_{h,i}\,HML_t + \varepsilon_{i,t}$$

- $E(R)_{i,t}$ is the expected return of stock i on trading day t
- rf_t is the risk-free rate at trading day t
- $\beta_{m,i}$ is market beta of stock i
- $(R_{m,t}$- $Rf_t)$ is the market premium at trading day t, calculated as market return minus the risk-free rate
- $\beta_{s,i}$ is the exposure of stock i in relation to small-to-large company factor loading (SMB)
- SMB_t is the historical factor loading for small-to-large companies on trading day t
- $\beta_{h,i}$ is the exposure of stock i in relation to high-to-low book-to-market ratio factor loading (HML)
- HML_t is the historical factor loading for high-to-low companies on trading day t
- $\varepsilon_{i,t}$ is the error term for stock i at trading day t

Abnormal return is the difference between actual and expected stock performance per day. In the event study, the sum of abnormal returns is used to capture the abnormal performance of companies within an event window. Abnormal returns are calculated using model (2.2):

(2.2)

$$Abnormal\ Return_{i,t} = R_{i,t} - E(R)_{i,t}$$

- $Abnormal\ Return_{i,t}$ is the abnormal return of stock i on trading day t
- $R_{i,t}$ is the actual return of stock i on trading day t
- $E(R)_{i,t}$ is the expected return of stock i on trading day t

The Cumulative Abnormal Return is the sum of abnormal returns on all days within the event window and calculated with the model (2.3):

(2.3)

$$CAR_i = \sum_{t=1}^{T} Abnormal\ Return_{i,t}$$

- CAR_i is the cumulative abnormal return of stock i in a specified event window
- $Abnormal\ Return_{i,t}$ is the abnormal return of stock i on trading day t
- *T* is the total number of days in the specified event window

As CARs are estimated per company for each event window, the variable can now be used to find relationships in deviating stock performance and company characteristics. To analyse the effect of gender-diverse boards on abnormal stock performance, I regress three different gender variables on the CAR. Several control variables are added to increase model robustness and can generally be categorised as financial performance and governance variables. Industry-specific effects are captured in dummy variables. The model uses industry clustered variances for robustness. The full model used in this research is specified in the following regression (3):

(3)

$$\begin{aligned} CAR_i = \beta_0 + \beta_1\, GenderVariable_i + \beta_2\, Leverage_i + \beta_3\, ROA_i + \beta_4\, LnSales_i + \beta_5\, TobinsQ_i \\ + \beta_6\, AgeBoard_i + \beta_7\, Tenure_i + \beta_8\, OtherBoards_i + \beta_9\, BoardIndependence_i \\ + i\,.SIC\ Industry + vce \end{aligned}$$

- CAR_i is the cumulative abnormal return of stock *i* in the specific event window
- *GenderVariable* is one of three selected gender variables: FemaleRatio, Min3FDs and FemaleCEO
- *i.SIC Industry* are the dummy variables per industry
- *vce* is the robust error clustered by industry

4. Results

This part contains the results from the different models denoted in Section 3.4. The main explanatory variables in the models are FemaleRatio, Min3FDs and FemaleCEO. The section will start with a univariate analysis to find discrepancies between diverse and less diverse firms. Following, to examine the relationship between female directors and the stock performance during the pandemic, CARs of Covid-19 related event windows are investigated. Lastly, several extensions of this analysis will include interaction terms to research cross-sectional relationships between female representation and firm related characteristics.

4.1 Univariate analysis

The univariate results are presented in Table 2. This table includes two-sample Welch t-tests on the main variables used in the event study. The test determines if the difference between groups is significantly different from zero. Table 2 presents three panels for the main explanatory variables, Min3FDs and FemaleCEO. FemaleRatio is not used as no group distinction can be made with a ratio, but replaced by a dummy variable MedianFemaleRatio, denoting 1 of the board has an above median FemaleRatio.

Regarding the two-sample t-test of difference in means by Min3FDs in Panel A, firms with at least three Female Directors (FDs) show substantial differences between all variables except ROA_Year and TobinsQ. Firms meeting the Critical Mass had more total sales in 2020 and, on average, used more debt to finance operations (Leverage). In turn, the relative higher level of debt lowers the relative level of shareholders' equity, which relates to the statistical difference in ROE_Year. These firms also have larger boards, which increases the possibility of meeting the Critical Mass, and their directors are slightly younger and have been sitting 1.2 years less on their boards than firms with two FDs or less. On average, directors are busier at firms with at least three FDs, although the total compensation is significantly higher. These findings align with the literature as larger companies attract more female directors than smaller companies while offering higher salaries. The fact that these firms are busier can be explained by the research by Adams and Ferreira (2009), as they show that the scarcity of female directors leads to a higher average of other board seats per FD.

Additionally, Panel B presents the results for groups segregated by the FemaleCEO dummy. In contrast with Min3FDs, the number of observations is strongly unbalanced, as CEO positions for females are more limited compared to director positions. Compared to the Min3FDs results, fewer variables are significantly different between the groups. However, the significant differences hold the same signs as differences in Panel A. Important to note are the more minor differences between the groups compared with Min3FDs, except for age. Firms with female CEOs have a higher average for LnSalesYearly, BoardSize, OtherBoardsPerDirector, BoardIndependence in 2020 than firms with male

CEOs. An interesting difference with the Min3FDs results is that directors are not getting paid more if a female CEO is in charge, but having at least three FDs on the board suggests a higher average total compensation. However, in governance research, it is difficult to entirely allocate the difference in total to the Critical Mass of three FDs as many factors determine total compensation.

Following, Panel C present the results on an adjusted variable, measured as the median of the FemaleRatio. Splitting firms by median enables the data to be compared by group, with MedianFemaleRatio denoting 1 if the board observation of FemaleRatio is above the median of the whole sample and 0 otherwise. The median for FemaleRatio for 2016-2020 is 0.22, or 22% is the average percentage of female directors in all board observations. Further, just two variables tested are not significantly different, being the return variables ROA and ROE. This suggests that the firms in each group do not outperform each other. However, firms with above-median FemaleRatio appear to be smaller (-1.101 LnSales, 1%), have higher leverage (+2.6% Leverage, 5%), and are perceived with higher potential (+0.158 TobinsQ, 1%). Additionally, the directors on the boards of firms with above-median FemaleRatio are sitting on larger boards (+0.614 BoardSize, 1%), are younger (-1.008 Age, 1%), sit fewer years at the board (-1.381 Tenure, 1%) and are busier with other boards than firms with below-median FemaleRatio (+0.168 OtherBoardsPerDirector, 1%). The split by female directors is significant between groups, and FDs are sitting on boards governing firms with different financial and board characteristics. This contributes to investigating the effect of FD and firm differences.

Concluding, this analysis offers a straightforward comparison of several firms and board characteristics. The differences between firms with three or more FDs, a female CEO and above median FemaleRatio are distinctive and significant. These first results are in line with the literature and according to expectations. To conclude any hypotheses would be too early as many governance relationships know endogeneity.

Table 2: Welch t-tests of firms 2020

Comparison of firms split by three female variables. Panel A is grouped by Min3FDs, Panel B by FemaleCEO, and Pancel C by MedianFemaleRatio. Observations include US-listed S&P 1500 firms but exclude financial firms. Variable definitions can be found in the Appendix, Table A. Min3FDs is a dummy variable, which equals 1 if at least three female directors sit on a board, and 0 otherwise. FemaleCEO is a dummy variable, which equals 1 if a firms' CEO is female. MedianFemaleRatio is a dummy variable, which equals 1 if a board's FemaleRatio is higher than the median FemaleRatio of the whole sample (2016-2020), and 0 otherwise. LnSalesYearly is the natural logarithm of the total sales in 2020. ROA_Year is the net income divided by total assets in 2020. ROE_Year is net income divided by total shareholder's equity. Leverage is the long term debt divided by total assets. TobinsQ is the company's market value, calculated as total assets plus market capitalisation minus shareholder's equity, divided by total assets. BoardSize is the total number of directors on the board per year. Age is the average age on the board. Tenure is the average time a director sits on the board. OtherBoardsPerDirector is the average number of other boards per director. BoardIndependenceRatio is the percentage of directors who are classified as independent. TotalCompensation is the average total compensation per director in thousands of US dollars, including cash and non-cash compensation. Welch T-tests are conducted to test for differences in means. Continuous variables are winsorised at the 5% level. ***, ** and * indicate significance at the 1%, 5% and 10%, respectively.

	Mean		Difference	Observations	
Panel A: Min3FDs	Firms with less than 3 FDs	Firms with at least 3 FDs		<3 FDs	≥3 FDs
LnSalesYearly	7.264	8.382	-1.118***	622	482
ROA Year	0.027	0.034	-0.007	622	482
ROE Year	0.046	0.083	-0.037**	622	482
Leverage	0.278	0.326	-0.048***	617	481
TobinsQ	2.357	2.413	-0.056	622	482
BoardSize	8.581	10.348	-1.768***	622	482
Age	62.685	61.839	0.846***	622	482
Tenure	8.845	7.643	1.202***	622	482
OtherBoardsPerDirector	0.673	0.884	-0.21***	622	482
BoardIndependenceRatio	0.796	0.844	-0.046***	622	482
TotalCompensation	224.184	248.877	-24.693***	575	464
	Mean		**Difference**	**Observations**	
Panel B: FemaleCEO	Firms without female CEOs	Firms with female CEOs		Without	With
LnSalesYearly	7.691	8.238	-0.547***	980	124
ROA Year	0.030	0.036	-0.007	980	124
ROE Year	0.060	0.085	-0.026	980	124
Leverage	0.298	0.303	-0.005	975	123
TobinsQ	2.380	2.393	-0.013	980	124
BoardSize	9.287	9.871	-0.584***	980	124
Age	62.364	61.931	0.432	980	124
Tenure	8.417	7.556	0.861***	980	124
OtherBoardsPerDirector	0.749	0.893	-0.144***	980	124
BoardIndependenceRatio	0.814	0.842	-0.028***	980	124
TotalCompensation	233.897	245.282	-11.386	919	120
Panel C: Median FemaleRatio *(Median = 0.22)*	**Mean**		**Difference**	**Observations**	
	Firms below median	Firms above median		< Median	>median
LnSalesYearly	7.949	6.848	1.101***	907	197
ROA Year	0.026	.033	-.007	466	638
ROE Year	0.053	.069	-.015	466	638
Leverage	0.283	.309	-.026**	463	635
TobinsQ	2.290	2.448	-.158***	466	638
BoardSize	8.998	9.611	-.614***	466	638
Age	62.898	61.89	1.008***	466	638
Tenure	9.117	7.736	1.381***	466	638
OtherBoardsPerDirector	0.668	.836	-.168***	466	638
BoardIndependenceRatio	0.793	.835	-.042***	466	638
TotalCompensation	223.715	243.001	-19.287***	434	605

4.2 Baseline results

Table 3 present the OLS regressions baseline results of the main explanatory variables on CARs with windows [-1d, +1d] and [-3d, +3d]. To account for industry differences, all baseline models include industry dummies. The CARs are summed abnormal returns within windows and noted in ratio to 1. The coefficients are the average estimated effect on the abnormal returns in the specified window in absolute numbers.

4.2.1 FemaleRatio

Overall, the percentage of female directors on the board does not seem to affect abnormal returns during the Covid-19 events. In the [-1d,+1d] window, only at the official start of the pandemic (PSD) significant negative results have been found (10% level). This coefficient suggests a 5.5 percentage point lower cumulative abnormal returns in the [-1d,+1d] window for companies with 100% female directors on the board compared to those without female directors. This estimation is not in line with expectations and combined with the other event coefficients in this window, I cannot reject the null hypothesis for Hypothesis 1. The significance in Event 3 does not hold for the [-3d,+3] window (Table 3, Panel B). However, in this window, a significant positive result for FemaleRatio is found for Event 2 (PMD suggests a 2.5 percentage point increase (significant at the 5% level) for companies with complete female directors when the market was at the highest level (PMD) before the crash. While other coefficients in the [-3d,+3d] windows are insignificant, the Event 2 coefficient is in line with Hypothesis 1, where outperformance for companies with a higher female board representation is expected. For the [-1d, +5d] window presented in Table 9, a significant estimation of 1.9 percentage point decrease has been found if FemaleRatio would be 1 at Event 5 (RSD), significant at the 5% level.

4.2.2 Min3FDs

The results of models using Min3FDs presented in Table 3 suggest similar patterns as FemaleRatio. As both variables are positively related to the number of female directors on the board, these similarities are expected. The dummy variable for minimal 3 female directors only finds a significant relation, at the 10% level, in the first event (HED). The model suggests a 0.4 percentage point decrease in cumulative abnormal returns for the [-1,+1] window when the WHO declared the increasing outbreak of Covid-19 cases an international health concern. This means that companies with less than three female directors on the board experience better stock returns. No significant results are found for other coefficients in the [-1,+1] window. In line with the significant coefficient for FemaleRatio in the [-3,+3] window, Event 2 suggests a positive relationship between having a minimum of three female directors and the cumulative abnormal return around the peak of the market (PMD), significant at the 10% level. The baseline model shows a 0.4 percentage point increase in CAR for companies meeting the female threshold on their boards. Unfortunately, the extended window [-1d,+5d]

(Table 9) does not have any existing relationships in the baseline models for Min3FDs. Overall, the Critical Mass of three female directors based on research by Kramer et al. (2006) cannot be associated with immediate market behaviour for the Covid-19 events. Therefore, I will not reject the null hypothesis of Hypothesis 2: '*Having a minimum of three female directors on the board is positively related to firm value'*.

4.2.3 FemaleCEO

As the previous variables are closely related and investigate the relationship of the level of females on the boards, models including the FemaleCEO variable are focused on female leadership in the Covid-19 crisis. Overall, these results are more in line with the hypotheses, although most coefficients are not found to be significant. As positive relations between female leadership and stock performance are expected, FemaleCEO has the appropriate signs for the baseline estimations. Unfortunately, only two coefficients are significantly different from zero. This is in contrast with FemaleRatio and Min3FDs, as most estimated signs are negative, independent of significance levels. For the [-1,+1] window, positive estimations are established between firms with female CEOs and the abnormal return in Events 5 and 6, significant at 5% and 10%, respectively. The baseline model for Event 5 (RSD) reports a 0.6 percentage point increase in abnormal returns for female-led companies. In the case of Event 6 (JBD), a 0.4 percentage point increase is found on the days around the announcement of Joe Biden as US President. Two events find a significant relationship with CAR for the extended window [-1d, +5d]. Event 1 (HED) shows a 0.6 percentage point increase for companies with a female CEO, significant at the 1% level. For Event 6 (JBD), a 1.0 percentage point increase is found if the CEO is a woman, significant at the 10% level.

Overall, the market seems to value stocks more in the days after some events if the company is female-led. However, there is a difference in market behaviour depending on the selected events. The events at the beginning of the Covid-19 pandemic, Event 1 (HED) and Event 2 (PMD) find positive relations in the baseline model for the [-3d,+3d] window. This cannot be concluded for the smallest window [-1d,+1d]. The CAR calculated on the extended window, only finds a significant relationship for Event 1 (HED).

Table 3: Baseline cumulative abnormal return regression results.

Female board representation and cumulative abnormal returns. The dependent variable is CAR for all events. CAR in Panel A and B is accumulated in the [-1d,+1d] and [-3d,+3d] windows, respectively. All events and variable data are from 2020 and include US-listed S&P 1500 firms, but exclude financial firms. FemaleRatio is the percentage of female directors relative to total board size. Min3FDs is a dummy variable, which equals 1 if at least three female directors sit on a board, and 0 otherwise. FemaleCEO is a dummy variable, which equals 1 if a firm's CEO is female. All event and variable definitions are provided in Appendix, Table A. Industry dummy variables are included in all baseline models. Continuous variables are winsorised at the 5% level. Robust standard errors are in parentheses. ***, ** and * indicate significance at the 1%, 5% and 10%, respectively.

