



# Cash is queen? Impact of gender-diverse boards on firms' cash holdings during COVID-19

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## ABSTRACT

This study examines the role of gender-diverse boards in preserving cash holdings during crises. Using a sample of UK firms during the COVID-19 period, we find that firms with more female directors had higher cash holdings. This increase in cash reserves is primarily driven by reduced board compensation, reflecting the careful stewardship associated with gender-diverse boards. Interestingly, we find no evidence of female directors reducing acquisition activity or capital expenditures, suggesting that these firms did not compromise on growth prospects while building their cash buffer. Our study underscores the value of gender-diverse boards in navigating firms through crises without sacrificing shareholder value. Our results remain robust even after controlling for endogeneity and alternative estimation techniques. The findings hold significant implications for investors, policymakers, and advocates of gender diversity in boardrooms, emphasizing the financial prudence that gender diversity can bring in crisis management.

## 1. Introduction

The COVID-19 pandemic has created an unprecedented economic crisis with widespread uncertainty, forcing firms to prioritize preserving their cash holdings to survive the disruptions caused by the pandemic. While research consistently shows that robust cash holdings buffer firms against crisis impacts (Chang et al., 2017; Duchin et al., 2010; Zheng, 2022), the strategies for building these reserves, particularly in response to unique challenges like those presented by COVID-19, are less understood. This study addresses this gap, focusing on the influence of gender-diverse boards on enhancing cash reserves during crises.

Over the past decade, the focus on gender diversity within boardrooms has gained considerable momentum (Abdelkader et al., 2024; Abou-El-Sood, 2021; Khatib, Abdullah, Elamer, & Abueid, 2021; Khatib, Abdullah, Elamer, Yahaya, & Owusu, 2021; Nguyen et al., 2020; Zalata et al., 2018). Gender-diverse boards are posited to adopt more conservative resource management strategies, reflecting a higher risk aversion among women compared to men (Adhikari, 2018; Alkhawaja et al., 2023; Almeida et al., 2004; Garcia-Blandon et al., 2022; García-Meca et al., 2022; Han & Qiu, 2007; Opler et al., 1999; Song & Lee, 2012). This trend aligns with broader findings that gender balance at the top

echelons of leadership associated with improved firm performance, proactive social responsibility, and effective crisis management (Amin et al., 2023; Boubaker, Derouiche, & Lasfer, 2015; Boubaker, Derouiche, & Nguyen, 2015; Carter et al., 2010; Chen et al., 2024; Cimini, 2022; Hu et al., 2023; Huang & Kisgen, 2013; Jebran et al., 2023; Kara et al., 2022; Lu et al., 2022; Nekhili et al., 2017; Papangkorn et al., 2021; Sun et al., 2015), reinforcing the global move towards gender quotas in boards. Yet, the specific contribution of female directors to firm resilience during crises, particularly through cash holdings, remains understudied.

Why do firms hold cash? The precautionary motive for cash holdings suggests that firms hold cash to mitigate unexpected future shocks (Myers, 1977). According to this theory, firms should hold more cash when there is a high degree of uncertainty surrounding their ability to raise cash. Numerous studies have found support for the precautionary motive (Acharya et al., 2012; Han & Qiu, 2007; McLean, 2011; Sun et al., 2023; Tosun et al., 2022; Yang et al., 2023). For example, Hou and Liu (2020) found evidence of precautionary motive for cash holdings in emerging markets such as China. More specifically, they found that private firms in China with foreign residency rights face higher cash flow uncertainty in the future. The gender differences in risk-taking behavior, mentioned earlier, can have implications for cash holdings during crises.

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As a result, female directors may be better equipped to make decisions that preserve their firms' cash holdings in line with the precautionary motive of cash holdings. There is already some evidence to support this conjecture. Preliminary evidence suggests firms led by female executives or with gender-diverse boards tend to maintain higher cash reserves, especially under financial constraints, underscoring a cautious approach to financial management (Adhikari, 2018).

Using a sample of 663 firm-quarter observations between March 2020 and June 2021, our study reveals that firms with a higher proportion of female directors maintained higher cash holdings during the pandemic's peak compared to their male-dominated counterparts. Using simultaneous equation estimations, we found that this increment was not attributable to an uptick in divestitures or a downswing in acquisition activities and capital expenditures. Intriguingly, we also found that firms with more gender-diverse boards had higher dividend payouts compared to those dominated by male directors. Our findings trace the higher cash holdings to the ability of female directors to curtail overall board cash compensation, thereby offering tangible evidence that gender-diverse boards make decisions that uphold shareholder value.

Our study makes several contributions to the literature. First, we contribute to the literature on the role of gender-diverse boards during crisis periods. While past studies found that gender-diverse boards are effective during crises, they did not explore the mechanisms through which these boards are effective. We bridge this gap by identifying the mechanism of reducing board compensation as an effective way for female directors to preserve their firms' cash holdings. Second, we contribute to the ongoing debate on the ability of female directors to create value. Campbell and Mínguez-Vera (2008) argued that gender-diverse boards lead to economic gains, while Adams and Ferreira (2009) found the impact of gender-diverse boards to be negative. Our findings support the former as we found that gender-diverse boards undertook voluntary pay cuts to preserve their firms' cash holdings during the pandemic, rather than sacrificing shareholder value through dividend cuts. Our findings also offer support to the FTSE Women-Leaders Review target of 40% representation of women on the boards of FTSE 350 companies by 2025. Third, our study investigates the impact of gender-diverse boards on firm value during COVID-19, an area that has been largely unexplored. While Kara et al. (2022) found that banks with a higher proportion of female directors were more socially responsible during COVID-19, our study demonstrates that gender diversity at the board level also served as an effective corporate governance mechanism during the pandemic. In addition, our findings suggest that female directors also created economic gains for their shareholders during COVID-19, as evidenced by the higher dividend payouts.