Panel A: [-1d,+1d] CAR	Event 1 HED	Event 2 PMD	Event 3 PSD	Event 4 PUD	Event 5 RSD	Event 6 JBD
FemaleRatio	-.011	.009	-.055*	-.017	-.002	-.01
	(.009)	(.013)	(.027)	(.012)	(.009)	(.021)
Constant	.027***	-.069***	-.09***	-.01***	-.015***	.019***
	(.002)	(.002)	(.005)	(.002)	(.002)	(.004)
Observations	1040	1030	1030	1033	1034	1040
R-squared	.022	.045	.069	.105	.036	.019
Min3FDs	-.004*	.001	-.013	-.001	-.002	.002
	(.002)	(.002)	(.009)	(.003)	(.001)	(.003)
Constant	.026***	-.068***	-.099***	-.013***	-.015***	.016***
	(.001)	(0)	(0)	(0)	(0)	(.002)
Observations	1040	1030	1030	1033	1034	1040
R-squared	.024	.044	.071	.104	.036	.019
FemaleCEO	.002	.004	-.002	.006	.006**	.004*
	(.002)	(.003)	(.007)	(.004)	(.002)	(.002)
Constant	.025***	-.068***	-.099***	-.013***	-.015***	.017***
	(0)	(0)	(0)	(0)	(0)	(0)
Observations	1040	1030	1030	1033	1034	1040
R-squared	.021	.045	.065	.105	.039	.019
Panel B: [-3d,+3d] CAR	Event 1 HED	Event 2 PMD	Event 3 PSD	Event 4 PUD	Event 5 RSD	Event 6 JBD
FemaleRatio	-.019	.025**	-.075	-.022	.006	-.011
	(.018)	(.01)	(.048)	(.025)	(.013)	(.023)
Constant	.042***	-.086***	.149***	-.081***	-.013***	.013**
	(.004)	(.002)	(.008)	(.004)	(.002)	(.005)
Observations	1040	1030	1030	1033	1034	1040
R-squared	.007	.024	.074	.049	.042	.007
Min3FDs	-.002	.004*	-.025	-.001	-.002	-.005
	(.003)	(.002)	(.015)	(.005)	(.002)	(.004)
Constant	.039***	-.082***	.137***	-.085***	-.012***	.013***
	(.001)	(0)	(0)	(0)	(0)	(.002)
Observations	1040	1030	1030	1033	1034	1040
R-squared	.006	.023	.078	.048	.043	.009
FemaleCEO	.006**	.01**	-.019	-.001	.004	.006
	(.003)	(.004)	(.011)	(.009)	(.002)	(.006)
Constant	.038***	-.082***	.137***	-.085***	-.012***	.011***
	(0)	(0)	(0)	(0)	(0)	(0)
Observations	1040	1030	1030	1033	1034	1040
R-squared	.008	.026	.073	.048	.043	.008

4.3 Full model results

Table 4 present the OLS regressions results of the three explanatory and control variables on CARs within the [-3,+3] window. The models include firm and governance control variables. To account for industry differences, all models include industry dummies. Industry dummies are based on

2-digit SIC codes. The CARs are summed returns within windows, and the coefficients are the absolute change in the CAR per unit increase of the associated variable. A coefficient of 1.0 should be interpreted as an increase of 100 percentage points for every unit increase in the independent variable.

4.3.1 FemaleRatio and full models

Table 4.A shows the results of the extended models for the [-1d,+1d] and [-3d,+3d] windows. Besides Event 3 (PSD) and Event 4 (PUD) in the short window [-1d,+1d], no significant relationship between the percentage of female directors and the abnormal returns is found. For the Pandemic Start Date (Event 3), the result suggests a 5.8 percentage decrease for companies having a 100% female board, significant at the 10% level. When unemployment was very high as a result of the pandemic (Event 4, PUD), a decrease of 3.1 percentage points has been found if FemaleRatio would be 1 (10%). As the model and the window are similar for all events, it appears that Event 3 and 4 create a level of market sentiment where the presence of female directors is punished. However, as the significance does no hold for the longer period [-3d,+3d]. In the sample, no board holds only women. Therefore the coefficients for FemaleRatio are not realistic to interpret to the full extent. However, it shows that increased levels of female directors negatively affect stock performance in the very short term. Comparing the results with baseline models, Event 3 (PSD) confirms the negative relationship and Event 4 (PUD) distinguishes the negative relation if control variables are included.

Results of extended models in the [-3d,+3] window are presented in Panel B of Table 4.A. All of the estimated coefficients are insignificantly different from zero. This means that the percentage of females on the board has no relationship to the abnormal stock performance for the extended period. The model loses significance for Events 3 and 4 compared to the [-1d,+1d] window. Compared to [-3d,+3d], the results for the [-1d,+5d] window (Table 9) only diff in the coefficient for Event 5 (RSD), finding a significant negative coefficient of 0.042, significant at the 1% level. This result shows that companies with complete female boards would have a 4.2% percentage point decrease in the CAR calculated mostly after the date when the US economy was declared to be in a recession. Overall, the models including the control variables do not find new patterns for the FemaleRatio in the CARs. The null hypothesis of Hypothesis 1 is not rejected based on these results.

4.3.2 Min3FDs and full models

Further, most of the full models in the event study do not show new results for Min3FDs compared to the baseline models. Besides Event 1 (HED), all coefficients remain insignificant. HED shows a slightly stronger negative relationship between having three female directors and the CAR in the [-1d, +1d] window: a 0.5 percentage point decrease, significant at the 10% level. For the [-3d, +3d] window, the significant coefficient of Event 2 (PMD) does not hold when control variables are included.

However, the results of the extended regression models in the [-1d, +5] window (Table 9) show a new negative coefficient for Event 5 (RSD), significant at the 1% level. This result suggests a 1 percentage point decrease in CARs for companies with at least three female directors when the US is declared to be in a recession. In the baseline model (Table 5), all estimations were not significantly different from zero. Subsequently, these results are not in line with expectations, and with the full results, Hypothesis 2 cannot be accepted.

4.3.3 FemaleCEO and full models

Moreover, in the [-1d, +1d] window, FemaleCEO appears to stay significant on CARs for Events 5 and 6 in the extended models. For Event 5 (RSD), the same 0.6 percentage point increase is expected for female-led companies, after controlling for firm and governance variables, significant at the 5% level. Event 6 (JBD) finds a 0.5 percentage point increase in CAR for companies with a female CEO, significant at the 10% level.

Similar conclusions can be drawn from the full regression models in the [-3d, +3d] window (Table 4). Where the baseline model found significant positive estimates for Event 1 (HED) and Event 2 (PMD), the models including the control variables show another significant coefficient for Event 5 (RSD). FemaleCEO regressed on CAR and controlling for firm and governance variables suggest a 0.6 percentage point increase for HED (10% significance), 0.9 percentage point increase for PMD (5%) and a 0.05 percentage point increase for RSD (5%).

Table 9 presents the same significant coefficients for FemaleCEO regression on CAR in the [-1d, +5d] window in line with different event windows. Event 1 (HED) suggests a 0.6 percentage point increase for women-led companies, significant at 1%. Event 6 (JBD) keeps the same value for the extended regression model, a 1% increase in CAR if FemaleCEO is equal to 1, significant at the 10% level.

The models including control variables establish similar results for the relationship between companies having a female CEO and the cumulative abnormal returns in all windows. These findings are in line with expectations and appear to isolate the positive effect of female CEOs on stock performance. Despite the different events, the results for FemaleCEO on CAR in significantly positive for the [-3d,+3d] window. This leads to the acceptance of the third hypothesis, a positive relationship between female CEOs and firm value in Covid-19. Important to highlight is that it appears that investors do value the leadership of females in certain events, whereas a mixed board is perceived as less valuable in a crisis.

Table 4.A: Extended cumulative abnormal return regression results

Female board representation and cumulative abnormal returns. The dependent variable is CAR for all events. CAR in Panel A and B is accumulated in the [-1d,+1d] and [-3d,+3d] windows, respectively. All events and variable data are from 2020 and include US-listed S&P 1500 firms, but exclude financial firms. FemaleRatio is the percentage of female directors relative to total board size. Min3FDs is a dummy variable, which equals 1 if at least three female directors sit on a board, and 0 otherwise. FemaleCEO is a dummy variable, which equals 1 if a firm's CEO is female. All event and variable definitions are provided in Appendix, Table A. Industry dummy variables are included in all baseline models. Continuous variables are winsorised at the 5% level. Robust standard errors are in parentheses. ***, ** and * indicate significance at the 1%, 5% and 10%, respectively.

Panel A: [-1d,+1d] CAR	Event 1 HED	Event 2 PMD	Event 3 PSD	Event 4 PUD	Event 5 RSD	Event 6 JBD
FemaleRatio	-.016	.006	-.058*	-.031*	-.006	.005
	(.011)	(.013)	(.026)	(.014)	(.013)	(.026)
Constant	.014	-.072**	-.081	-.038	-.012	-.042*
	(.017)	(.022)	(.061)	(.04)	(.011)	(.022)
Observations	1030	1020	1020	1024	1025	1035
R-squared	.043	.053	.091	.123	.061	.068
Min3FDs	-.005*	-.001	-.014	-.005	-.002	.005
	(.002)	(.003)	(.009)	(.004)	(.002)	(.005)
Constant	.01	-.071**	-.101	-.048	-.014	-.04
	(.015)	(.023)	(.055)	(.042)	(.012)	(.025)
Observations	1030	1020	1020	1024	1025	1035
R-squared	.046	.053	.092	.122	.062	.071
FemaleCEO	.002	.004	-.004	.004	.006**	.005*
	(.002)	(.003)	(.006)	(.005)	(.002)	(.003)
Constant	.011	-.07**	-.096	-.046	-.013	-.04
	(.015)	(.022)	(.059)	(.04)	(.013)	(.026)
Observations	1030	1020	1020	1024	1025	1035
R-squared	.041	.054	.087	.12	.063	.07
Panel B: [-3d,+3d] CAR	Event 1 HED	Event 2 PMD	Event 3 PSD	Event 4 PUD	Event 5 RSD	Event 6 JBD
FemaleRatio	-.024	.017	-.062	-.03	.008	0
	(.022)	(.019)	(.042)	(.023)	(.022)	(.029)
Constant	.017	-.108**	.184	.003	.048*	.026
	(.042)	(.046)	(.118)	(.045)	(.025)	(.033)
Observations	1030	1020	1020	1024	1025	1035
R-squared	.015	.062	.101	.073	.069	.04
Min3FDs	-.004	.002	-.023	-.003	-.001	-.003
	(.003)	(.004)	(.014)	(.005)	(.004)	(.005)
Constant	.011	-.103*	.159	-.006	.049	.026
	(.037)	(.046)	(.108)	(.046)	(.031)	(.03)
Observations	1030	1020	1020	1024	1025	1035
R-squared	.015	.061	.104	.072	.069	.041
FemaleCEO	.006*	.009**	-.02*	-.001	.005**	.007
	(.003)	(.004)	(.009)	(.01)	(.002)	(.006)
Constant	.012	-.103*	.168	-.005	.05	.027
	(.038)	(.046)	(.112)	(.045)	(.03)	(.03)
Observations	1030	1020	1020	1024	1025	1035
R-squared	.015	.064	.101	.071	.07	.042

4.4 Cross-sectional analysis of female representation

As results on female representation in boards are still mixed, prior research can be used to investigate further the cross-sectional effect of female directors on firm performance. First, Chen et al. (2009) find significant results in their research on FDs and CEO overconfidence that female directors mitigate CEOs' overconfidence in specific industries. They even conclude that firms with diverse boards performed less bad during the Global Financial Crisis due to female directors and their influence on CEO decision making. The event study will be repeated, including overconfident industries, to measure possible outperformance during the Covid-19 pandemic. Secondly, another relevant angle on diverse boards and firm performance by industry is presented in the paper by Brammer, Millington and Pavelin (2007). They investigate the cross-sectional level of gender and ethnic diversity among UK boards and find significant results on female representation in boards of companies close to the final customers. To capture possible effects suggested in this paper, an additional analysis, including the industries mentioned by Brammer et al. (2007), will capture possible interaction effects. Thirdly, as research found that female directors tend to sit on boards of large companies (Harrigan, 1981; Agrawal & Knoeber, 2001; Carter et al., 2003), an interaction term will be added to investigate if female representation at large firms results in differences in stock performance.

Concluding, the following subsection will discuss an additional analysis of CARs and interaction terms mentioned above, including the three main female variables, overconfidence industries, ClosetoConsumers Industries (CtC) and firm size.

4.4.1 Female representation in Overconfidence Industries

The construction of the CEO overconfidence proxy is known as the 'Moneyness' or 'Holder 67' variable. This proxy is extensively used in papers of Malmendier & Tate (2005; 2008), Chen et al. (2019), and Campbell, Gallmeyer, Johnson, Rutherford & Stanley (2011). In these papers, the proxy of overconfidence is based on how deep in-the-money options CEOs hold when they are still in charge of firms. If CEOs hold exercisable options which are over 67% in-the-money (Holder 67), they are considered overconfident. As Chen et al. (2019) and, Malmendier & Tate (2005) present overconfidence per industry in earlier periods, new 2019 data on the equity rewards for directors in the US is extracted from the ExecuComp database. Average overconfidence levels are calculated for 2016-2019. 2020 is not included as the pandemic could alter the expected level of confidence. The average CEO overconfidence is calculated per industry, based on the Fame-French 12 Industry classification. Overconfidence is a variable equal to 1 if the CEO is classified as Holder 67, and 0 otherwise. To be classified as Holder 67, a CEO has an option portfolio that averages at least 67% in-the-money. The portfolios analysed include exercisable but not yet exercised options. The percentage of in-the-money options is measured in the variable Moneyness. In line with the research (Malmendier and Tate, 2004; Chen et al., 2019), Moneyness is defined in equation (4):

(4)

$$Moneyness_{c,t} = \frac{Share\ price_t}{Share\ price_t - \frac{Total\ realisable\ value_t}{\#\ exercisable\ options\ held_t}}$$

- *Moneyness$_c$* is the percentage of the option portfolio classified as in-the-money, per CEO, at year t
- *Share price* is the share price of the CEO's company at year t
- *Total realisable value* is the aggregated difference between the strike price and the share price at year t
- *# exercisable options* is the total number of options classified as exercisable, but not exercised yet, at year t

The data from ExecuComp provides 3.439 CEO observations from 2016-2019 who hold exercisable options in their portfolio. 3.257 CEOs are male (95%), and 182 are female (5%). CEO observations with no stock data are dropped. CEO compensation packages exist out of several options components with different strike prices. The realisable value is calculated per option component and is the difference between the strike price and the share price, multiplied by the total options held in the component. These values aggregated are the Total realisable value per CEO. The Average Realisable Value per Option (AVRO) is the Total realisable value divided by the total number of exercisable options held by the CEO. This value is the average strike price for the CEO portfolio. Lastly, Moneyness is calculated by the Share price divided by the difference between the Share price and the AVRO (see Equation (4)).

Next, statistics on the average Moneyness and Overconfidence per industry are used to identify industries with overconfident CEOs and presented in Table 11 (Panel A). Industries with average Moneyness of 67% are used as Overconfident Industries (OI). The Fama-French 12 Industry classification is combined with SIC codes from ExecuComp (Appendix Table 10).

Based on the statistics (Appendix Table 11) and the Holder 67 measure, six of 12 industries can be considered overconfident. These are Non-durable Consumer Goods, Business Equipment, Telecom, Healthcare, Money and Other. Average Moneyness per CEO ranges from 72.5% (Non-durable Consumer Goods) to 114.7% (Healthcare), and 75.1% in-the-money across all industries. The average CEO overconfidence in the most confident industries ranges from 35.2% of CEOs in Telecom to 49.7% of CEOs in Bussiness Equipment. Furthermore, the overconfident industries (IO) are used in the interaction terms FemaleRatioXOI, Min3FDsXOI and FemaleCEOXOI. These interaction terms and the OI variable are added for all events to the OLS regression model (3), specified in section 3.4. The extended regressions will be estimated on the [-1d,+1d] and [-3d,+3d] windows. Lastly, despite the new industry classifications, the same SICIndustry dummy variables are used to maintain comparability with the initial CAR analysis. The results of the cross-sectional analysis for overconfidence industries (OI) are presented in Table 5. This table only includes the main independent variables and interaction terms for both windows and no control variables. The full model results, including control variables, are in the Appendix (Tables 12 and 13).

Finally, the results for FemaleRatio do show significant estimations in rare cases. Overall, the interaction variable FemaleRatioXOI is insignificant for most events and windows. However, the interaction term is significantly positive (5%) in Event 1. In the case of an entire female board, the positive coefficient in the model suggests that higher female board representation in Overconfident Industries increases the abnormal returns with a maximal of 4.6 percentage points in the three-day window of the Health Emergency Day event. This effect does not hold for the [-3d, +3d] window. However, in this window, Event 3 shows an extremely high positive coefficient for FemaleRatioXOI of 21.1 percentage points if the board were entirely female. The effect is significant at the 10% level. Event 3 includes the PandemicStartDate, implying that investors on this day valued the presence of female directors, a rare but strong result supporting Hypothesis 1. H1 expects higher female representation to increase firm value. Unfortunately, the implied relation for Event 3 does not hold for Min3FDs and FemaleCEO, as coefficients are insignificant for these interaction terms. For Min3FDs, similar dynamics are suggested regarding Event 1, with a 1 percentage point increase in CAR if the firm has three FDs and is active in OI, significant at the 10% level. However, the relation between Min3FDs and OI and CAR are both negative, and the cumulative magnitude of CAR overshadows the effect of the interaction term. Further, having a female CEO in OI does have a significant positive impact on CARs for Events 2 and 5 (5% level). These results in the [-1d,+1d] window show that the market recognises female leadership at public firms. For the [-3d,+3d] window, the positive relationship for Event 2 (PMD) holds but disappears in the model for Event 5. Interestingly, Event 4 estimation of the interaction term becomes significantly negative, suggesting female leadership around the PeakUnemploymentDate is not appreciated by investors.