Taken together, our study highlights the importance of gender diversity in boardrooms and its role in safeguarding firms' cash holdings during crises. Our results offer valuable insights for policymakers and corporations alike, informing them on the development of corporate governance mechanisms that can help firms withstand future crises while maintaining shareholder value.

The rest of the paper is structured as follows. Section 2 reviews the existing literature and develops testable hypotheses. Section 3 outlines the sample construction. Section 4 outlines the results. Section 5 provides the results of the additional analysis. Section 6 concludes.

## 2. Literature review and hypotheses development

The inclusion of gender diversity within corporate boards is associated with several benefits, including enhanced decision-making processes and an increase in firm value (Campbell & Mínguez-Vera, 2008; Carter, Simkins, & Simpson, 2003; Elamer & Boulhaga, 2024; El-Dyasty & Elamer, 2023; El-Dyasty & Elamer, 2024). Firms with a substantial presence of female directors not only demonstrate improved financial performance but also enjoy a higher market valuation (Carter et al., 2003; Joecks et al., 2013; Liu et al., 2014). Additionally, the presence of gender-diverse boards tends to result in stock prices that more

accurately reflect firm-specific information (Gul et al., 2011), and these firms often outperform financially (Erhardt et al., 2003). The underlying premise is that gender-diverse boards amalgamate varied perspectives and experiences, enhancing the evaluation of options and risk management (Hui, Li, & Elamer, 2024; Terjesen, Couto, & Francisco, 2016; Ullah, Owusu, & Elamer, 2024; Elamer, Boulhaga, & Ibrahim, 2024). Furthermore, such boards are characterized by more effective monitoring, attributed to the independence and active involvement of female directors in the boardroom (Adams & Ferreira, 2009).

The aforementioned characteristics of gender-diverse boards should also enable them to help their companies in better managing crisis periods. During the COVID-19 pandemic, one of the critical measures undertaken by companies was to preserve their cash holdings. This action is consistent with the precautionary motive hypothesis, which suggests that firms may hold onto more cash to be better prepared for any future financial uncertainties, such as the one brought about by the pandemic (Opler et al., 1999). Given their ability to effectively monitor their firms, female directors are more likely to help their firms undertake decisions that preserve cash reserves during the pandemic. Existing studies have found evidence of firms increasing their cash holdings post a CEO turnover that results in a female CEO replacing a male CEO, which further suggests that gender-diverse boards may be more likely to support the decision to hold onto more cash reserves during the pandemic.

Based on the theoretical underpinnings and existing empirical evidence, we conjecture that firms with a higher fraction of female directors had higher cash holdings during crisis periods, consistent with the precautionary motive. Therefore, we construct our first hypothesis as follows:

**H1.** Firms with a higher fraction of female directors have higher levels of cash holdings during crises.

There are various mechanisms through which firms can preserve their cash holdings (Ahmed et al., 2024; Alam et al., 2022; Amess et al., 2015; Khatib, Abdullah, Hendrawaty, & Elamer, 2021; Orlova, 2020; Sarker et al., 2023; Seifert & Gonenc, 2016). Prior research has suggested that while divestitures can be an effective mechanism for raising cash, they also incur transaction costs (Song & Lee, 2012). Given that gender-diverse boards allocate more effort towards monitoring (Adams & Ferreira, 2009), this increased monitoring is likely to prevent the management from engaging in divestitures to raise cash. Furthermore, female directors are expected to prioritize the long-term interests of their firms over short-term gains, consistent with the idea of the precautionary motive of cash holdings (Brown & Petersen, 2011; Terjesen et al., 2009). Thus, we conjecture that female directors prioritize cost saving over generating quick cash during crisis periods and as a result, undertake fewer divestitures during crisis periods in order to avoid the costs and potential losses associated with these transactions. Therefore, we propose the following hypothesis:

**H2.** Firms with a higher fraction of female directors undertake fewer divestitures during crises.

Existing research demonstrates that firms tend to preserve cash during crisis periods by reducing their capital expenditures and acquisition activity (Almeida et al., 2009; Arslan-Ayaydin et al., 2014; Duchin et al., 2010; Tawiah & O'Connor Keefe, 2022). Constrained firms, in particular, have been found to reduce current investments during periods where future cash flow volatility is high (Hou & Liu, 2020). However, entrenched managers may use excess cash for their personal benefits, such as expanding their firms or engage in value-destroying activities, such as overpaying for acquisitions (Harford, 1999; Lang et al., 1991; Richardson, 2006). Moreover, overconfident CEOs have been found to undertake value-destroying acquisitions (Malmendier & Tate, 2008). More recently, Hou and Liu (2020) found that poor corporate governance worsens the agency conflicts in Chinese private firms with foreign residency rights, leading to a decline in the market value of their cash holdings. Lou et al. (2021) further expanded the

literature on the relationship between cash holdings and managerial incentives by investigating the impact of CEOs' political promotion incentives on the value of corporate cash holdings in China's state-owned enterprises. They found that the value of cash holdings significantly decreased when these CEOs received political promotion and this effect was more pronounced when there was less external supervision.

The literature suggests that boards with gender diversity are associated with increased monitoring and reduced CEO overconfidence (Adams & Ferreira, 2009; Gul et al., 2011). Such boards are also expected to be less prone to empire-building incentives through acquisitions (Chen et al., 2016; Huang & Kisgen, 2013; Levi et al., 2014), and are more likely to avoid value-destroying activities (Campbell & Minguez-Vera, 2008; Carter et al., 2003). The increased monitoring associated with gender-diverse boards can also result in better decision-making and greater transparency in financial reporting (Evgeniou & Vermaelen, 2017). Therefore, we posit that female directors are unlikely to sacrifice capital expenditures or value-boosting acquisitions to enhance their firms' cash holdings. We construct our third hypothesis as follows:

**H3.** Firms with a higher proportion of female directors do not reduce capital expenditures and acquisition activity during crises.

Another critical component of firms' capital allocation decision is their dividend payout policies, which could be subject to change during a crisis period. According to agency theory, dividend payouts help mitigate agency problems, as they signal managers' confidence in the firm's underlying financial strength and can prevent managers from wasting cash on value-destroying projects (Baker et al., 2016; Jensen, 1986). Such agency problems were further confirmed by Lou et al. (2021) who found that CEOs, in China's state-owned enterprises, who received political promotions, were more likely to engage in social activities and vanity projects at the expense of cash dividends. On the contrary, the precautionary saving theory argues that firms prioritize retaining cash during crises and may cut dividends to maintain their cash levels and finance value-increasing investments (Bliss et al., 2015), even at the cost of sending negative signals to the market and creating uncertainty about the firm's financial health (Pettit, 1972).

Female directors tend to be more risk-averse and cautious, leading to more prudent decision-making during crises (Xu et al., 2019). As such, we conjecture that firms with a higher proportion of female directors are more likely to prioritize retaining cash during a crisis, even if it means reducing dividends. This is because female directors may place a higher value on maintaining the firm's financial health and preserving its long-term value (Terjesen et al., 2009). Based on this rationale, we construct our fourth hypothesis as follows:

**H4.** Firms with a higher fraction of female directors reduce cash dividends during crises.

Finally, studies have found that firms with female directors on the remuneration committee are likely to moderate the growth in executive compensation and reduce shareholder dissent via the say-on-pay mechanism (Alkalbani et al., 2019; García-Izquierdo et al., 2018). Moreover, given that female directors are considered to be more effective monitors (Adams & Ferreira, 2009), we conjecture that they are likely to initiate pay cuts at the boardroom level during crisis periods in order to boost their firms' overall cash holdings. Based on this rationale, we construct our fifth and final hypothesis as follows:

**H5.** Firms with a higher fraction of female directors reduce their total board compensation during crises.

### 3. Data, sample selection, and descriptive statistics

Data on the Board of Directors of U.K. firms, during the period from March 2020 to June 2021, was obtained from BoardEx. This sample period was chosen because it coincides with the first COVID-19-induced

lockdown in the United Kingdom in March 2020, and it ends with the complete removal of COVID-19 restrictions by the U.K. Government in June 2021. The sample includes only those directors who were associated with the firm as of June 2021. The initial sample of the study comprises of 4780 unique directors and 10,177 director-firm observations.

For our analysis, we obtained accounting data from Worldscope, covering firms listed on the FTSE All-Share Index. The study utilized quarterly financials, a choice dictated by the 15-month span of our sample period. This granularity, as opposed to annual aggregates, proved crucial for two reasons. First, the quarterly format aligns with the rapid developments inherent to the COVID-19 pandemic, offering a lens into the temporal nuances of board decisions. Second, it provides a detailed view of the influence exerted by female directors on firm strategies during this volatile period, thereby enabling a more precise assessment of gender diversity's impact on corporate resilience and decision-making. We merged our Worldscope data with the BoardEx sample. We removed those observations that had any missing values for any of our variables. In addition, to eliminate any outliers, all continuous variables were winsorized at the 1% level. Our final sample, following this process, consists of 532 unique firms and 663 firm-quarter observations. Appendix A provides a definition of all variables used in the study. Descriptive statistics for the variables used in the analysis are presented in Table 1.

As evidenced by Table 1, on average, the firms held \$329 million in cash and short-term investments, with a mean total asset value of \$4.22 billion. The average fraction of female directors on the board was 13.73%. With respect to firms' corporate actions, we found that firms acquired, on average, 1.14% of their assets and divested 0.84% of their assets during the sample period. In terms of cash payouts, firms paid out an average of \$85.50 million in cash dividends during the sample period, while the total board compensation, which comprises salary and bonus, amounted to \$213.85 million.

The correlation analysis is presented in Appendix B. We have tested for potential multicollinearity issues, and the results indicate no significant correlations among the control variables.