Table 5: CAR Extension Overconfidence results

Female board representation and cumulative abnormal returns including overconfidence proxies. This table only presents concise results of the main independent variables. Results including all control variables estimates are provided in the Appendix (Tables 12 and 13). The dependent variable is CAR for all events. CAR in Panel A and B is accumulated in the [-1d,+1d] and [-3d,+3d] windows, respectively. All events and variable data are from 2020 and include US-listed S&P 1500 firms, but exclude financial firms. FemaleRatio is the percentage of female directors relative to total board size. Min3FDs is a dummy variable, which equals 1 if at least three female directors sit on a board, and 0 otherwise. FemaleCEO is a dummy variable, which equals 1 if a firms' CEO is female. OI is a dummy variable, which equals 1 if a company is classified as overconfident (Overconfident Industries), based on statistics presented in Table 11, and 0 otherwise. These three variables are used to construct interaction variables named as 'variable' + XOI. All event and variable definitions are provided in Appendix, Table A. Industry dummy variables are included in all models. Continuous variables are winsorised at the 5% level. Robust standard errors are in parentheses. ***, ** and * indicate significance at the 1%, 5% and 10%, respectively.

Panel A: [-1d,+1d] CAR	Event 1 HED	Event 2 PMD	Event 3 PSD	Event 4 PUD	Event 5 RSD	Event 6 JBD
FemaleRatio	-.042**	.015	-.114	-.035	-.049	.005
	(.015)	(.025)	(.065)	(.021)	(.034)	(.033)
OI	-.02***	.003	-.028	-.015	-.027	0
	(.005)	(.008)	(.02)	(.013)	(.018)	(.006)
FemaleRatioXOI	.046**	-.015	.099	.008	.077	0
	(.015)	(.029)	(.067)	(.023)	(.045)	(.021)
Observations	1030	1020	1020	1024	1025	1035
R-squared	.065	.054	.094	.137	.077	.068
Industry Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes
Min3FDs	-.01**	.001	-.03	-.008	-.009*	.005
	(.004)	(.003)	(.02)	(.007)	(.005)	(.006)
OI	-.012***	0	-.015	-.015	-.013	0
	(.003)	(.004)	(.015)	(.012)	(.011)	(.005)
Min3FDsXOI	.01*	-.003	.029	.004	.013	0
	(.005)	(.005)	(.022)	(.008)	(.007)	(.004)
Observations	1030	1020	1020	1024	1025	1035
R-squared	.068	.054	.099	.136	.075	.071
Industry Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes
FemaleCEO	-.002	-.001	.004	.007*	-.001	.004
	(.004)	(.003)	(.008)	(.003)	(.004)	(.005)
OI	-.009**	-.002	-.001	-.012	-.009	0
	(.003)	(.002)	(.018)	(.01)	(.008)	(.007)
FemaleCEOXOI	.006	.01**	-.017	-.006	.015**	.003
	(.005)	(.004)	(.01)	(.008)	(.006)	(.008)
Observations	1030	1020	1020	1024	1025	1035
R-squared	.057	.057	.088	.134	.073	.07
Industry Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes
Panel B: [-3d,+3d] CAR	Event 1 HED	Event 2 PMD	Event 3 PSD	Event 4 PUD	Event 5 RSD	Event 6 JBD
FemaleRatio	-.038	0	-.182	-.02	-.009	.017
	(.034)	(.038)	(.101)	(.054)	(.04)	(.04)
OI	-.017*	-.012	-.06	-.003	-.016	.011
	(.008)	(.015)	(.037)	(.017)	(.015)	(.009)
FemaleRatioXOI	.024	.03	.211*	-.017	.03	-.029
	(.025)	(.048)	(.106)	(.059)	(.038)	(.031)
Observations	1030	1020	1020	1024	1025	1035
R-squared	.028	.064	.106	.075	.075	.042
Industry Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes
Min3FDs	-.007	.002	-.053	-.002	-.004	-.004
	(.004)	(.006)	(.031)	(.011)	(.003)	(.007)

OI	-.013**	-.004	-.029	-.007	-.011	.004
	(.005)	(.008)	(.023)	(.013)	(.006)	(.004)
Min3FDsXOI	.005	-.001	.053	-.002	.006**	0
	(.005)	(.007)	(.035)	(.012)	(.002)	(.006)
Observations	1030	1020	1020	1024	1025	1035
R-squared	.027	.062	.112	.074	.075	.042
Industry Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes
FemaleCEO	.002	.002	-.032**	.011	.006	.013*
	(.006)	(.002)	(.011)	(.007)	(.006)	(.007)
OI	-.012	-.005	-.01	-.005	-.008	.005
	(.006)	(.006)	(.034)	(.015)	(.007)	(.005)
FemaleCEOXOI	.008	.017**	.025	-.027*	-.003	-.011
	(.008)	(.005)	(.018)	(.013)	(.01)	(.007)
Observations	1030	1020	1020	1024	1025	1035
R-squared	.027	.068	.102	.077	.075	.044
Industry Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes

4.4.2 Female representation in Close-to-Customer Industries

Next to the main analysis and the cross-sectional analysis, including overconfident industries, additional industry segregation will be used to capture gender effects between industries. The paper of Brammer et al. (2007) finds that board diversity differs between industries based on how close they operate to the final customers. They find above-average representation in Retail, Utilities, Media and Banking. As female executives might favour these industries by personal preference, possible stronger relations between FDs and firm performance based on CtC distinction are analysed. For simplicity, the industries found by Brammer et al. (2007) are used as interaction terms on the CARs.

Brammer et al. (2007) industry data has a DataStream ICB industry classification. The authors eventually categorise 13 industries. Due to time limitations, the exact distinction between industries used by the authors and the associated SIC codes in this paper's sample could not be identified. However, the SIC classification can roughly be matched with the industries found in their paper, as Brammer et al. (2007) state this comparison too. For Retail and Media, Retail Trade SIC 2-digit codes 52-59 are used. For Utilities (Utilities) and Banking (Finance, Insurance & Real Estate), 40-49 and 60-67 are used, respectively. The dummy variable CtC is constructed, which is 1 if the 2-digit code is in between any of these ranges, and 0 otherwise. Next, interaction terms FemaleRatioXCtC, Min3FDsXCtC and FemaleCEOXCtC are constructed to include in the regression model (3) specified in section 3.4. The results are concisely presented in Table 6 and extensively in the Appendix (Table 14 and 15)

Following, Table 6 presents the results of this CtC event study. Firms in the CtC industries experience similar effects on their CARs per event, including the three different female variables. These effects would probably depend on the economic implications of those events, as companies in CtC are per definition close to human interaction, something which was of high relevance during the pandemic. Also, the percentage of FDs on the board is generally not significantly related to CAR in both windows.

Event 4 (PUD) shows a significant negative estimation 0.34 for both the [-1d,+1d] and [-3d,+3d] windows. Similar coefficients are found for Event 1 (HED) and FemaleRatio. The estimations for a 100% female board are of large magnitude, as the results suggest a decrease of 3.6 percentage points on the CAR. Another interesting effect is the 0.069 coefficient for FemaleRatioXCtC on the [-1d,+1d] window for Event 6 (JBD), significant at the 5% level. The positive relation around this event suggests that Joe Biden announced as president increased abnormal returns for firms with high female representation active in the CtC industries. In contrast, the CtC dummy variable is significantly negative to CAR around Joe Biden's announcement. Furthermore, Min3FDs do not present relevant coefficients in both windows. The FD Critical Mass (and in the CtC industries) is irrelevant to investors. Regarding the FemaleCEO regressions, it is notable that significant positive coefficients have been estimated in both event windows for three out of six events. However, female CEOs lead to lower CAR in some events as the models find three significant negative coefficients for the interaction term FemaleCEOXCtC across both windows.

Concluding, controlling for ClosetoConsumers industries suggested by Brammer et al. (2007) and female leadership in several forms does not present strong evidence for stronger stock performance through female representation. The CtC industry dummy is relevant to explaining CAR variance, despite including industry dummies. This suggests that abnormal stock returns can be related to sector-wide effects resulting from the events.

Table 6: CAR Extension ClosetoConsumers (CtC) results

Female board representation and cumulative abnormal returns including ClosetoConsumers industry proxies. This table only presents concise results of the main independent variables. Results including all control variables estimates are provided in the Appendix (Tables 14 and 15). The dependent variable is CAR for all events. CAR in Panel A and B is accumulated in the [-1d,+1d] and [-3d,+3d] windows, respectively. All events and variable data are from 2020 and include US-listed S&P 1500 firms, but exclude financial firms. FemaleRatio is the percentage of female directors relative to total board size. Min3FDs is a dummy variable, which equals 1 if at least three female directors sit on a board, and 0 otherwise. FemaleCEO is a dummy variable, which equals 1 if a firms' CEO is female. CtC is a dummy variable, which equals 1 if a company is classified as ClosetoConsumer based on Brammer, Millington & Pavelin (2007), and 0 otherwise. The main female variables are used to construct interaction variables named as 'variable' + XCtC. All event and variable definitions are provided in Appendix, Table A. Industry dummy variables are included in all models. Continuous variables are winsorised at the 5% level. Robust standard errors are in parentheses. ***, ** and * indicate significance at the 1%, 5% and 10%, respectively.

Panel A: [-1d,+1d] CAR	Event 1 HED	Event 2 PMD	Event 3 PSD	Event 4 PUD	Event 5 RSD	Event 6 JBD
FemaleRatio	-.019	-.003	-.038	-.034*	.001	-.011
	(.013)	(.012)	(.028)	(.015)	(.011)	(.025)
CtC	-.012***	.022***	-.055	.012	-.015**	-.027***
	(.002)	(.005)	(.034)	(.008)	(.005)	(.007)
FemaleRatioXCtC	.019	.015	-.025	.002	-.009	.069**
	(.013)	(.018)	(.123)	(.023)	(.014)	(.029)
Observations	1030	1020	1020	1024	1025	1035
R-squared	.045	.067	.104	.124	.067	.073
Industry Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes

Min3FDs	-.005**	-.001	-.008	-.004	-.002	.003
	(.002)	(.004)	(.009)	(.003)	(.002)	(.005)
CtC	-.009***	.027***	-.051**	.015**	-.019***	-.013**
	(.002)	(.002)	(.019)	(.006)	(.003)	(.005)
Min3FDsXCtC	.004	-.002	-.02	-.007	.003	.009
	(.004)	(.003)	(.034)	(.006)	(.002)	(.009)
Observations	1030	1020	1020	1024	1025	1035
R-squared	.048	.067	.108	.124	.067	.073
Industry Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes
FemaleCEO	.003	.006**	.001	.007	.007**	.004*
	(.003)	(.002)	(.004)	(.006)	(.003)	(.002)
CtC	-.007***	.028***	-.064***	.011***	-.019***	-.008***
	(.002)	(.001)	(.005)	(.002)	(.002)	(.002)
FemaleCEOXCtC	-.003	-.01**	-.009	-.01	-.001	.006
	(.004)	(.004)	(.023)	(.006)	(.004)	(.009)
Observations	1030	1020	1020	1024	1025	1035
R-squared	.043	.069	.102	.122	.069	.071
Industry Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes
Panel B: [-3d,+3d]	Event 1	Event 2	Event 3	Event 4	Event 5	Event 6
CAR	HED	PMD	PSD	PUD	RSD	JBD
FemaleRatio	-.036*	.008	-.032	-.034*	.012	-.001
	(.019)	(.022)	(.059)	(.015)	(.024)	(.029)
CtC	-.011	.025***	-.038	.024	.016*	-.029
	(.014)	(.007)	(.035)	(.026)	(.008)	(.022)
FemaleRatioXCtC	.045	.01	-.068	-.005	-.024	.022
	(.048)	(.023)	(.149)	(.076)	(.027)	(.078)
Observations	1030	1020	1020	1024	1025	1035
R-squared	.017	.069	.105	.075	.07	.045
Industry Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes
Min3FDs	-.006*	.001	-.012	-.001	.001	-.001
	(.003)	(.004)	(.016)	(.004)	(.004)	(.006)
CtC	-.003	.03***	-.028	.028**	.014***	-.016**
	(.005)	(.006)	(.024)	(.011)	(.003)	(.007)
Min3FDsXCtC	.006	-.002	-.047	-.013	-.008**	-.01
	(.008)	(.007)	(.052)	(.012)	(.003)	(.012)
Observations	1030	1020	1020	1024	1025	1035
R-squared	.015	.069	.111	.075	.071	.047
Industry Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes
FemaleCEO	.009*	.011**	-.009	.001	.004*	.008
	(.004)	(.004)	(.009)	(.011)	(.002)	(.006)
CtC	0	.029***	-.052***	.021**	.009***	-.023***
	(.002)	(.002)	(.009)	(.008)	(.002)	(.003)
FemaleCEOXCtC	-.007*	-.009*	-.031	-.006	.001	-.001
	(.004)	(.005)	(.028)	(.022)	(.003)	(.016)
Observations	1030	1020	1020	1024	1025	1035
R-squared	.016	.072	.106	.073	.071	.047
Industry Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Control Variables	Yes	Yes	Yes	Yes	Yes	Yes

5. Discussion & Limitations

This paper investigates if female board representation positively affects firm value during the Covid-19 pandemic. As female representation grows in corporate organisations, the findings contribute to the existing literature by analysing diverse boards at US companies during the pandemic. As most papers have found mixed effects of gender diversity in boards and firm governance, the ongoing Covid-19 pandemic offers a unique environment to test the impact of growing female representation on corporate boards. The rationale of this paper is primarily based on the findings of diverse boards improving corporate governance presented by Adams and Ferreira (2009) and new evidence from Chen et al. (2019) , who found positive effects of female directors on firm performance in the GFC. Other research established positive associations between female directors and internal management, shareholder management and corporate governance. In combination with unprecedent levels of female directors in the US, implications of positive relationships between female directors and firm value are significant and could accelerate efforts to diversify boards.

Further, the paper presents results on the relationship between female representation and stock performance in a crisis. Testing for differences between groups with relatively high and low female leadership suggests that diverse boards differ on ROE, sales, leverage and board characteristics. However, no statistical differences can be found between ROA and Leverage. The findings of the event studies present mostly insignificant coefficients for the main independent variables. For the baseline models (Table 3), eight out of 36 estimations are significant for female variables, with six coefficients significantly positive. The extended models, including control variables, only find four out of 36 estimates to be significant, with one being significantly positive. The findings suggest a possible relationship between female leadership and firm value in the Covid-19 pandemic but are not considered strong enough to reject any null hypotheses. These hypotheses (Section 2.4) expect positive relations between the female variables (FemaleRatio, Min3FDs, and FemaleCEO) and stock performance during the pandemic. The mixed results align with previous research into gender diversity in governance, as both negative and positive findings have been presented.

A wide range of reasons can cause the mixed results. Generally, there could be three reasons. First, there is no relationship between female representation and firm value. Second, there is a relationship, but the methodology is insufficient to capture this relation. Inadequate methods or limitations can cause biased results to come out. Third, there is a relationship, but the financial markets are inefficient. The actual reason is likely a combination of these explanations. A selection bias in the events can cause to miss out on capturing the anticipated relationship. In addition to this method. a major flaw of the event study is the assumption that markets are efficient. Lim, Brooks and Kim (2008) find that market efficiency decreases in times of crisis due to investors' chaotic economic environment and overreaction to the news. The Covid-19 pandemic had similar aspects in 2020. The same research also finds overreaction to news in other markets. The level of globalisation might increase this effect on investors.

According to the KOF Globalisation Index, the Covid-19 pandemic started at an all-time high for the globalisation score (Gygli, Healg, Potrafke & Sturm, 2019). Furthermore, the pandemic caused much social unrest, increasing the complexity of correctly estimating the pandemic's economic and societal implications for investors. Previous research presents a negative relationship between social unrest, confidence and uncertainty in stock markets (Barret, Bondar, Chen, Chivakul & Igan, 2021; Epstein& Schniet, 2002; Hadzi-Vaskov, Pienknagura & Ricca, 2021). Another possible factor affecting investor behaviour is the unusual macroeconomic policy activated by central banks worldwide. The FED in the US introduced quantitative easing programmes to support the (internationally integrated) US markets. This causes investors to adjust their interpretation of economic relevant events, which is hard to capture in a relative simple econometric model. Nozowa and Qiu (2021) try to define corporate bonds' credit spread behaviour impacted by the same quantitative easing in 2020. Credit spreads are effectively representing default risks and should reflect corporate risks. However, they are unable to completely define credit spreads in the first six months of 2020. Furthermore, the different results between events might be caused by many implications Covid-19 could have. Not all events have the same negative or positive effect on companies. This increases the complexity of interpreting all models equally.