**Table 1**  
Summary Statistics.

Variable	N	Number of Unique Firms	Mean	Standard Deviation
Cash&Short-TermInvestments (\$mil.)	663	532	329.00	954.00
Ln (Cash&Short-TermInvestments)	663	532	17.4334	2.1258
FracFemale (%)	663	532	13.73	18.40
Ln (Board Size)	663	532	1.8460	0.3393
M/B	663	532	3.5091	4.6152
Leverage	663	532	0.1580	0.1653
Size (\$ mil.)	663	532	4220.00	14,600.00
Ln (Size)	663	532	19.9760	1.9722
AcquiredAssets (%)	663	532	1.1424	3.4692
Capex / Assets (%)	663	532	2.2043	3.6307
DivestedAssets (%)	663	532	0.8395	2.7650
Cash Dividends (\$ mil.)	663	532	85.50	275.00
Ln (Cash Dividends)	663	532	16.1881	2.0198
Total Compensation (\$ mil.)	663	532	213.8582	354.1821
Ln (Total Compensation)	663	532	4.5618	1.1567

Notes: This table provides the summary statistics of our sample. The sample consists of 663 firm-quarter observations of 532 U.K. firms spanning a time period between March 2020 and June 2021. This sample period was chosen because it coincides with the first COVID-19-induced lockdown in the United Kingdom in March 2020, and it ends with the complete removal of COVID-19 restrictions by the U.K. Government in June 2021. All variables are defined in Appendix A.

**Table 2**

Do firms with a higher proportion of female directors have higher cash holdings during COVID-19?

Dependent Variable	Ln (Cash & Short-Term Investments)
FracFemale	0.7670* (0.086)
CEO Duality	-1.1715 (0.171)
Ln (Board Size)	0.2461 (0.475)
M/B	0.0185* (0.084)
Leverage	-0.9571 (0.171)
Size	0.6441*** (0.000)
DivestedAssets	3.2471 (0.112)
AcquiredAssets	-1.9253* (0.077)
Capex/Assets	0.0918 (0.943)
Ln (Cash Dividends)	0.0793 (0.160)
Ln (Total Compensation)	0.0706 (0.212)
Constant	3.5628*** (0.000)
N	663
R <sup>2</sup>	0.7766
Industry Fixed Effects	YES

Notes: An OLS regression is used to estimate the relationship between corporate cash holdings and the proportion of female directors in the boardroom. All variables are defined in Appendix A. p-values are shown in parentheses. Standard errors are clustered by firm. Statistical significance at the 1%, 5%, and 10% levels are denoted as \*\*\*, \*\*, and \* respectively.

**4. Results & discussion**

**4.1. Do female directors increase Firms' cash holdings during crisis periods?**

In this section, we test our conjecture that firms with a higher proportion of female directors have higher cash holdings compared to those firms with a lower proportion of female directors. To investigate this, we estimate an ordinary least squares (OLS) regression, as shown in Eq. (1):

$$Ln(Cash\&ShortTermInvestments) = \alpha + \beta_1FracFemale + \beta_2CEODuality + \beta_3Ln(BoardSize) + \beta_4\left(\frac{M}{B}\right) + \beta_5Leverage + \beta_6Size + \beta_7DivestedAssets + \beta_8AcquiredAssets + \beta_9\left(\frac{Capex}{Assets}\right) + \beta_{10}Ln(CashDividends) + \beta_{11}Ln(TotalCompensation) + \epsilon_{it} + f_{ind} \tag{1}$$

where the dependent variable  $Ln(Cash\&ShortTermInvestments)$  represents the natural logarithm of the cash and short-term investments, and the key variable of interest,  $FracFemale$ , represents the fraction of female directors on the board. All other firm and board-level characteristics are defined in Appendix A. Table 2 outlines the results.

Table 2 shows that firms with a higher proportion of female directors hold more cash reserves compared to those with a higher fraction of male directors, which confirms our first hypothesis. More specifically, we find that a 1% increase in the proportion of female directors leads to a 108.49% increase in cash holdings.<sup>1</sup> These results are consistent with previous research that suggests that gender-diverse boards lead to better

<sup>1</sup> A 1% increase in female directors increases the  $Ln(Cash\&ShortTermInvestments)$  by 76.7%. This implies that Cash & Short-Term Investments increase by  $(e^{0.767}-1) \times 100\%$ , which is approximately 108.49%.

**Table 3**

Do female directors use divestitures to boost their firms' cash holdings during COVID-19?

Dependent Variable	Coefficient	Coefficient
	(1)	(2)
	Ln (Cash & Short-Term Investments)	DivestedAssets
FracFemale	0.7854** (0.015)	-0.0022 (0.772)
DivestedAssets	6.204*** (0.001)	
CEO Duality	-0.9889 (0.190)	-0.0061 (0.734)
Ln (Board Size)	0.2522 (0.359)	0.0047 (0.467)
M/B	0.0246* (0.083)	-0.0005 (0.164)
Leverage	-0.9585* (0.061)	0.0017 (0.891)
Size	0.7239*** (0.001)	-0.0038*** (0.006)
Ln (Cash & Short-Term Investments)		0.0035*** (0.001)
Constant	3.1191** (0.025)	0.0069 (0.834)
N	663	663
R <sup>2</sup>	0.7730	0.2503
Industry Fixed Effects	YES	YES

Notes: A Simultaneous equation model is estimated to analyse whether the increase in cash holdings in firms with a higher proportion of female directors is due to these firms undertaking more divestitures during COVID-19. All variables are defined in Appendix A. p-values are shown in parentheses. Standard errors are clustered by firm. Statistical significance at the 1%, 5%, and 10% levels are denoted as \*\*\*, \*\*, and \* respectively.

economic outcomes (Campbell & Mínguez-Vera, 2008).

Next, we evaluate the mechanisms through which, the firms' cash holdings are being boosted. We first examine whether more gender-diverse boards rely on divestitures, as outlined by the second hypothesis. To test this conjecture, we run the following simultaneous equations:

$$Ln(Cash\&ShortTermInvestments) = \alpha + \beta_1FracFemale + \beta_2DivestedAssets + \beta_3CEODuality + \beta_4Ln(BoardSize) + \beta_5\left(\frac{M}{B}\right) + \beta_6Leverage + \beta_7Size + \epsilon_{it} + f_{ind} \tag{2}$$

$$DivestedAssets = \alpha + \beta_1FracFemale + \beta_2CEODuality + \beta_3Ln(BoardSize) + \beta_4\left(\frac{M}{B}\right) + \beta_5Leverage + \beta_6Size + \beta_7Ln(Cash\&ShortTermInvestments) + \epsilon_{it} + f_{ind} \tag{3}$$

The dependent variable in Eq. (2),  $Ln(Cash\&ShortTermInvestments)$  is the natural logarithm of the cash and short-term investments. The key variables of interest are  $FracFemale$ , which represents the fraction of female directors in a firm's board and  $DivestedAssets$ , which represent the ratio of the total fixed assets that are disposed of during the period to the total assets.

The dependent variable in Eq. (3) is  $DivestedAssets$  and the key variable of interest is  $FracFemale$ . All other board and firm-related variables are defined in Appendix A. The results of the Simultaneous equation regression of cash holdings and divestitures is shown in Table 3.

In the first specification of Table 3, our study confirms the positive relationship between the fraction of female directors and firms' cash holdings, consistent with our first hypothesis. We also find that in general, firms in our sample do undertake divestitures to boost their cash holdings, despite the associated transaction costs, as evidenced by the positive coefficient of the  $DivestedAssets$  variable, which is statistically significant at the 1% level. This finding aligns with prior studies that have suggested that financial constraints can drive firms to divestitures



(Lang et al., 1995).

However, based on the evidence from the second specification of Table 3, where *DivestedAssets* is the dependent variable, we observe that firms with a higher fraction of female directors are less likely to resort to divestitures to raise cash, as evidenced by the statistical insignificance of the *FracFemale* coefficient. This finding lends support to our second hypothesis, thereby implying that gender-diverse boards encourage their firms to find alternate mechanisms to preserve cash, those that do not incur transaction costs. This finding is consistent with prior studies that have shown that female directors are more proactive in their involvement with the firm (Adams & Ferreira, 2009) and can help to create value for the firm (Campbell & Minguez-Vera, 2008; Liu et al., 2014 and Terjesen et al., 2016).

Overall, the results of this section show that gender diversity on corporate boards can have a significant impact on a firm's financial decision-making during crises, particularly concerning their cash holdings and divestiture decisions.

#### 4.2. Do gender-diverse boards reduce corporate investments to boost cash holdings during crisis?

In this section, we explore whether gender-diverse boards reduce corporate investments as a way to preserve their firms' cash holdings.

First, we investigate whether gender-diverse boards cause firms to reduce their acquisition activity during crisis. During periods of crisis, firms tend to hold more cash as a precautionary measure to mitigate the negative impact of unexpected earnings shocks (Denis, 2011). However, entrenched managers are more likely to waste free cash flow by investing in value-destroying projects (Jensen, 1986). Overconfident CEOs have been found to pursue value-destroying acquisitions (Malmendier & Tate, 2008). Additionally, during crises, acquirers often engage in value-destroying acquisitions due to the perception that they can acquire assets at discounted prices (Ang & Mauck, 2011). Female directors, through their increased monitoring, are expected to prevent such decisions and direct firms towards boosting their cash holdings. To test this conjecture, we estimate the following regression models simultaneously:

$$\begin{aligned} \ln(\text{Cash\&ShortTermInvestments}) = & \alpha + \beta_1 \text{FracFemale} + \beta_2 \text{AcquiredAssets} \\ & + \beta_3 \text{CEODuality} + \beta_4 \ln(\text{BoardSize}) + \beta_5 \left(\frac{M}{B}\right) + \beta_6 \text{Leverage} + \beta_7 \text{Size} + \varepsilon_{it} + f_{ind} \end{aligned} \tag{4}$$

$$\begin{aligned} \text{AcquiredAssets} = & \alpha + \beta_1 \text{FracFemale} + \beta_2 \text{CEODuality} + \beta_3 \ln(\text{BoardSize}) \\ & + \beta_4 \left(\frac{M}{B}\right) + \beta_5 \text{Leverage} + \beta_6 \text{Size} + \beta_7 \ln(\text{Cash\&ShortTermInvestments}) \\ & + \varepsilon_{it} + f_{ind} \end{aligned} \tag{5}$$

where  $\ln(\text{Cash\&ShortTermInvestments})$  is the natural logarithm of the cash and short-term investments. The key variables of interest are *FracFemale*, which represents the fraction of female directors in a firm's board and *AcquiredAssets*, which represent the ratio of the total fixed assets that are acquired during the period to the total assets.