Furthermore, there are limitations to the methods used in this paper. First, due to time constraints, only event studies have been conducted to analyse the effect of female directors and short-term stock performance in the Covid-19 pandemic. Additionally, the selected days for the event study show limited discrepancies in stock performance for companies grouped by the main independent gender dummy variables (Min3FDs and FemaleCEO). The stock performances around the events in a [-20d, +20d] window are presented in Figure 2 (Appendix). Overall, these graphs show similar returns for both groups, measured by the accumulated abnormal returns (AAR). Based on these graphs, strong differences between diverse firms are not evident. In contrast, the univariate analysis in Section 4.1 presents significant differences between the groups. Furthermore, the methods behind the Overconfidence and ClosetoConsumers cross-sectional analysis include limitations too. The overconfidence measured by 'Moneyness' does not consider the options' expiration , which might influence if CEOs feel the need to exercise. Additionally, the economic environment for the Overconfidence period 2016-2019 has not been investigated to determine exceptional drivers of overconfidence. This might impact the industry selection based on results in Table 11 (Appendix). Regarding the CtC models, the selected industries which are found to be highly represented by females (Brammer et al., 2007) could not be classified explicitly due to missing SIC specifications. The industries are manually selected on the SIC sector definitions. This might cause a sample bias. Nevertheless, the coefficients of the CtC dummy on CARs are highly significant, while dummy variables are included too.

Next, a suggestion for further research would be an extension of the period and could include more financial data on firm performance for the whole Covid-19 period. The current event study includes only 2020, whereas the pandemic continued in 2021 and is currently still active in Q1 2022. As Chen et al. (2019) took the delta on performance measures such as ROA and Tobin's Q over the GFC period, they found results suggesting better firm performance over time through female directors. This paper is limited to only 2020 financial data published on Compustat. 2021 data was not yet available at the time of collection. However, I expect the implications of missing out on 2021 data to be moderate as the Covid-19 pandemic economically had the most considerable exogenous shock in 2020. Any event study, including both 2020 and 2021 dates, would have to correct for adaptability of industries and firms as the business shows resilience through monetary and governmental cushions. This would make capturing the effect of female leadership in crisis noisy. Another suggestion would be to measure the impact of female directors on governance during the pandemic and how this would affect firm performance. Due to time limitations, this paper only includes possible direct effects of female directors and stock performance in a crisis. Research suggests that female directors change culture and behaviour in the boardroom (e.g. Adams & Ferreira, 2009; Chen et al., 2019; Kramer et al., 2007). Corporate governance mechanisms are not taken into account in this paper. Adam and Ferreira (2009) do this and find significant negative results for female representation as take-over mechanisms are weak. Further research could analyse this by using the governance index of Gompers, Ishii and Metrick (2003) to measure how strong governmental mechanisms are per firm.

Concluding, as this paper aims to capture a possible relationship between female directorships at S&P 1500 companies in the US, the results are insufficient to present substantial implications. The literature discussed in this research remains relevant and strong enough to expect a positive relationship between female board representation and firm value still exists. This paper is limited in its methodology and data, and unable to find strong relations for female representation in boards. Female CEOs are found to have a positive effect on firm value. If more significantly positive results were to be found, the relevance for corporate America is obvious. Besides ethical arguments for gender diversity, enhancing firm value could boost hiring and promoting strategies at firms to balance boardrooms.

6. Conclusion

This paper investigates the possible relation between female directors (FDs) and firm value during the Covid-19 pandemic. Research on the relationship between female representation, corporate governance and management provides solid arguments supporting positive expectations between FDs and firm value. However, research on female directors and recent crises is limited, especially considering the levels of female representation are low in those years. If women are better represented on boards, it contributes to higher quality data to establish robust results on gender differences within corporate governance and leadership. This paper uses 2020 data of US-based S&P 1500 firms to analyse abnormal returns of diverse boards around Covid-19 related events. The main independent variables used for female representation include the percentage of female directors (FemaleRatio), a dummy variable for 'Critical Mass' of female directors (Min3FDs), and a dummy variable if the firms' CEO is female. These variables are separately regressed on the cumulate abnormal returns around six events in 2020. Additionally, cross-sectional extensions are constructed to capture abnormal returns related to female representation in specified industries. Overall, this research contributes to diverse corporate boards and their relationship to governance in crisis.

In contrast to the large body of literature on the benefits of female leadership, the results in this paper do not find strong results on the relationship between female representation and cumulative abnormal returns in Covid-19. The estimations for each of the six events differ across windows and between events. Important to highlight is the fact that some models do present positive significant results for the main independent variables. However, as most of the coefficients are insignificant, the findings overall are insufficient to conclude a positive relationship. Further, the cross-sectional analysis presents similar results. The inclusion of proxies for overconfident industries and industries which have close proximity to the final customer should be considered in future research, as coefficients for these proxies are highly significant. The methodology and data in this paper have some severe limitations. Event studies assume efficient markets, an assumption challenging to uphold in times of a pandemic. Additionally, financial data on firms was constrained at the time of this research. Furthermore, the selected events show weak patterns of discrepancies between diverse and less diverse boards.

Concluding, this paper contributes to the growing literature on diverse boards and firm values. The results are insufficient to accept new relationships for female representation in boards. It finds sufficient results on higher firm value if a female CEO is leading the company. Additionally, it offers implications for future research, which could significantly contribute to enhancing gender diversity on boards, as economic incentives would be highly relevant.

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Appendix

Appendix A

Table A: Variable List

Variables	Description	Source
Main Ind. Variables		
FemaleRatio	Percentage of female directors relative to total board size, per quarter	ISS Directors
Min3FDs	Dummy variable, which equals 1 if the board holds at least three female directors, and 0 otherwise	ISS Directors
FemaleCEO	Dummy variable, which equals 1 if the CEO of the firm is female, and 0 otherwise	ISS Directors
Events Abbreviations		
HED	Health Emergency Date – 30 January 2020	CRSP
PMD	Peak Market Date – 19 February 2020	CRSP
PSD	Pandemic Start Date – 11 March 2020	CRSP
PUD	Peak Unemployment Date – 11 May 2020	CRSP
RSD	Recession Start Date – 8 June 2020	CRSP
JBD	Joe Biden Date – 7 November 2020	CRSP
Firm Variables		
LnSales	Natural Logarithm of sales per quarter	Compustat
LnSalesYearly	Natural Logarithm of sales per year	Compustat
ROA	Return on Assets. Calculated as net income over total assets per quarter	Compustat
ROA_Year	Return on Assets. Calculated as net income over total assets per year	Compustat
ROE	Return on Equity. Calculated as net income over shareholder's equity per quarter	Compustat
ROE_Year	Return on Equity. Calculated as net income over shareholder's equity per year	Compustat
Market Capitalisation	Number of shares outstanding times share price end of the quarter	Compustat
TobinsQ	Tobin's Q, measured by market capitalisation divided by total assets	Compustat
Leverage	Long-term debt divided by total assets	Compustat
Board Variables		
Age	Average age per director. Calculated as the mean age of total board	ISS Directors
Tenure	Average tenure per director. Calculated as the mean tenure of the total board	ISS Directors
Board Size	Total number of directors on a firm's board per quarter	ISS Directors
BoardIndependenceRatio	Percentage of independent directors relative to total directors	ISS Directors
CommitteeMemberRatio	Percentage of directors who are committee members	ISS Directors
AttendanceProblem	Average per board of a dummy variable which equals 1 if a director has been less than 75% of board meetings in the previous year, and 0 otherwise	ISS Directors
FemaleDirectors	Number of female directors on the board	ISS Directors
OnlyOneFemale	Dummy variable which equals 1 if the firm has one female director on board, and 0 otherwise	ISS Directors
FemaleInBoard	Dummy variable which equals 1 if the firm has at least one female director and 0 otherwise	ISS Directors
	The average number of other board seats per director, per	ISS Directors

OtherBoardsPerDirector	board	
OBSbyMaleDirector	The average number of other board seats per male director, per board	ISS Directors
OBSbyFemaleDirector	The average number of other board seats per female director, per board	ISS Directors
Compensation Variables		
Total Compensation	Average total compensation per director, including cash and equity-based rewards	ExecuComp
Cash Compensation	Average cash compensation per director, including only cash-based rewards	ExecuComp
Non-Cash Compensation	Average equity-based compensation per director, excluding cash-based rewards	ExecuComp
Non-Cash Comp. Ratio	Percentage of non-cash compensation relative to total compensation	ExecuComp
Other variables		
Strike price	The exercise price of an option at which a CEO can buy shares	ExecuComp
Stock Price	The stock price of a US firm on a specified date	CRSP / ExecuComp
Overconfident	Dummy variable, which equals 1 if a CEO holds on average more than 67% in-the-money options	ExecuComp
Moneyness	The ratio of the realisable gain relative to the current stock price. In-the-money(ness) of an option	ExecuComp
OI	Dummy variable, which equals 1 if a CEO at an FF12 industry is on average more than 657% in-the-money	ExecuComp
CtC	Close to Consumer dummy variable, which equals 1 if the industry is one of the four industries mentioned in the paper of Brammer et al. (2007), and 0 otherwise	Compustat
FF12	Fama-French 12 industry classification (see Table 10)	Kenneth French website
AAR	Accumulated Abnormal Returns, calculated as the sum of abnormal returns of a specified window per firm or group of firms	CRSP / ExecuComp

Appendix B

Table 4B: Extended cumulative abnormal return regression results

Female board representation and cumulative abnormal returns. The dependent variable is CAR for all events. CAR in Panel A and B is accumulated in the [-1d,+1d] and [-3d,+3d] windows, respectively. All events and variable data are from 2020 and include US-listed S&P 1500 firms, but exclude financial firms. FemaleRatio is the percentage of female directors relative to total board size. Min3FDs is a dummy variable, which equals 1 if at least three female directors sit on a board, and 0 otherwise. FemaleCEO is a dummy variable, which equals 1 if a firms' CEO is female. All event and variable definitions are provided in Appendix, Table A. Industry dummy variables are included in all models. Continuous variables are winsorised at the 5% level. Robust standard errors are in parentheses. ***, ** and * indicate significance at the 1%, 5% and 10%, respectively.

Panel A: CAR [-1d,+1d]	Event 1 HED	Event 2 PMD	Event 3 PSD	Event 4 PUD	Event 5 RSD	Event 6 JBD
FemaleRatio	-.016	.006	-.058*	-.031*	-.006	.005
	(.011)	(.013)	(.026)	(.014)	(.013)	(.026)
Leverage	.016	.003	-.039	.004	-.007	-.023***
	(.009)	(.006)	(.027)	(.007)	(.01)	(.006)
ROA	-.046	.069**	.094	-.118	-.207*	-.373***
	(.038)	(.029)	(.136)	(.141)	(.1)	(.083)
LnSales	-.001	.001	-.003	.004*	-.001	0
	(.001)	(.001)	(.005)	(.002)	(.001)	(.001)
TobinsQ	0	0	.004	.001	.002**	0
	(.001)	(.001)	(.002)	(.001)	(.001)	(.001)
Age	0	0	0	0	0	.001
	(0)	(0)	(.001)	(0)	(0)	(0)
Tenure	0	0	-.001	-.001***	-.001	0
	(0)	(.001)	(.001)	(0)	(.001)	(.001)
OtherBoardsP. Dir	.003	-.001	.018***	-.004	.005	-.003
	(.002)	(.003)	(.005)	(.006)	(.005)	(.007)
BoardIndepRatio	.007	-.005	-.015	-.003	-.015	.01
	(.01)	(.012)	(.029)	(.016)	(.015)	(.019)
Constant	.014	-.072**	-.081	-.038	-.012	-.042*
	(.017)	(.022)	(.061)	(.04)	(.011)	(.022)
Observations	1030	1020	1020	1024	1025	1035
R-squared	.043	.053	.091	.123	.061	.068
Min3FDs	-.005*	-.001	-.014	-.005	-.002	.005
	(.002)	(.003)	(.009)	(.004)	(.002)	(.005)
Leverage	.016	.003	-.039	.004	-.007	-.023***
	(.009)	(.006)	(.028)	(.007)	(.01)	(.006)
ROA	-.049	.067*	.086	-.121	-.208*	-.37***
	(.039)	(.03)	(.139)	(.143)	(.1)	(.083)
LnSales	-.001	.002	-.002	.004*	0	0
	(.001)	(.001)	(.005)	(.002)	(.002)	(.001)
TobinsQ	0	0	.004	.001	.002**	0
	(.001)	(.001)	(.003)	(.001)	(.001)	(.001)
Age	0	0	0	0	0	.001*
	(0)	(0)	(.001)	(0)	(0)	(0)
Tenure	0	0	-.001	-.001***	-.001	0
	(0)	(.001)	(.001)	(0)	(.001)	(.001)
OtherBoardsP. Dir	.003	0	.018***	-.004	.006	-.003
	(.002)	(.003)	(.005)	(.006)	(.005)	(.007)
BoardIndepRatio	.008	-.003	-.013	-.004	-.014	.006
	(.01)	(.014)	(.026)	(.015)	(.016)	(.018)
Constant	.01	-.071**	-.101	-.048	-.014	-.04
	(.015)	(.023)	(.055)	(.042)	(.012)	(.025)
Observations	1030	1020	1020	1024	1025	1035
R-squared	.046	.053	.092	.122	.062	.071

FemaleCEO	.002	.004	-.004	.004	.006**	.005*
	(.002)	(.003)	(.006)	(.005)	(.002)	(.003)
Leverage	.016*	.003	-.039	.004	-.007	-.023***
	(.009)	(.006)	(.027)	(.007)	(.01)	(.006)
ROA	-.043	.069**	.101	-.118	-.207*	-.374***
	(.038)	(.028)	(.132)	(.142)	(.098)	(.084)
LnSales	-.001	.001	-.003	.004	-.001	0
	(.001)	(.001)	(.005)	(.002)	(.001)	(.002)
TobinsQ	0	0	.004	.001	.002**	0
	(.001)	(.001)	(.002)	(.001)	(.001)	(.001)
Age	0	0	.001	0	0	.001
	(0)	(0)	(.001)	(0)	(0)	(0)
Tenure	0	0	-.001	-.001***	-.001	.001
	(0)	(.001)	(.001)	(0)	(.001)	(.001)
OtherBoardsP. Dir	.003	-.001	.017**	-.005	.005	-.003
	(.002)	(.003)	(.005)	(.006)	(.005)	(.007)
BoardIndepRatio	.004	-.005	-.024	-.01	-.017	.009
	(.009)	(.012)	(.032)	(.017)	(.015)	(.017)
Constant	.011	-.07**	-.096	-.046	-.013	-.04
	(.015)	(.022)	(.059)	(.04)	(.013)	(.026)
Observations	1030	1020	1020	1024	1025	1035
R-squared	.041	.054	.087	.12	.063	.07

Table 4B: Extended cumulative abnormal return regression results (continued)

Female board representation and cumulative abnormal returns. The dependent variable is CAR for all events. CAR in Panel A and B is accumulated in the [-1d,+1d] and [-3d,+3d] windows, respectively. All events and variable data are from 2020 and include US-listed S&P 1500 firms, but exclude financial firms. FemaleRatio is the percentage of female directors relative to total board size. Min3FDs is a dummy variable, which equals 1 if at least three female directors sit on a board, and 0 otherwise. FemaleCEO is a dummy variable, which equals 1 if a firms' CEO is female. All event and variable definitions are provided in Appendix, Table A. Industry dummy variables are included in all models. Continuous variables are winsorised at the 5% level. Robust standard errors are in parentheses. ***, ** and * indicate significance at the 1%, 5% and 10%, respectively.