The dependent variable in Eq. (5) is *AcquiredAssets* and the key variable of interest is *FracFemale*. All other board and firm-related variables are defined in Appendix A. The results of the simultaneous equation regression of cash holdings and acquisition activity is shown in Table 4.

Our initial results surrounding the precautionary motive of cash holdings are preserved, as evidenced from the first specification of Table 4, that is, firms with a higher fraction of female directors have higher cash holdings during crises. Additionally, we find that firms, in general, tend to reduce their acquisition activity during crises to preserve their cash holdings, as evidenced by the statistical significance of the *AcquiredAssets* coefficient, which is negative, in the first

**Table 4**

Do female directors reduce acquisition activity to boost their firms' cash holdings during COVID-19?

Dependent Variable	Coefficient	Coefficient
	(1)	(2)
	Ln (Cash & Short-Term Investments)	AcquiredAssets
FracFemale	0.7841** (0.015)	0.0010 (0.903)
AcquiredAssets	-4.1563** (0.021)	
CEO Duality	-1.1657 (0.124)	-0.0308 (0.106)
Ln (Board Size)	0.3007 (0.275)	0.0039 (0.577)
M/B	0.0212 (0.136)	-0.0002 (0.609)
Leverage	-0.9549* (0.063)	0.0008 (0.950)
Size	0.7126*** (0.000)	0.0011 (0.440)
Ln (Cash & Short-Term Investments)		-0.0026 (0.021)
Constant	3.2799** (0.019)	0.0202 (0.569)
N	663	663
R <sup>2</sup>	0.7730	0.4578
Industry Fixed Effects	YES	YES

Notes: A Simultaneous equation model is estimated to analyse whether the increase in cash holdings in firms with a higher proportion of female directors is due to these firms undertaking fewer acquisitions during COVID-19. All variables are defined in Appendix A. *p*-values are shown in parentheses. Standard errors are clustered by firm. Statistical significance at the 1%, 5%, and 10% levels are denoted as \*\*\*, \*\*, and \* respectively.

specification. This finding is in line with the literature that shows that firms tend to prioritize cash preservation during crises by cutting capital expenditures and reducing acquisition activity (Almeida et al., 2009; Arslan-Ayaydin et al., 2014; Duchin et al., 2010; Tawiah & O'Connor Keefe, 2022).

However, as seen from the second specification of Table 4, the *FracFemale* variable is positive albeit statistically insignificant. Thus, we find no evidence that female directors constrain firms' acquisition activity to increase their cash holdings. One possible explanation for this finding is that firms with a higher fraction of female directors could be targeting stand-alone private firms or subsidiaries of financially constrained firms, which typically offer acquisition discounts of between 15% to 30% relative to acquisition multiples of their listed counterparts (Officer, 2007). Thus, female directors may continue to encourage their firms to seek out such crisis-specific opportunities even when cash preservation is the priority.

Next, we evaluate whether female directors reduce firms' capital expenditures in order to preserve their cash holdings. To test this conjecture, we run the following regressions simultaneously:

$$\begin{aligned} \ln(\text{Cash\&ShortTermInvestments}) = & \alpha + \beta_1 \text{FracFemale} + \beta_2 \left(\frac{\text{Capex}}{\text{Assets}}\right) \\ & + \beta_3 \text{CEODuality} + \beta_4 \ln(\text{BoardSize}) + \beta_5 \left(\frac{M}{B}\right) + \beta_6 \text{Leverage} \\ & + \beta_7 \text{Size} + \varepsilon_{it} + f_{ind} \end{aligned} \tag{6}$$

$$\begin{aligned} \left(\frac{\text{Capex}}{\text{Assets}}\right) = & \alpha + \beta_1 \text{FracFemale} + \beta_2 \text{CEODuality} + \beta_3 \ln(\text{BoardSize}) \\ & + \beta_4 \left(\frac{M}{B}\right) + \beta_5 \text{Leverage} + \beta_6 \text{Size} + \beta_7 \ln(\text{Cash\&ShortTermInvestments}) \\ & + \varepsilon_{it} + f_{ind} \end{aligned} \tag{7}$$

The dependent variable in Eq. (6),  $\ln(\text{Cash\&ShortTermInvestments})$  is the natural logarithm of the cash and short-term investments. The key

**Table 5**

Do female directors reduce capital expenditures to boost their firms' cash holdings during COVID-19?

Dependent Variable	Coefficient	Coefficient
	(1)	(2)
	Ln (Cash & Short-Term Investments)	Capex/Total Assets
FracFemale	0.7915** (0.014)	-0.0030 (0.721)
Capex/Total Assets	1.2244 (0.484)	
CEO Duality	-1.0067 (0.185)	-0.0337* (0.087)
Ln (Board Size)	0.3060 (0.269)	-0.0151** (0.035)
M/B	0.0219 (0.123)	0.0002 (0.623)
Leverage	-0.9902* (0.054)	0.0181 (0.176)
Size	0.7135*** (0.000)	0.0013 (0.398)
Ln (Cash & Short-Term Investments)		0.0008 (0.484)
Constant	3.2032** (0.022)	0.0205 (0.574)
N	663	663
R <sup>2</sup>	0.7730	0.4742
Industry Fixed Effects	YES	YES

Notes: A Simultaneous equation model is estimated to analyse whether the increase in cash holdings in firms with a higher proportion of female directors is due to these firms reducing their capital expenditures during COVID-19. All variables are defined in Appendix A. *p*-values are shown in parentheses. Standard errors are clustered by firm. Statistical significance at the 1%, 5%, and 10% levels are denoted as \*\*\*, \*\*, and \* respectively.

variables of interest are *FracFemale*, which represents the fraction of female directors in a firm's board and  $\left(\frac{Capex}{Assets}\right)$ , which represent the ratio of the total capital expenditures during the period to the total assets.