Panel B: CAR [-3d,+3d]	Event 1	Event 2	Event 3	Event 4	Event 5	Event 6
	HED	PMD	PSD	PUD	RSD	JBD
FemaleRatio	-.024	.017	-.062	-.03	.008	0
	(.022)	(.019)	(.042)	(.023)	(.022)	(.029)
Leverage	.018	.001	-.128**	.044*	.029***	.007
	(.014)	(.01)	(.052)	(.022)	(.005)	(.011)
ROA	.019	.265***	.165	-.031	-.128**	-.314***
	(.074)	(.071)	(.147)	(.153)	(.054)	(.077)
LnSales	.001	.001	-.005	.002	-.002	-.001
	(.002)	(.001)	(.007)	(.004)	(.003)	(.001)
TobinsQ	.001	.002*	-.001	.002	0	0
	(.001)	(.001)	(.004)	(.002)	(.001)	(.001)
Age	0	0	0	-.001**	-.001	0
	(.001)	(.001)	(.001)	(0)	(0)	(0)
Tenure	0	-.001	-.001	-.001	0	-.001**
	(0)	(.001)	(.003)	(.001)	(.001)	(0)
OtherBoardsP. Dir	.002	-.003	.021*	-.005	.002	0
	(.004)	(.004)	(.011)	(.008)	(.006)	(.005)
BoardIndepRatio	.002	.017	.019	-.051	-.022	-.038*
	(.013)	(.024)	(.082)	(.035)	(.026)	(.02)
Constant	.017	-.108**	.184	.003	.048*	.026
	(.042)	(.046)	(.118)	(.045)	(.025)	(.033)
Observations	1030	1020	1020	1024	1025	1035
R-squared	.015	.062	.101	.073	.069	.04

Min3FDs	-.004	.002	-.023	-.003	-.001	-.003
	(.003)	(.004)	(.014)	(.005)	(.004)	(.005)
Leverage	.018	.001	-.128**	.044*	.029***	.007
	(.014)	(.01)	(.052)	(.022)	(.005)	(.011)
ROA	.017	.265***	.147	-.033	-.128**	-.316***
	(.074)	(.071)	(.156)	(.156)	(.054)	(.066)
LnSales	.001	.001	-.003	.002	-.002	0
	(.001)	(.002)	(.007)	(.004)	(.003)	(.001)
TobinsQ	.001	.002*	0	.002	0	0
	(.001)	(.001)	(.004)	(.002)	(.001)	(.001)
Age	0	0	0	-.001**	-.001	0
	(.001)	(.001)	(.001)	(0)	(0)	(0)
Tenure	0	-.001	-.001	-.001	0	-.001*
	(0)	(.001)	(.003)	(.001)	(.001)	(0)
OtherBoardsP. Dir	.002	-.003	.022*	-.006	.003	0
	(.003)	(.004)	(.011)	(.009)	(.006)	(.005)
BoardIndepRatio	.001	.018	.029	-.054	-.02	-.035
	(.013)	(.025)	(.076)	(.034)	(.026)	(.02)
Constant	.011	-.103*	.159	-.006	.049	.026
	(.037)	(.046)	(.108)	(.046)	(.031)	(.03)
Observations	1030	1020	1020	1024	1025	1035
R-squared	.015	.061	.104	.072	.069	.041

FemaleCEO	.006*	.009**	-.02*	-.001	.005**	.007
	(.003)	(.004)	(.009)	(.01)	(.002)	(.006)
Leverage	.018	.002	-.129**	.044*	.029***	.007
	(.014)	(.01)	(.051)	(.022)	(.005)	(.011)
ROA	.025	.267***	.165	-.031	-.128**	-.317***
	(.072)	(.072)	(.149)	(.156)	(.054)	(.076)
LnSales	.001	.001	-.005	.002	-.002	-.001
	(.002)	(.001)	(.008)	(.004)	(.002)	(.001)
TobinsQ	0	.002*	-.001	.002	0	0
	(.001)	(.001)	(.004)	(.002)	(.001)	(.001)
Age	0	0	0	-.001*	-.001	0
	(.001)	(.001)	(.001)	(0)	(0)	(0)
Tenure	0	-.001	-.001	-.001	0	-.001*
	(0)	(.001)	(.003)	(.001)	(.001)	(0)
OtherBoardsP. Dir	.002	-.003	.021*	-.006	.002	-.001
	(.003)	(.004)	(.01)	(.009)	(.006)	(.005)
BoardIndepRatio	-.004	.018	.013	-.056	-.021	-.039*
	(.012)	(.022)	(.081)	(.036)	(.025)	(.019)
Constant	.012	-.103*	.168	-.005	.05	.027
	(.038)	(.046)	(.112)	(.045)	(.03)	(.03)
Observations	1030	1020	1020	1024	1025	1035
R-squared	.015	.064	.101	.071	.07	.042

Table 7: Summary Statistics whole sample 2016-2020

All variable data are from 2016-2020 and include US-listed S&P 1500 firms, but exclude financial firms. FemaleRatio is the percentage of female directors relative to total board size. Min3FDs is a dummy variable, which equals 1 if at least three female directors sit on a board, and 0 otherwise. FemaleCEO is a dummy variable, which equals 1 if a firms' CEO is female. All variable definitions and sources are provided in Appendix, Table A. Continuous variables are winsorised at the 5% level.

Panel A: 2020	N	Mean	SD	Min	Max
LnSalesYearly	5444	7.745	1.464	4.392	10.731
ROA Year	5444	.045	0.067	-.123	.16
ROE Year	5444	.1	0.234	-.561	.638
Leverage	5415	.272	0.180	0	.728
TobinsQ	5444	2.219	1.399	.826	6.936
FemaleRatio	5444	.208	0.110	0	.455
Min3FDs	5444	.296	0.456	0	1
FemaleCEO	5444	.1	0.299	0	1
FemaleDirectors	5444	1.991	1.170	0	5
OnlyOneFemale	5444	.265	0.441	0	1
FemaleInBoard	5444	.913	0.281	0	1
BoardSize	5444	9.289	1.851	6	13
Age	5444	62.329	3.409	55	69.714
Tenure	5444	8.594	3.570	2.25	17.667
BoardIndependenceRatio	5444	.813	0.097	.556	.917
AttendanceProblem	5444	.004	0.019	0	.1
CommitteeMemberRatio	5444	.727	0.151	.3	.909
OtherBoardsPerDirector	5444	.789	0.431	0	1.75
OBSbyMaleDirector	5444	.751	0.446	0	1.75
OBSbyFemaleDirector	5444	.853	0.791	0	3
Total Compensation	5309	233.886	75.584	86.059	434.884
Cash Compensation	5309	88.472	31.109	22.5	163.833
Non-Cash Compensation	5309	144.662	67.082	22.672	346.878
Non-Cash Comp. Ratio	5303	.585	0.134	.19	.875

Figure 2a: Average Abnormal Return [-20d,+20d] – HealthEmergencyDate (Min3FDs, FemaleCEO)

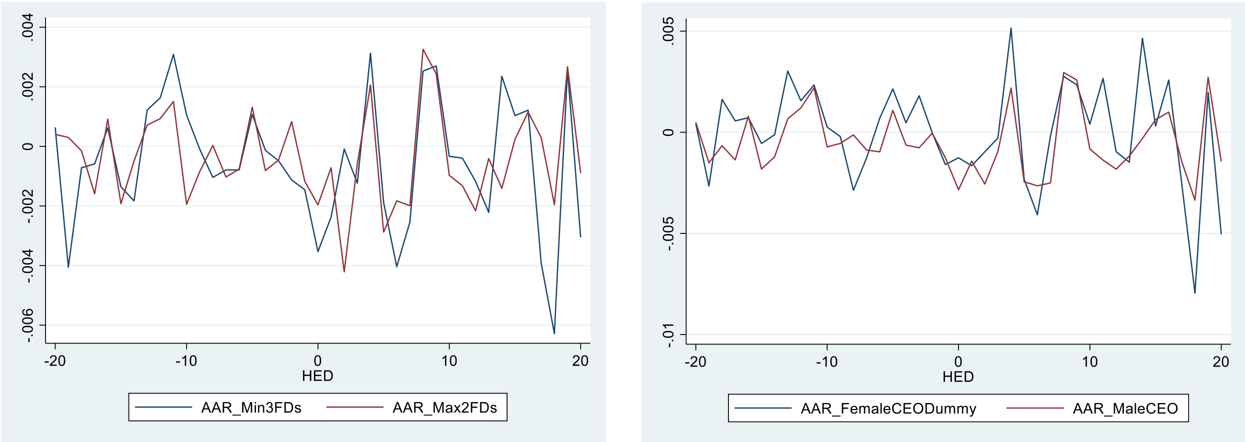

Figure 2b: Average Abnormal Return [-20d,+20d] – PandemicStartDate (Min3FDs, FemaleCEO)

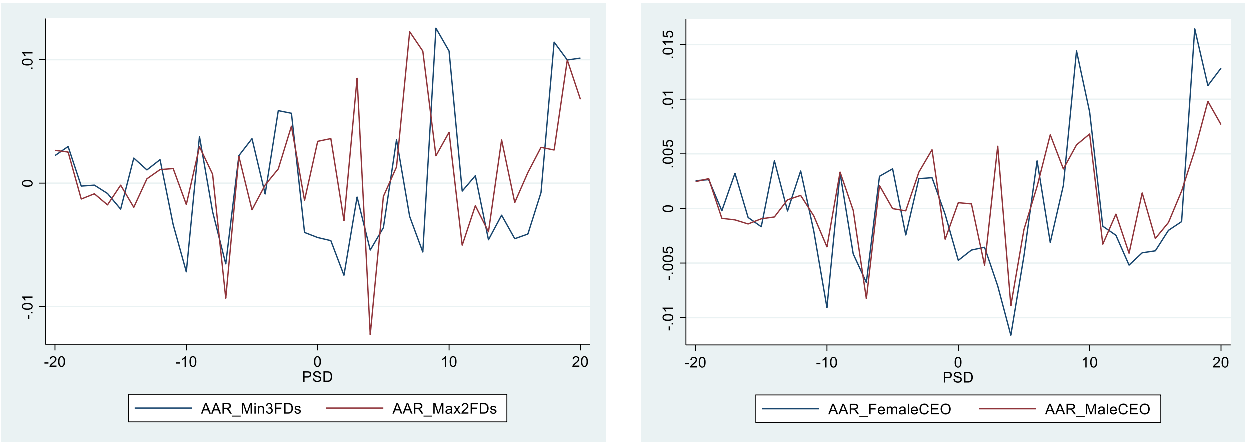

Figure 2c: Average Abnormal Return [-20d,+20d] – PeakMarketDate (Min3FDs, FemaleCEO)

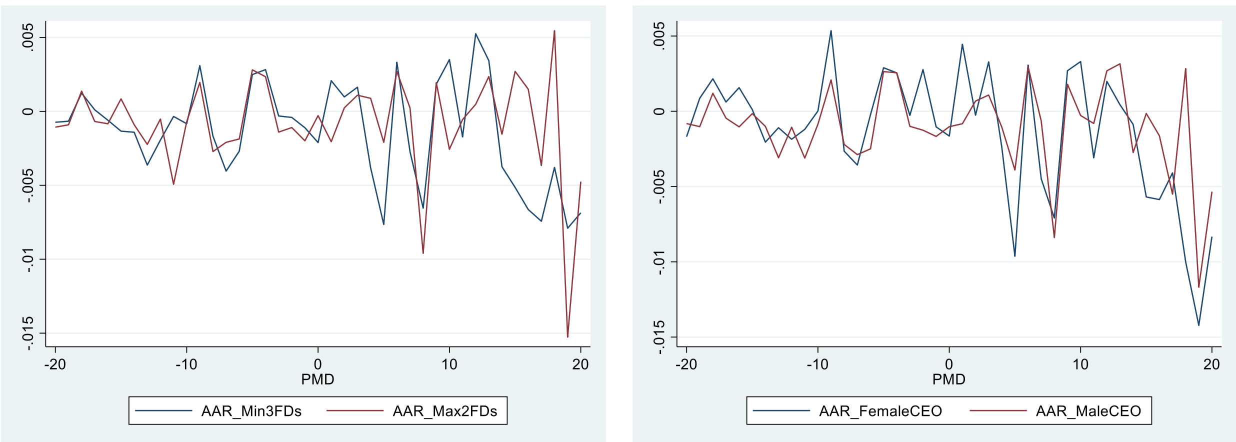

Figure 2d: Average Abnormal Return [-20d,+20d] – PeakUnemploymentDate (Min3FDs, FemaleCEO)

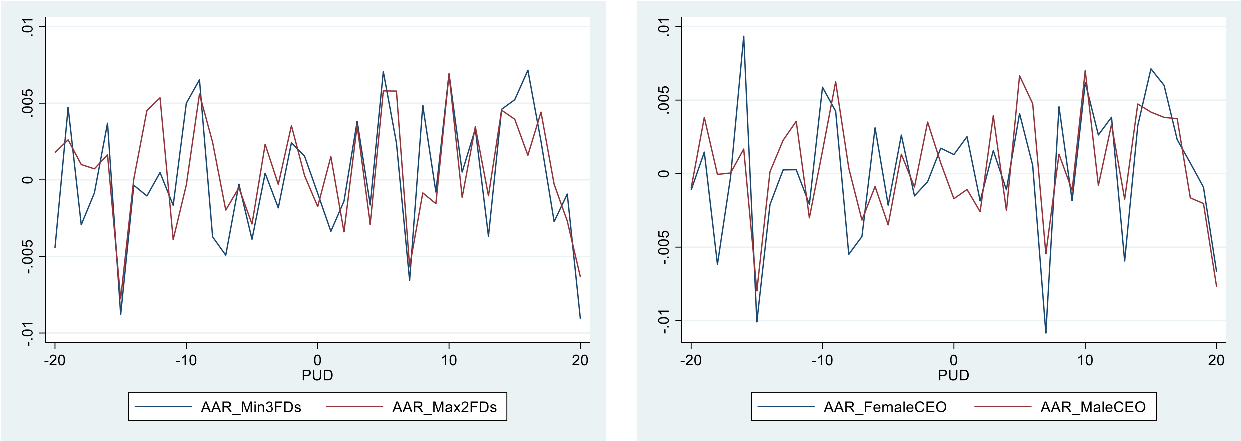

Figure 2e: Average Abnormal Return [-20d,+20d] – RecessionStartDate (Min3FDs, FemaleCEO)

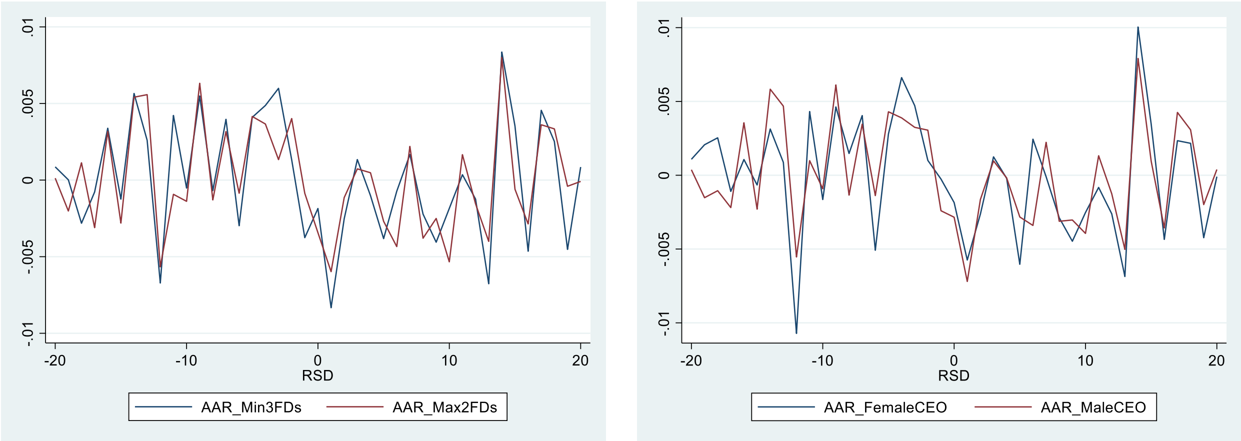

Figure 2f: Average Abnormal Return [-20d,+20d] – JoeBidenDate (Min3FDs, FemaleCEO)

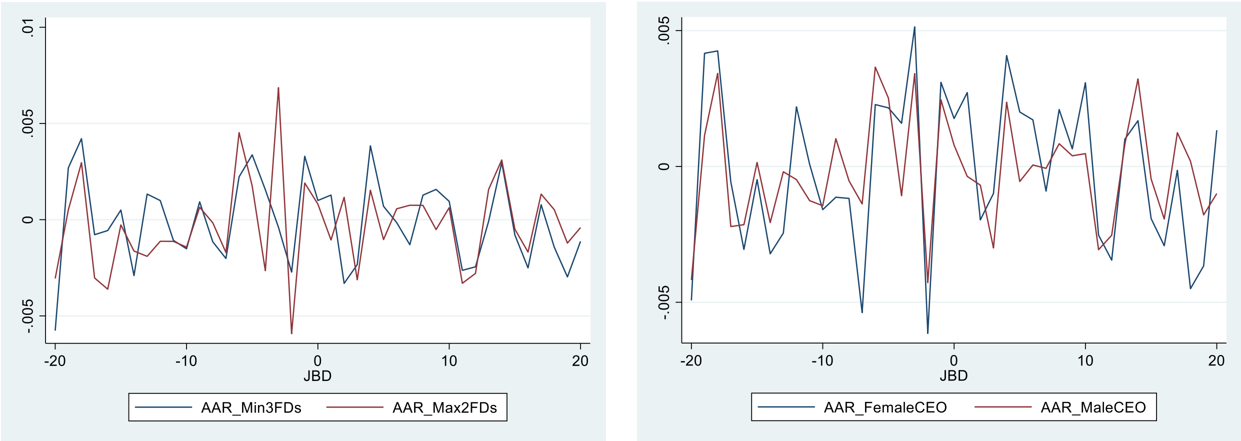

Table 8: Correlation matrix

Pairwise correlations between variables included in the regression model. Significance level per coefficient in parentheses. Continuous variables are winsorised at the 5% level.

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
(1) FemaleRatio	1.000														
(2) Min3FDs	0.722	1.000													
	(0.000)														
(3) FemaleCEO	0.295	0.249	1.000												
	(0.000)	(0.000)													
(4) Leverage	0.120	0.105	0.020	1.000											
	(0.000)	(0.000)	(0.003)												
(5) ROA	0.050	0.039	0.024	-0.132	1.000										
	(0.000)	(0.000)	(0.000)	(0.000)											
(6) LnSales	0.289	0.358	0.141	0.208	0.160	1.000									
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)										
(7) TobinsQ	0.042	0.030	-0.004	-0.138	**0.457**	-0.097	1.000								
	(0.000)	(0.000)	(0.539)	(0.000)	(0.000)	(0.000)									
(8) Age	-0.168	-0.101	-0.027	-0.079	-0.003	0.013	-0.126	1.000							
	(0.000)	(0.000)	(0.000)	(0.000)	(0.624)	(0.062)	(0.000)								
(9) Tenure	-0.219	-0.139	-0.088	-0.214	0.101	-0.091	0.075	0.487	1.000						
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)							
(10) OBSperDirector	0.207	0.193	0.117	0.159	-0.034	0.393	-0.036	-0.048	-0.270	1.000					
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)						
(11) BoardIndepRatio	0.256	0.193	0.102	0.136	-0.029	0.179	-0.076	-0.065	-0.350	0.290	1.000				
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)					
(12) BoardSize	0.253	0.430	0.106	0.198	0.027	**0.580**	-0.078	0.032	-0.056	0.276	0.180	1.000			
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)				
(13) AttendanceProblem	-0.020	0.018	-0.002	-0.034	0.011	-0.013	0.003	0.011	0.019	-0.016	-0.039	0.025	1.000		
	(0.003)	(0.006)	(0.729)	(0.000)	(0.101)	(0.057)	(0.665)	(0.107)	(0.004)	(0.019)	(0.000)	(0.000)			
(14) FemaleDirectors	**0.929**	**0.809**	0.305	0.159	0.054	0.439	0.019	-0.136	-0.199	0.263	0.270	**0.544**	-0.006	1.000	
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.005)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.354)		
(15) FemaleInBoard	**0.583**	0.199	0.102	0.113	0.037	0.258	-0.013	-0.086	-0.175	0.171	0.201	0.313	-0.026	**0.524**	1.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.049)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	

Table 9: Extended cumulative abnormal return regression results in extended period

Female board representation and cumulative abnormal returns. The dependent variable is CAR for all events. CAR is accumulated in the [-1d,+5d] window. All events and variable data are from 2020 and include US-listed S&P 1500 firms, but exclude financial firms. FemaleRatio is the percentage of female directors relative to total board size. Min3FDs is a dummy variable, which equals 1 if at least three female directors sit on a board, and 0 otherwise. FemaleCEO is a dummy variable, which equals 1 if a firms' CEO is female. All event and variable definitions are provided in Appendix, Table A. Industry dummy variables are included in all models. Continuous variables are winsorised at the 5% level. Robust standard errors are in parentheses. ***, ** and * indicate significance at the 1%, 5% and 10%, respectively.

CAR [-1d,+5d]	Event 1 HED	Event 2 PMD	Event 3 PSD	Event 4 PUD	Event 5 RSD	Event 6 JBD
FemaleRatio	-.009	-.017	-.074	-.016	-.042***	.022
	(.015)	(.028)	(.072)	(.013)	(.006)	(.03)
Leverage	.016*	-.022	-.192**	.013	.02	-.029***
	(.007)	(.017)	(.059)	(.018)	(.011)	(.003)
ROA	-.038	.256**	.296	-.029	-.04	-.376***
	(.064)	(.097)	(.306)	(.104)	(.111)	(.106)
LnSales	.001	0	-.01	.007***	.004*	.003*
	(.001)	(.002)	(.01)	(.002)	(.002)	(.001)
TobinsQ	0	.001	.01*	.001	.006***	-.001
	(.001)	(.003)	(.005)	(.002)	(.001)	(.001)
Age	0	0	.002***	0	0	.001
	(.001)	(.001)	(.001)	(.001)	(0)	(.001)
Tenure	0	0	-.001	-.001	-.001**	0
	(0)	(.001)	(.002)	(.001)	(0)	(.001)
OtherBoardsP. Dir	.003	.002	.019	-.008	-.004	.003
	(.004)	(.006)	(.017)	(.006)	(.006)	(.008)
BoardIndepRatio	.009	.035	.023	-.014	-.014	-.017
	(.011)	(.034)	(.068)	(.026)	(.025)	(.029)
Constant	.017	-.079*	.144	-.087**	-.023	-.004
	(.031)	(.04)	(.107)	(.036)	(.024)	(.045)
Observations	1030	1020	1020	1024	1025	1035
R-squared	.021	.07	.11	.092	.119	.047
Min3FDs	0	-.01	-.013	-.002	-.01***	.004
	(.003)	(.006)	(.014)	(.005)	(.003)	(.006)
Leverage	.016*	-.022	-.192**	.013	.02*	-.03***
	(.007)	(.017)	(.059)	(.018)	(.011)	(.004)
ROA	-.037	.248**	.291	-.03	-.046	-.368***
	(.064)	(.101)	(.313)	(.106)	(.114)	(.101)
LnSales	.001	.001	-.009	.007***	.004**	.002**
	(.001)	(.002)	(.01)	(.002)	(.001)	(.001)
TobinsQ	0	.002	.01*	.001	.006***	-.001
	(.001)	(.003)	(.005)	(.002)	(.001)	(.001)
Age	0	0	.002***	0	0	.001
	(.001)	(.001)	(.001)	(.001)	(0)	(.001)
Tenure	0	0	-.001	-.001	-.001**	0
	(0)	(.001)	(.002)	(.001)	(0)	(.001)
OtherBoardsP.Dir	.003	.003	.019	-.008	-.004	.003
	(.004)	(.006)	(.017)	(.006)	(.006)	(.008)
BoardIndep. Ratio	.007	.041	.021	-.015	-.013	-.016
	(.011)	(.034)	(.06)	(.025)	(.026)	(.028)
Constant	.015	-.087*	.12	-.092**	-.037	.002
	(.028)	(.043)	(.103)	(.038)	(.024)	(.047)
Observations	1030	1020	1020	1024	1025	1035
R-squared	.02	.074	.109	.091	.122	.046
FemaleCEO	.006***	-.003	-.019	.001	.001	.01*
	(.001)	(.006)	(.012)	(.006)	(.004)	(.004)
Leverage	.016*	-.023	-.193**	.013	.02	-.029***

	(.007)	(.017)	(.059)	(.018)	(.011)	(.004)
ROA	-.034	.257**	.299	-.029	-.04	-.374***
	(.063)	(.094)	(.302)	(.105)	(.118)	(.104)
LnSales	.001	0	-.01	.007***	.003*	.003*
	(.001)	(.002)	(.011)	(.001)	(.002)	(.001)
TobinsQ	0	.001	.01*	.001	.006***	-.001
	(.001)	(.003)	(.005)	(.002)	(.001)	(.001)
Age	0	0	.002***	0	0	.001
	(0)	(.001)	(.001)	(.001)	(0)	(.001)
Tenure	0	0	-.001	0	-.001**	0
	(0)	(.001)	(.002)	(.001)	(0)	(.001)
OtherBoardsP.Dir	.003	.002	.019	-.008	-.005	.003
	(.004)	(.006)	(.016)	(.006)	(.006)	(.008)
BoardIndep. Ratio	.006	.033	.014	-.017	-.022	-.015
	(.01)	(.029)	(.064)	(.025)	(.026)	(.025)
Constant	.016	-.083*	.125	-.091**	-.034	.002
	(.028)	(.041)	(.105)	(.037)	(.025)	(.047)
Observations	1030	1020	1020	1024	1025	1035
R-squared	.022	.07	.109	.091	.114	.048

Table 10: Fama-French 12 industries

SIC Codes per FF12 Industry

Code		**Industry**	**Industry description**
1		Nondurable Consumer Goods	Consumer Nondurables - Food, Tobacco, Textiles, Apparel, Leather, Toys
	SIC codes:	0100-0999, 2000-2399, 2700-2749, 2770-2799, 3100-3199, 3940-3989	
2		Durable Consumer Goods	Consumer Durables -- Cars, TVs, Furniture, Household Appliances
	SIC codes:	0100-0999, 2000-2399, 2700-2749, 2770-2799, 3100-3199, 3940-3989	
3		Manufacturing	Machinery, Trucks, Planes, Off Furn, Paper, Com Printing
	SIC codes:	2520-2589, 2600-2699, 2750-2769, 3000-3099, 3200-3569, 3580-3629, 3700-3709, 3712-3713, 3715-3715, 3717-3749, 3752-3791, 3793-3799, 3830-3839, 3860-3899	
4		Energy	Oil, Gas, and Coal Extraction and Products
	SIC codes:	1200-1399, 2900-2999	
5		Chemicals	Chemicals and Allied Products
	SIC codes:	2800-2829, 2840-2899	
6		Business Equipment	Business Equipment -- Computers, Software, and Electronic Equipment
	SIC codes:	3570-3579, 3660-3692, 3694-3699, 3810-3829, 7370-7379	
7		Telecom	Telephone and Television Transmission
	SIC codes:	4800-4899	
8		Utilities	Utilities
	SIC codes:	4900-4949	
9		Shops	Wholesale, Retail, and Some Services (Laundries, Repair Shops)
	SIC codes:	5000-5999, 7200-7299, 7600-7699	
10		Healthcare	Healthcare, Medical Equipment, and Drugs
	SIC codes:	2830-2839, 3693-3693, 3840-3859, 8000-8099	
11		Money	Finance
	SIC codes:	6000-6999	
12		Other	Other -- Mines, Construction, Building Materials, Transport, Hotels, Entertainment
	SIC codes:	Remaining SIC codes	

Table 11: Summary statistics CEO Overconfidence (2016-2019)

Summary statistics on the CEO overconfidence per industry measured by 'Moneyness'. Panel A includes industry observations between 2016 and 2019. Moneyness is a variable which measures the level of in-the-moneyness of the option portfolio of the CEO. If the portfolio is more than 67% in the money, the CEO is considered as overconfident. Overconfident statistics and industries are bold. Panel B presents the mean moneyness per year. Panel C presents the average moneyness per gender. Variable definitions are provided in Appendix, Table A.

Panel A: By Fama-French 12 industries

Industry	No. of obs.	Avg. Moneyness per CEO		Overconfident CEO %	
		Mean	Median	Mean	Median
Non-dur CG	148	**.725**	.528	**.432**	0
Durable CG	88	.356	.285	.239	0
Manufacturing	402	.467	.340	.269	0
Energy	160	-.059	-.321	.094	0
Chemicals	145	.405	.341	.276	0
Buss. Equip.	608	**1.015**	.663	**.497**	0
Telecom	71	**.913**	.433	**.352**	0
Utilities	62	.378	.136	.194	0
Shops	329	.588	.270	.319	0
Healthcare	343	**1.147**	.634	**.493**	0
Money	651	**.809**	.534	**.412**	0
Other	432	**.900**	.583	**.456**	0
Total	3439	.751	.448	.386	0

Panel B: By Year

Year	No. of obs.	Avg. Moneyness per CEO		Overconfident CEO %	
		Mean	Median	Mean	Median
2016	916	.791	.506	.405	0
2017	834	.847	.505	.429	0
2018	846	.627	.337	.313	0
2019	843	.739	.430	.394	0
Total	3439	.751	.448	.386	0

Panel C: By Gender

Gender		Avg. Moneyness per CEO		Overconfident CEO %	
	No. of obs.	Mean	Median	Mean	Median
Male CEO	3,257	.746	.446	.385	0
Female CEO	182	.842	.471	.390	0
Total	3439	.751	.448	.386	0

Table 12: Full model OLS regressions – Overconfidence Extension [-1d,+1d]

Female board representation and cumulative abnormal returns including overconfidence proxies. The dependent variable is CAR for all events. CAR is accumulated [-1d,+1d] window. All events and variable data are from 2020 and include US-listed S&P 1500 firms, but exclude financial firms. FemaleRatio is the percentage of female directors relative to total board size. Min3FDs is a dummy variable, which equals 1 if at least three female directors sit on a board, and 0 otherwise. FemaleCEO is a dummy variable, which equals 1 if a firms' CEO is female. OI is a dummy variable, which equals 1 if a company is classified as overconfident (Overconfident Industries), based on statistics presented in Table 11, and 0 otherwise. These three variables are used to construct interaction variables named as 'variable' + XOI. All event and variable definitions are provided in Appendix, Table A. Industry dummy variables are included in all models. Continuous variables are winsorised at the 5% level. Robust standard errors are in parentheses. ***, ** and * indicate significance at the 1%, 5% and 10%, respectively.

CAR [-1d,+1d]	Event 1 HED	Event 2 PMD	Event 3 PSD	Event 4 PUD	Event 5 RSD	Event 6 JBD
FemaleRatio	-.042**	.015	-.114	-.035	-.049	.005
	(.015)	(.025)	(.065)	(.021)	(.034)	(.033)
OI	-.02***	.003	-.028	-.015	-.027	0
	(.005)	(.008)	(.02)	(.013)	(.018)	(.006)
FemaleRatioXOI	.046**	-.015	.099	.008	.077	0
	(.015)	(.029)	(.067)	(.023)	(.045)	(.021)
Leverage	.016*	.002	-.038	.002	-.007	-.023***
	(.008)	(.006)	(.028)	(.006)	(.01)	(.006)
ROA	-.043	.069**	.096	-.113	-.208**	-.373***
	(.032)	(.029)	(.134)	(.129)	(.089)	(.081)
LnSales	-.001	.001	-.003	.004	-.001	0
	(.001)	(.001)	(.005)	(.002)	(.001)	(.001)
TobinsQ	0	0	.004	.002	.002*	0
	(.001)	(.001)	(.003)	(.002)	(.001)	(.001)
Age	0	0	0	0	0	.001
	(0)	(0)	(.001)	(0)	(0)	(0)
Tenure	0	0	-.001	-.001***	-.001	0
	(0)	(.001)	(.001)	(0)	(.001)	(.001)
OtherBoardsP. Dir	.003*	-.001	.018***	-.005	.005	-.003
	(.001)	(.003)	(.005)	(.006)	(.005)	(.008)
BoardIndepRatio	.004	-.006	-.014	-.012	-.017	.01
	(.01)	(.013)	(.025)	(.02)	(.018)	(.019)
Constant	.03	-.073**	-.069	-.03	.001	-.042
	(.018)	(.022)	(.059)	(.041)	(.013)	(.024)
Observations	1030	1020	1020	1024	1025	1035
R-squared	.065	.054	.094	.137	.077	.068
Min3FDs	-.01**	.001	-.03	-.008	-.009*	.005
	(.004)	(.003)	(.02)	(.007)	(.005)	(.006)
OI	-.012***	0	-.015	-.015	-.013	0
	(.003)	(.004)	(.015)	(.012)	(.011)	(.005)
Min3FDsXOI	.01*	-.003	.029	.004	.013	0
	(.005)	(.005)	(.022)	(.008)	(.007)	(.004)
Leverage	.016	.002	-.038	.003	-.008	-.023***
	(.008)	(.006)	(.027)	(.006)	(.01)	(.006)
ROA	-.046	.068*	.088	-.115	-.204**	-.37***
	(.035)	(.03)	(.138)	(.129)	(.087)	(.082)
LnSales	-.001	.002	-.002	.004	0	0
	(.001)	(.001)	(.005)	(.002)	(.001)	(.001)
TobinsQ	.001	0	.004	.002	.002*	0
	(.001)	(.001)	(.003)	(.002)	(.001)	(.001)
Age	0	0	0	0	0	.001*
	(0)	(0)	(.001)	(0)	(0)	(0)
Tenure	0	0	-.001	-.001***	-.001	0
	(0)	(.001)	(.001)	(0)	(.001)	(.001)
OtherBoardsP. Dir	.003**	-.001	.019***	-.004	.006	-.003
	(.001)	(.003)	(.005)	(.006)	(.005)	(.008)
BoardIndepRatio	.004	-.004	-.013	-.012	-.017	.006

	(.01)	(.014)	(.022)	(.019)	(.018)	(.019)
Constant	.02	-.07**	-.099*	-.04	-.009	-.04
	(.016)	(.023)	(.051)	(.044)	(.01)	(.029)
Observations	1030	1020	1020	1024	1025	1035
R-squared	.068	.054	.099	.136	.075	.071