The dependent variable in Eq. (7) is  $\left(\frac{Capex}{Assets}\right)$  and the key variable of interest is *FracFemale*. All other board and firm-related variables are defined in Appendix A. The results of the Simultaneous equation regression of cash holdings and capital expenditures is shown in Table 5.

Based on the second specification of Table 5, we find that although firms with a higher fraction of female directors decrease their capital expenditures, the result is statistically insignificant. This finding, combined with our finding that female directors do not resort to reducing their firms' acquisition activity, lends support to our third hypothesis, that is, female directors do not place constraints on firms' investment activity to increase cash holdings. Instead, they may still encourage their firms to seek out positive net present value projects during times of crisis, which further lends support to the notion that gender diversity in the boardroom creates value for firms during crisis periods.

#### 4.3. Do female directors alter firms' payout policy to boost cash holdings?

In this section, we turn our focus to the relationship between gender-diverse boards and cash dividends during crisis, as outlined by our fourth hypothesis. To test this hypothesis, we estimate the following regressions simultaneously:

$$\begin{aligned} \text{Ln}(\text{Cash\&ShortTermInvestments}) &= \alpha + \beta_1 \text{FracFemale} \\ + \beta_2 \text{Ln}(\text{Cash Dividends}) + \beta_3 \text{CEODuality} + \beta_4 \text{Ln}(\text{BoardSize}) & \quad (8) \\ + \beta_5 \left(\frac{M}{B}\right) + \beta_6 \text{Leverage} + \beta_7 \text{Size} + \varepsilon_{it} + f_{ind} \end{aligned}$$

**Table 6**

Do female directors reduce cash dividends to boost their firms' cash holdings during COVID-19?

Dependent Variable	Coefficient	Coefficient
	(1)	(2)
	Ln (Cash & Short-Term Investments)	Ln (Cash Dividends)
FracFemale	0.6582** (0.042)	0.6742** (0.010)
Ln (Cash Dividends)	0.1708*** (0.002)	
CEO Duality	-1.0395 (0.168)	0.0631 (0.918)
Ln (Board Size)	0.2651 (0.335)	0.1008 (0.655)
M/B	0.0120 (0.408)	0.0569*** (0.000)
Leverage	-1.0005** (0.050)	0.3237 (0.439)
Size	0.5838*** (0.000)	0.6921*** (0.000)
Ln (Cash & Short-Term Investments)		0.1131*** (0.002)
Constant	3.9217*** (0.006)	-4.4057*** (0.000)
N	663	663
R <sup>2</sup>	0.7730	0.8336
Industry Fixed Effects	YES	YES

Notes: A Simultaneous equation model is estimated to analyse whether the increase in cash holdings in firms with a higher proportion of female directors is due to these firms reducing their cash dividend pay outs during COVID-19. All variables are defined in Appendix A. *p*-values are shown in parentheses. Standard errors are clustered by firm. Statistical significance at the 1%, 5%, and 10% levels are denoted as \*\*\*, \*\*, and \* respectively.

$$\begin{aligned} \text{Ln}(\text{Cash Dividends}) &= \alpha + \beta_1 \text{FracFemale} + \beta_2 \text{CEODuality} \\ + \beta_3 \text{Ln}(\text{BoardSize}) + \beta_4 \left(\frac{M}{B}\right) + \beta_5 \text{Leverage} + \beta_6 \text{Size} & \quad (9) \\ + \beta_7 \text{Ln}(\text{Cash\&ShortTermInvestments}) + \varepsilon_{it} + f_{ind} \end{aligned}$$

The dependent variable in Eq. (8), *Ln(Cash&ShortTermInvestments)* is the natural logarithm of the cash and short-term investments. The key variables of interest are *FracFemale*, which represents the fraction of female directors in a firm's board and *Ln(Cash Dividends)*, which represents the natural logarithm of cash dividends.

The dependent variable in Eq. (9) is *Ln(Cash Dividends)* and the key variable of interest is *FracFemale*. All other board and firm-related variables are defined in Appendix A. The results of the Simultaneous equation regression of cash holdings and cash dividends is shown in Table 6.

Based on the positive and statistically significant *FracFemale* coefficient in the second specification of Table 6, we find that firms with a higher proportion of female directors increased their dividend payouts during the COVID-19 pandemic, which rejects our fourth hypothesis. This result suggests that gender-diverse boards, during the pandemic, prioritized maintaining positive relationships with shareholders and avoided the negative market signals associated with dividend cuts (Pettit, 1972). Furthermore, dividend increases could also be seen as a way to mitigate the agency costs of free cash flow (Jensen, 1986) and signal the confidence of gender-diverse boards in the firm's financial strength (Baker et al., 2016). Our finding contradicts the findings of Xu et al. (2019), which implied that gender-diverse boards take actions that could be detrimental to shareholders.

Our findings, until this point, suggest that gender-diverse boards do not necessarily sacrifice investing activities or dividend payouts to preserve cash reserves.