FemaleCEO	-.002	-.001	.004	.007*	-.001	.004
	(.004)	(.003)	(.008)	(.003)	(.004)	(.005)
OI	-.009**	-.002	-.001	-.012	-.009	0
	(.003)	(.002)	(.018)	(.01)	(.008)	(.007)
FemaleCEOsXOI	.006	.01**	-.017	-.006	.015**	.003
	(.005)	(.004)	(.01)	(.008)	(.006)	(.008)
Leverage	.016*	.003	-.04	.002	-.007	-.023***
	(.008)	(.006)	(.028)	(.007)	(.01)	(.006)
ROA	-.043	.067**	.106	-.112	-.206*	-.372***
	(.032)	(.026)	(.127)	(.13)	(.089)	(.083)
LnSales	-.001	.001	-.003	.003	-.001	0
	(.001)	(.001)	(.005)	(.002)	(.001)	(.001)
TobinsQ	0	0	.004	.002	.002*	0
	(.001)	(.001)	(.003)	(.002)	(.001)	(.001)
Age	0	0	.001	0	0	.001
	(0)	(0)	(.001)	(0)	(0)	(0)
Tenure	0	0	-.001	-.001***	-.001	.001
	(0)	(.001)	(.001)	(0)	(.001)	(.001)
OtherBoardsP. Dir	.003	-.001	.017**	-.005	.005	-.003
	(.002)	(.003)	(.005)	(.006)	(.005)	(.007)
BoardIndepRatio	-.001	-.005	-.025	-.018	-.022	.009
	(.009)	(.013)	(.029)	(.02)	(.017)	(.017)
Constant	.021	-.069**	-.096	-.039	-.008	-.04
	(.017)	(.021)	(.059)	(.042)	(.011)	(.03)
Observations	1030	1020	1020	1024	1025	1035
R-squared	.057	.057	.088	.134	.073	.07

Table 13: Full model OLS regressions – Overconfidence Extension [-3d,+3d]

Female board representation and cumulative abnormal returns including overconfidence proxies. The dependent variable is CAR for all events. CAR is accumulated [-3d,+3d] window. All events and variable data are from 2020 and include US-listed S&P 1500 firms, but exclude financial firms. FemaleRatio is the percentage of female directors relative to total board size. Min3FDs is a dummy variable, which equals 1 if at least three female directors sit on a board, and 0 otherwise. FemaleCEO is a dummy variable, which equals 1 if a firms' CEO is female. OI is a dummy variable, which equals 1 if a company is classified as overconfident (Overconfident Industries), based on statistics presented in Table 11, and 0 otherwise. These three variables are used to construct interaction variables named as 'variable' + XOI. All event and variable definitions are provided in Appendix, Table A. Industry dummy variables are included in all models. Continuous variables are winsorised at the 5% level. Robust standard errors are in parentheses. ***, ** and * indicate significance at the 1%, 5% and 10%, respectively.

CAR [-3d,+3d]	Event 1 HED	Event 2 PMD	Event 3 PSD	Event 4 PUD	Event 5 RSD	Event 6 JBD
FemaleRatio	-.038	0	-.182	-.02	-.009	.017
	(.034)	(.038)	(.101)	(.054)	(.04)	(.04)
OI	-.017*	-.012	-.06	-.003	-.016	.011
	(.008)	(.015)	(.037)	(.017)	(.015)	(.009)
FemaleRatioXOI	.024	.03	.211*	-.017	.03	-.029
	(.025)	(.048)	(.106)	(.059)	(.038)	(.031)
Leverage	.017	.001	-.125**	.043*	.028***	.007
	(.014)	(.009)	(.052)	(.021)	(.005)	(.012)
ROA	.023	.266***	.169	-.028	-.126**	-.316***
	(.071)	(.07)	(.154)	(.148)	(.05)	(.081)
LnSales	.001	0	-.006	.002	-.002	-.001
	(.002)	(.001)	(.007)	(.004)	(.002)	(.001)
TobinsQ	.001	.002**	-.001	.003	.001	0
	(.001)	(.001)	(.004)	(.002)	(.001)	(.001)
Age	0	0	0	-.001**	-.001*	0
	(.001)	(.001)	(.001)	(0)	(0)	(0)
Tenure	0	-.001	0	-.001	0	-.001**
	(0)	(.001)	(.003)	(.001)	(.001)	(0)
OtherBoardsP. Dir	.002	-.003	.021*	-.006	.002	0
	(.003)	(.004)	(.01)	(.008)	(.006)	(.005)
BoardIndepRatio	-.004	.016	.022	-.057	-.026	-.036
	(.011)	(.026)	(.061)	(.031)	(.024)	(.02)
Constant	.034	-.102*	.211*	.006	.056**	.018
	(.045)	(.049)	(.11)	(.038)	(.019)	(.031)
Observations	1030	1020	1020	1024	1025	1035
R-squared	.028	.064	.106	.075	.075	.042

Min3FDs	-.007	.002	-.053	-.002	-.004	-.004
	(.004)	(.006)	(.031)	(.011)	(.003)	(.007)
OI	-.013**	-.004	-.029	-.007	-.011	.004
	(.005)	(.008)	(.023)	(.013)	(.006)	(.004)
Min3FDsXOI	.005	-.001	.053	-.002	.006**	0
	(.005)	(.007)	(.035)	(.012)	(.002)	(.006)
Leverage	.017	0	-.126**	.043*	.028***	.007
	(.014)	(.01)	(.05)	(.021)	(.005)	(.012)
ROA	.021	.266***	.15	-.03	-.125**	-.314***
	(.07)	(.071)	(.16)	(.148)	(.052)	(.064)
LnSales	.001	0	-.004	.002	-.002	0
	(.002)	(.002)	(.008)	(.004)	(.003)	(.001)
TobinsQ	.001	.002**	0	.003	.001	0
	(.001)	(.001)	(.004)	(.002)	(.001)	(.001)
Age	0	0	0	-.001**	-.001*	0
	(.001)	(.001)	(.001)	(0)	(0)	(0)
Tenure	0	-.001	0	-.001	0	-.001*
	(0)	(.001)	(.003)	(.001)	(.001)	(0)
OtherBoardsP. Dir	.002	-.003	.023*	-.006	.003	0
	(.003)	(.004)	(.01)	(.009)	(.006)	(.005)
BoardIndepRatio	-.005	.016	.029	-.059*	-.024	-.033

	(.011)	(.026)	(.054)	(.031)	(.024)	(.02)
Constant	.025	-.101*	.164	-.001	.055*	.021
	(.04)	(.048)	(.09)	(.043)	(.028)	(.025)
Observations	1030	1020	1020	1024	1025	1035
R-squared	.027	.062	.112	.074	.075	.042

FemaleCEO	.002	.002	-.032**	.011	.006	.013*
	(.006)	(.002)	(.011)	(.007)	(.006)	(.007)
OI	-.012	-.005	-.01	-.005	-.008	.005
	(.006)	(.006)	(.034)	(.015)	(.007)	(.005)
FemaleCEOXOI	.008	.017**	.025	-.027*	-.003	-.011
	(.008)	(.005)	(.018)	(.013)	(.01)	(.007)
Leverage	.017	.002	-.129**	.042*	.028***	.007
	(.014)	(.01)	(.051)	(.022)	(.005)	(.012)
ROA	.026	.263***	.161	-.026	-.124**	-.322***
	(.068)	(.069)	(.15)	(.148)	(.052)	(.078)
LnSales	0	0	-.005	.002	-.002	-.001
	(.002)	(.001)	(.007)	(.004)	(.002)	(.001)
TobinsQ	.001	.002***	0	.003	.001	0
	(.001)	(.001)	(.004)	(.002)	(.001)	(.001)
Age	0	0	0	-.001*	-.001	0
	(.001)	(.001)	(.001)	(0)	(0)	(0)
Tenure	0	-.001	-.001	-.001	0	-.001*
	(0)	(.001)	(.003)	(.001)	(.001)	(0)
OtherBoardsP. Dir	.001	-.003	.02*	-.006	.002	-.001
	(.003)	(.004)	(.01)	(.009)	(.006)	(.005)
BoardIndepRatio	-.01	.015	.009	-.06	-.026	-.037*
	(.01)	(.024)	(.064)	(.033)	(.023)	(.019)
Constant	.027	-.1*	.174	-.003	.054*	.02
	(.041)	(.047)	(.101)	(.041)	(.025)	(.025)
Observations	1030	1020	1020	1024	1025	1035
R-squared	.027	.068	.102	.077	.075	.044

Table 14: Full model OLS regressions – ClosetoConsumers (CtC) Extension [-1d,+1d]

Female board representation and cumulative abnormal returns including a ClosetoConsumers industry proxy. The dependent variable is CAR for all events. CAR is accumulated in the [-1d,+1d] window. All events and variable data are from 2020 and include US-listed S&P 1500 firms, but exclude financial firms. FemaleRatio is the percentage of female directors relative to total board size. Min3FDs is a dummy variable, which equals 1 if at least three female directors sit on a board, and 0 otherwise. FemaleCEO is a dummy variable, which equals 1 if a firms' CEO is female. CtC is a dummy variable, which equals 1 if a company is classified as ClosetoConsumer based on Brammer, Millington & Pavelin (2007), and 0 otherwise. The main female variables are used to construct interaction variables named as 'variable' + XCtC. All event and variable definitions are provided in the Appendix, Table A. Industry dummy variables are included in all models. Continuous variables are winsorised at the 5% level. Robust standard errors are in parentheses. ***, ** and * indicate significance at the 1%, 5% and 10%, respectively.

CAR [-1d,+1d]	Event 1 HED	Event 2 PMD	Event 3 PSD	Event 4 PUD	Event 5 RSD	Event 6 JBD
FemaleRatio	-.019	-.003	-.038	-.034*	.001	-.011
	(.013)	(.012)	(.028)	(.015)	(.011)	(.025)
CtC	-.012***	.022***	-.055	.012	-.015**	-.027***
	(.002)	(.005)	(.034)	(.008)	(.005)	(.007)
FemaleRatioXCtC	.019	.015	-.025	.002	-.009	.069**
	(.013)	(.018)	(.123)	(.023)	(.014)	(.029)
Leverage	.017*	-.001	-.03	.002	-.005	-.022**
	(.009)	(.005)	(.02)	(.007)	(.01)	(.007)
ROA	-.047	.075**	.078	-.125	-.198*	-.367***
	(.038)	(.032)	(.137)	(.139)	(.098)	(.077)
LnSales	-.001	.002*	-.004	.004*	-.001	0
	(.001)	(.001)	(.005)	(.002)	(.001)	(.001)
TobinsQ	0	0	.004	.001	.002**	0
	(.001)	(.001)	(.002)	(.001)	(.001)	(.001)
Age	0	0	0	0	0	.001*
	(0)	(0)	(.001)	(0)	(0)	(0)
Tenure	0	0	-.001	-.001***	-.001	0
	(0)	(.001)	(.001)	(0)	(.001)	(.001)
OtherBoardsP. Dir	.003	-.001	.019***	-.004	.006	-.002
	(.002)	(.003)	(.005)	(.006)	(.005)	(.007)
BoardIndepRatio	.006	-.004	-.016	-.003	-.015	.009
	(.01)	(.013)	(.028)	(.016)	(.015)	(.019)
Constant	.015	-.078**	-.066	-.042	-.007	-.041
	(.017)	(.024)	(.055)	(.038)	(.008)	(.023)
Observations	1030	1020	1020	1024	1025	1035
R-squared	.045	.067	.104	.124	.067	.073
Min3FDs	-.005**	-.001	-.008	-.004	-.002	.003
	(.002)	(.004)	(.009)	(.003)	(.002)	(.005)
CtC	-.009***	.027***	-.051**	.015**	-.019***	-.013**
	(.002)	(.002)	(.019)	(.006)	(.003)	(.005)
Min3FDsXCtC	.004	-.002	-.02	-.007	.003	.009
	(.004)	(.003)	(.034)	(.006)	(.002)	(.009)
Leverage	.017*	-.001	-.03	.003	-.004	-.022**
	(.009)	(.005)	(.019)	(.007)	(.01)	(.007)
ROA	-.05	.073*	.071	-.127	-.198*	-.363***
	(.04)	(.032)	(.144)	(.139)	(.098)	(.081)
LnSales	-.001	.002*	-.003	.004*	-.001	0
	(.001)	(.001)	(.005)	(.002)	(.002)	(.001)
TobinsQ	0	0	.004	.001	.002**	0
	(.001)	(.001)	(.003)	(.001)	(.001)	(.001)
Age	0	0	0	0	0	.001
	(0)	(0)	(.001)	(0)	(0)	(0)
Tenure	0	0	-.001	-.001***	-.001	0
	(0)	(.001)	(.001)	(0)	(.001)	(.001)
OtherBoardsP. Dir	.003	-.001	.019***	-.004	.006	-.003
	(.002)	(.003)	(.005)	(.006)	(.005)	(.007)
BoardIndepRatio	.008	-.003	-.014	-.004	-.014	.006

	(.01)	(.014)	(.026)	(.015)	(.016)	(.018)
Constant	.01	-.078**	-.074	-.049	-.009	-.04
	(.015)	(.025)	(.054)	(.04)	(.009)	(.027)
Observations	1030	1020	1020	1024	1025	1035
R-squared	.048	.067	.108	.124	.067	.073

FemaleCEO	.003	.006**	.001	.007	.007**	.004*
	(.003)	(.002)	(.004)	(.006)	(.003)	(.002)
CtC	-.007***	.028***	-.064***	.011***	-.019***	-.008***
	(.002)	(.001)	(.005)	(.002)	(.002)	(.002)
FemaleCEOXCtC	-.003	-.01**	-.009	-.01	-.001	.006
	(.004)	(.004)	(.023)	(.006)	(.004)	(.009)
Leverage	.018*	-.001	-.029	.003	-.004	-.022**
	(.009)	(.005)	(.02)	(.007)	(.01)	(.007)
ROA	-.046	.074**	.081	-.123	-.196*	-.37***
	(.038)	(.03)	(.134)	(.138)	(.096)	(.085)
LnSales	-.001	.002*	-.004	.004	-.001	0
	(.001)	(.001)	(.005)	(.002)	(.001)	(.001)
TobinsQ	0	0	.004	.001	.002**	0
	(.001)	(.001)	(.003)	(.001)	(.001)	(.001)
Age	0	0	0	.001	0	.001
	(0)	(0)	(.001)	(0)	(0)	(0)
Tenure	0	0	-.001	-.001***	-.001	.001
	(0)	(.001)	(.001)	(0)	(.001)	(.001)
OtherBoardsP. Dir	.003	-.001	.018***	-.005	.005	-.003
	(.002)	(.003)	(.005)	(.006)	(.005)	(.007)
BoardIndepRatio	.004	-.004	-.023	-.009	-.017	.009
	(.009)	(.012)	(.031)	(.016)	(.015)	(.017)
Constant	.013	-.078**	-.077	-.049	-.007	-.038
	(.015)	(.024)	(.05)	(.039)	(.008)	(.026)
Observations	1030	1020	1020	1024	1025	1035
R-squared	.043	.069	.102	.122	.069	.071

Table 15: Full model OLS regressions – ClosetoConsumers (CtC) Extension [-3d,+3d]

Female board representation and cumulative abnormal returns including a ClosetoConsumers industry proxy. The dependent variable is CAR for all events. CAR is accumulated in the [-3d,+3d] window. All events and variable data are from 2020 and include US-listed S&P 1500 firms, but exclude financial firms. FemaleRatio is the percentage of female directors relative to total board size. Min3FDs is a dummy variable, which equals 1 if at least three female directors sit on a board, and 0 otherwise. FemaleCEO is a dummy variable, which equals 1 if a firms' CEO is female. CtC is a dummy variable, which equals 1 if a company is classified as ClosetoConsumer based on Brammer, Millington & Pavelin (2007), and 0 otherwise. The main female variables are used to construct interaction variables named as 'variable' + XCtC. All event and variable definitions are provided in the Appendix, Table A. Industry dummy variables are included in all models. Continuous variables are winsorised at the 5% level. Robust standard errors are in parentheses. ***, ** and * indicate significance at the 1%, 5% and 10%, respectively.

CAR [-3d,+3d]	Event 1 HED	Event 2 PMD	Event 3 PSD	Event 4 PUD	Event 5 RSD	Event 6 JBD
FemaleRatio	-.036*	.008	-.032	-.034*	.012	-.001
	(.019)	(.022)	(.059)	(.015)	(.024)	(.029)
CtC	-.011	.025***	-.038	.024	.016*	-.029
	(.014)	(.007)	(.035)	(.026)	(.008)	(.022)
FemaleRatioXCtC	.045	.01	-.068	-.005	-.024	.022
	(.048)	(.023)	(.149)	(.076)	(.027)	(.078)
Leverage	.018	-.003	-.119**	.041	.027***	.011
	(.015)	(.009)	(.045)	(.022)	(.006)	(.009)
ROA	.021	.271***	.148	-.044	-.135**	-.296***
	(.071)	(.071)	(.153)	(.152)	(.052)	(.068)
LnSales	.001	.001	-.006	.002	-.002	-.001
	(.001)	(.001)	(.007)	(.003)	(.002)	(.001)
TobinsQ	.001	.002	-.001	.002	0	0
	(.001)	(.001)	(.004)	(.002)	(.001)	(.001)
Age	0	0	0	-.001*	-.001	0
	(.001)	(.001)	(.001)	(0)	(0)	(0)
Tenure	0	-.001	0	-.001	0	-.001*
	(0)	(.001)	(.003)	(.001)	(.001)	(0)
OtherBoardsP. Dir	.002	-.003	.021*	-.006	.002	0
	(.004)	(.004)	(.01)	(.008)	(.006)	(.005)
BoardIndepRatio	.001	.017	.019	-.05	-.021	-.039*
	(.014)	(.024)	(.081)	(.034)	(.026)	(.019)
Constant	.016	-.115**	.199	-.003	.046*	.032
	(.041)	(.048)	(.119)	(.041)	(.024)	(.032)
Observations	1030	1020	1020	1024	1025	1035
R-squared	.017	.069	.105	.075	.07	.045
Min3FDs	-.006*	.001	-.012	-.001	.001	-.001
	(.003)	(.004)	(.016)	(.004)	(.004)	(.006)
CtC	-.003	.03***	-.028	.028**	.014***	-.016**
	(.005)	(.006)	(.024)	(.011)	(.003)	(.007)
Min3FDsXCtC	.006	-.002	-.047	-.013	-.008**	-.01
	(.008)	(.007)	(.052)	(.012)	(.003)	(.012)
Leverage	.018	-.003	-.12**	.041	.027***	.01
	(.014)	(.009)	(.044)	(.022)	(.006)	(.009)
ROA	.017	.271***	.133	-.045	-.134**	-.297***
	(.073)	(.071)	(.166)	(.149)	(.05)	(.06)
LnSales	.001	.001	-.004	.002	-.002	-.001
	(.001)	(.002)	(.008)	(.003)	(.003)	(.001)
TobinsQ	.001	.002	0	.002	0	0
	(.001)	(.001)	(.004)	(.002)	(.001)	(.001)
Age	0	0	0	-.001**	-.001	0
	(.001)	(.001)	(.001)	(0)	(0)	(0)
Tenure	0	-.001	0	-.001	0	-.001*
	(0)	(.001)	(.003)	(.001)	(.001)	(0)
OtherBoardsP. Dir	.002	-.003	.022*	-.006	.002	0
	(.003)	(.004)	(.01)	(.008)	(.006)	(.005)
BoardIndepRatio	.001	.019	.028	-.053	-.019	-.035

	(.013)	(.025)	(.076)	(.033)	(.026)	(.02)
Constant	.009	-.111**	.196	-.007	.049	.036
	(.037)	(.048)	(.128)	(.042)	(.03)	(.032)
Observations	1030	1020	1020	1024	1025	1035
R-squared	.015	.069	.111	.075	.071	.047

FemaleCEO	.009*	.011**	-.009	.001	.004*	.008
	(.004)	(.004)	(.009)	(.011)	(.002)	(.006)
CtC	0	.029***	-.052***	.021**	.009***	-.023***
	(.002)	(.002)	(.009)	(.008)	(.002)	(.003)
FemaleCEOXCtC	-.007*	-.009*	-.031	-.006	.001	-.001
	(.004)	(.005)	(.028)	(.022)	(.003)	(.016)
Leverage	.019	-.003	-.12**	.041	.028***	.012
	(.014)	(.009)	(.045)	(.023)	(.006)	(.009)
ROA	.023	.271***	.143	-.043	-.133**	-.297***
	(.074)	(.073)	(.157)	(.152)	(.053)	(.069)
LnSales	.001	.001	-.006	.002	-.002	-.001
	(.002)	(.001)	(.007)	(.004)	(.002)	(.001)
TobinsQ	0	.002*	0	.002	0	0
	(.001)	(.001)	(.004)	(.002)	(.001)	(.001)
Age	0	0	0	-.001*	-.001	0
	(.001)	(.001)	(.001)	(0)	(0)	(0)
Tenure	0	-.001	0	-.001	0	-.001*
	(0)	(.001)	(.003)	(.001)	(.001)	(0)
OtherBoardsP. Dir	.002	-.003	.022*	-.006	.002	0
	(.003)	(.004)	(.01)	(.008)	(.006)	(.005)
BoardIndepRatio	-.004	.018	.015	-.056	-.021	-.04*
	(.012)	(.023)	(.079)	(.035)	(.025)	(.019)
Constant	.013	-.111**	.184	-.011	.047	.035
	(.038)	(.047)	(.107)	(.042)	(.028)	(.029)
Observations	1030	1020	1020	1024	1025	1035
R-squared	.016	.072	.106	.073	.071	.047

Table 16: Full model OLS regressions – LnSales Extension [-1d,+1d]

Female board representation and cumulative abnormal returns including size proxy. The dependent variable is CAR for all events. CAR is accumulated in the [-1d,+1d] window. All events and variable data are from 2020 and include US-listed S&P 1500 firms, but exclude financial firms. FemaleRatio is the percentage of female directors relative to total board size. Min3FDs is a dummy variable, which equals 1 if at least three female directors sit on a board, and 0 otherwise. FemaleCEO is a dummy variable, which equals 1 if a firms' CEO is female. The main female variables are used to construct interaction variables named as 'variable' + XLnSales. All event and variable definitions are provided in the Appendix, Table A. Industry dummy variables are included in all models. Continuous variables are winsorised at the 5% level. Robust standard errors are in parentheses. ***, ** and * indicate significance at the 1%, 5% and 10%, respectively.

CAR [-1d,+1d]	Event 1 HED	Event 2 PMD	Event 3 PSD	Event 4 PUD	Event 5 RSD	Event 6 JBD
FemaleRatio	-.035	.078	-.185**	-.087	-.065	-.105
	(.034)	(.043)	(.075)	(.071)	(.065)	(.096)
FemaleRatioXLnSales	.003	-.011	.02*	.009	.009	.017
	(.004)	(.007)	(.009)	(.011)	(.01)	(.012)
Leverage	.016*	.002	-.038	.005	-.007	-.022***
	(.009)	(.007)	(.027)	(.008)	(.01)	(.006)
ROA	-.046	.068**	.095	-.113	-.202*	-.368***
	(.038)	(.029)	(.137)	(.141)	(.097)	(.078)
LnSales	-.002	.004	-.008	.001	-.003	-.004
	(.002)	(.003)	(.006)	(.004)	(.004)	(.004)
TobinsQ	0	0	.004	.001	.002**	0
	(.001)	(.001)	(.002)	(.001)	(.001)	(.001)
Age	0	0	0	0	0	.001*
	(0)	(0)	(.001)	(0)	(0)	(0)

Tenure	0	0	-.001	-.001***	-.001	0
	(0)	(.001)	(.001)	(0)	(.001)	(.001)
OtherBoardsP. Dir	.003	-.001	.018***	-.004	.005	-.003
	(.002)	(.003)	(.005)	(.006)	(.005)	(.007)
BoardIndepRatio	.007	-.004	-.016	-.004	-.015	.009
	(.01)	(.012)	(.029)	(.017)	(.015)	(.019)
Constant	.019	-.092***	-.045	-.022	.005	-.011
	(.023)	(.027)	(.059)	(.054)	(.02)	(.014)
Observations	1030	1020	1020	1024	1025	1035
R-squared	.044	.055	.092	.123	.063	.071
Min3FDs	-.002	.022*	-.018	-.028*	-.023*	-.011
	(.007)	(.01)	(.028)	(.013)	(.012)	(.023)
Min3FDsXLnSales	0	-.003**	.001	.003*	.003	.002
	(.001)	(.001)	(.004)	(.002)	(.002)	(.003)
Leverage	.016	.001	-.039	.006	-.006	-.022***
	(.009)	(.007)	(.026)	(.007)	(.011)	(.006)
ROA	-.049	.067**	.086	-.113	-.201*	-.359***
	(.039)	(.029)	(.139)	(.141)	(.098)	(.074)
LnSales	0	.003*	-.002	.002	-.002	-.001
	(.001)	(.002)	(.006)	(.002)	(.002)	(.002)
TobinsQ	0	0	.004	.001	.002**	0
	(.001)	(.001)	(.003)	(.001)	(.001)	(.001)
Age	0	0	0	0	0	.001*
	(0)	(0)	(.001)	(0)	(0)	(0)
Tenure	0	0	-.001	-.001***	-.001	0
	(0)	(.001)	(.001)	(0)	(.001)	(.001)
OtherBoardsP. Dir	.003	0	.018***	-.004	.005	-.003
	(.002)	(.003)	(.005)	(.006)	(.005)	(.007)
BoardIndepRatio	.008	-.002	-.013	-.006	-.015	.005
	(.01)	(.014)	(.027)	(.016)	(.016)	(.019)
Constant	.008	-.084***	-.099*	-.034	0	-.031
	(.015)	(.023)	(.05)	(.045)	(.013)	(.02)
Observations	1030	1020	1020	1024	1025	1035
R-squared	.046	.057	.092	.124	.065	.072
FemaleCEO	.013*	.03*	.012	.018	-.002	-.008
	(.006)	(.013)	(.035)	(.02)	(.018)	(.024)
FemaleCEOXLnSales	-.002	-.004*	-.002	-.002	.001	.002
	(.001)	(.002)	(.005)	(.002)	(.002)	(.003)
Leverage	.016*	.002	-.04	.004	-.007	-.023***
	(.009)	(.006)	(.027)	(.007)	(.01)	(.006)
ROA	-.043	.069**	.1	-.12	-.206*	-.37***
	(.038)	(.028)	(.132)	(.141)	(.096)	(.086)
LnSales	-.001	.002*	-.003	.004	-.001	0
	(.001)	(.001)	(.006)	(.002)	(.002)	(.002)
TobinsQ	0	0	.004	.001	.002**	0
	(.001)	(.001)	(.002)	(.001)	(.001)	(.001)
Age	0	0	.001	0	0	.001
	(0)	(0)	(.001)	(0)	(0)	(0)
Tenure	0	0	-.001	-.001***	-.001	.001
	(0)	(.001)	(.001)	(0)	(.001)	(.001)
OtherBoardsP. Dir	.002	-.001	.017**	-.005	.005	-.002
	(.002)	(.002)	(.005)	(.007)	(.005)	(.007)
BoardIndepRatio	.004	-.004	-.024	-.01	-.017	.009
	(.009)	(.012)	(.032)	(.017)	(.015)	(.017)
Constant	.009	-.074***	-.098	-.048	-.012	-.038
	(.015)	(.022)	(.057)	(.042)	(.014)	(.024)
Observations	1030	1020	1020	1024	1025	1035
R-squared	.042	.057	.087	.121	.064	.07

Table 17: Full model OLS regressions – LnSales Extension [-3d,+3d]

Female board representation and cumulative abnormal returns including size proxy. The dependent variable is CAR for all events. CAR is accumulated in the [-3d,+3d] window. All events and variable data are from 2020 and include US-listed S&P 1500 firms, but exclude financial firms. FemaleRatio is the percentage of female directors relative to total board size. Min3FDs is a dummy variable, which equals 1 if at least three female directors sit on a board, and 0 otherwise. FemaleCEO is a dummy variable, which equals 1 if a firms' CEO is female. These three variables are used to construct interaction variables named as 'variable' + XLnSales. All event and variable definitions are provided in the Appendix, Table A. Industry dummy variables are included in all models. Continuous variables are winsorised at the 5% level. Robust standard errors are in parentheses. ***, ** and * indicate significance at the 1%, 5% and 10%, respectively.

CAR [-3d,+3d]	Event 1 HED	Event 2 PMD	Event 3 PSD	Event 4 PUD	Event 5 RSD	Event 6 JBD
FemaleRatio	-.093	.117	-.273	-.023	-.019	-.098
	(.06)	(.073)	(.173)	(.121)	(.047)	(.065)
FemaleRatioXLnSales	.011	-.016	.033	-.001	.004	.015
	(.008)	(.009)	(.027)	(.017)	(.008)	(.009)
Leverage	.019	0	-.125**	.044*	.029***	.008
	(.014)	(.01)	(.051)	(.023)	(.005)	(.011)
ROA	.019	.264***	.167	-.032	-.126**	-.309***
	(.075)	(.07)	(.149)	(.155)	(.052)	(.074)
LnSales	-.002	.005	-.014	.002	-.003	-.005
	(.004)	(.003)	(.012)	(.006)	(.004)	(.003)
TobinsQ	.001	.002*	-.001	.002	0	0
	(.001)	(.001)	(.004)	(.002)	(.001)	(.001)
Age	0	0	0	-.001**	-.001	0
	(.001)	(.001)	(.001)	(0)	(0)	(0)
Tenure	0	-.001	-.001	-.001	0	-.001**
	(0)	(.001)	(.003)	(.001)	(.001)	(0)
OtherBoardsP. Dir	.002	-.003	.021*	-.005	.002	-.001
	(.003)	(.004)	(.011)	(.008)	(.006)	(.005)
BoardIndepRatio	.001	.018	.018	-.051	-.022	-.039*
	(.014)	(.024)	(.082)	(.035)	(.026)	(.02)
Constant	.036	-.136**	.243	.001	.055	.053
	(.048)	(.043)	(.143)	(.068)	(.033)	(.034)
Observations	1030	1020	1020	1024	1025	1035
R-squared	.017	.064	.102	.073	.069	.041
Min3FDs	.003	.023	.009	.001	-.006	-.011
	(.005)	(.017)	(.059)	(.022)	(.014)	(.016)
Min3FDsXLnSales	-.001	-.003	-.005	-.001	.001	.001
	(.001)	(.002)	(.008)	(.003)	(.002)	(.003)
Leverage	.017	-.001	-.13**	.044*	.029***	.007
	(.014)	(.011)	(.05)	(.023)	(.005)	(.011)
ROA	.017	.264***	.146	-.034	-.127**	-.311***
	(.073)	(.069)	(.155)	(.156)	(.05)	(.066)
LnSales	.002	.002	-.001	.002	-.002	-.001
	(.002)	(.002)	(.008)	(.003)	(.003)	(.002)
TobinsQ	.001	.002*	0	.002	0	0
	(.001)	(.001)	(.004)	(.002)	(.001)	(.001)
Age	0	0	0	-.001*	-.001	0
	(.001)	(.001)	(.001)	(0)	(0)	(0)
Tenure	0	-.001	-.001	-.001	0	-.001*
	(0)	(.001)	(.003)	(.001)	(.001)	(0)
OtherBoardsP. Dir	.002	-.002	.022*	-.006	.003	0
	(.003)	(.004)	(.011)	(.009)	(.006)	(.005)
BoardIndepRatio	.001	.019	.03	-.054	-.02	-.035
	(.013)	(.024)	(.078)	(.034)	(.026)	(.02)
Constant	.007	-.116**	.139	-.008	.053	.03
	(.036)	(.046)	(.122)	(.046)	(.034)	(.028)
Observations	1030	1020	1020	1024	1025	1035

R-squared	.015	.063	.105	.072	.069	.041

FemaleCEO	.027	.066***	.063	.006	.023	.008
	(.021)	(.017)	(.072)	(.038)	(.018)	(.02)
FemaleCEOXLnSales	-.003	-.008***	-.012	-.001	-.003	0
	(.003)	(.002)	(.009)	(.004)	(.002)	(.002)
Leverage	.018	0	-.131**	.044*	.029***	.007
	(.014)	(.01)	(.052)	(.022)	(.005)	(.011)
ROA	.025	.266***	.165	-.032	-.131**	-.317***
	(.072)	(.071)	(.147)	(.157)	(.052)	(.079)
LnSales	.001	.002	-.003	.002	-.002	-.001
	(.002)	(.002)	(.008)	(.004)	(.002)	(.001)
TobinsQ	0	.002*	-.001	.002	0	0
	(.001)	(.001)	(.004)	(.002)	(.001)	(.001)
Age	0	0	0	-.001*	-.001	0
	(.001)	(.001)	(.001)	(0)	(0)	(0)
Tenure	0	-.001	-.001	-.001	0	-.001*
	(0)	(.001)	(.003)	(.001)	(.001)	(0)
OtherBoardsP. Dir	.001	-.004	.019*	-.006	.002	-.001
	(.004)	(.004)	(.009)	(.009)	(.006)	(.005)
BoardIndepRatio	-.004	.019	.015	-.056	-.021	-.039*
	(.013)	(.022)	(.082)	(.036)	(.025)	(.019)
Constant	.009	-.112**	.156	-.006	.047	.027
	(.038)	(.044)	(.117)	(.047)	(.031)	(.03)
Observations	1030	1020	1020	1024	1025	1035
R-squared	.016	.07	.103	.071	.071	.042