**Table 7**

Do female directors reduce board cash compensation to boost their firms' cash holdings during COVID-19?

Dependent Variable	Coefficient	Coefficient
	(1)	(2)
	Ln (Cash & Short-Term Investments)	Ln (Total Board Compensation)
FracFemale	0.8781*** (0.007)	-0.6686*** (0.006)
Ln (Total Compensation)	0.1485** (0.014)	
CEO Duality	-1.2752* (0.094)	1.6111*** (0.005)
Ln (Board Size)	0.2460 (0.372)	0.2569 (0.215)
M/B	0.0228 (0.109)	-0.0060 (0.576)
Leverage	-0.9301* (0.070)	-0.1808 (0.640)
Size	0.6885*** (0.000)	0.1242*** (0.004)
Ln (Cash & Short-Term Investments)		0.0837** (0.014)
Constant	3.3354** (0.017)	-0.9694 (0.357)
N	663	663
R <sup>2</sup>	0.7730	0.5678
Industry Fixed Effects	YES	YES

Notes: A Simultaneous equation model is estimated to analyse whether the increase in cash holdings in firms with a higher proportion of female directors is due to these firms reducing the overall board cash compensation during COVID-19. All variables are defined in Appendix A. p-values are shown in parentheses. Standard errors are clustered by firm. Statistical significance at the 1%, 5%, and 10% levels are denoted as \*\*\*, \*\*, and \* respectively.

#### 4.4. Boosting cash holdings during crises: Do gender-diverse boards reduce total board compensation?

An alternative way to preserve cash without incurring higher transaction costs or sacrificing investing activities or dividend payouts would be to decrease the board's compensation. Prior research has found that firms with female directors on the remuneration committee are more likely to moderate executive compensation growth and reduce shareholder dissent through the say-on-pay mechanism (Alkalbani et al., 2019; García-Izquierdo et al., 2018). Furthermore, as female directors are also considered to be more effective monitors (Adams & Ferreira, 2009), they would be more likely to initiate pay cuts at the board level during times of crisis to increase overall cash holdings without compromising dividends and limiting investments through reduced capital expenditures or acquisition activity.

To examine whether female directors reduce board compensation in order to boost their firms' cash holdings during crisis, we simultaneously estimate the following regressions:

$$\begin{aligned} \ln(\text{Cash\&ShortTermInvestments}) = & \alpha + \beta_1 \text{FracFemale} \\ & + \beta_2 \ln(\text{Total Compensation}) + \beta_3 \text{CEODuality} + \beta_4 \ln(\text{BoardSize}) \\ & + \beta_5 \left(\frac{M}{B}\right) + \beta_6 \text{Leverage} + \beta_7 \text{Size} + \varepsilon_{it} + f_{ind} \end{aligned} \quad (10)$$

$$\begin{aligned} \ln(\text{Total Compensation}) = & \alpha + \beta_1 \text{FracFemale} + \beta_2 \text{CEODuality} \\ & + \beta_3 \ln(\text{BoardSize}) + \beta_4 \left(\frac{M}{B}\right) + \beta_5 \text{Leverage} + \beta_6 \text{Size} \\ & + \beta_7 \ln(\text{Cash\&ShortTermInvestments}) + \varepsilon_{it} + f_{ind} \end{aligned} \quad (11)$$

The dependent variable in Eq. (10),  $\ln(\text{Cash\&ShortTermInvestments})$  is the natural logarithm of the cash and short-term investments. The key variables of interest are *FracFemale*, which represents the fraction of female directors in a firm's board and  $\ln(\text{Total Compensation})$ , which represents the natural logarithm of total board cash compensation (Salary + Bonus).

The dependent variable in Eq. (11) is  $\ln(\text{Total Compensation})$  and the key variable of interest is *FracFemale*. All other board and firm-related variables are defined in Appendix A. The results of the Simultaneous equation regression of cash holdings and board cash compensation are shown in Table 7.

The results of the first specification of Table 7 indicate that higher board compensation was positively associated with cash holdings, indicating that firms in our sample, in general, did not resort to reducing board compensation to boost cash reserves during the pandemic. On the contrary, we find that directors saw their compensation increase during the pandemic. This could be because of the increased monitoring efforts that were required during this period, which could have led directors to demand for higher compensation.

However, as evidenced by the second specification of Table 7, we found that firms with a higher proportion of female directors had lower board compensation compared to firms with more male directors, and the result was statistically significant at the 1% level. More specifically, a 1% increase in the proportion of female directors reduced board compensation by 81.74% during our sample period.<sup>2</sup>

Thus, we find that it is through reducing board compensation that gender-diverse boards were able to boost their firm's cash holdings during COVID-19. Thus, we find that gender-diverse boards adopt measures, which do not come at the expense of either the firm or its shareholders, in order to preserve cash during a crisis period.

Studies that have examined the impact of female directors on non-corporate policies (e.g., CSR reporting) used the number of female directors as an alternative measure of gender-diversity. These studies have found evidence of "critical mass theory," which states that in order for female directors to have any meaningful impact on the board, a "critical mass" needs to be achieved (Joecks et al., 2013; Schwartz-Ziv, 2017). These studies define "critical mass," as having three or more female directors on the board. In untabulated results, we also find that it is boards with more than three female directors who reduce board compensation in order to boost their firms' cash holdings during COVID-19, thereby lending further support to the "critical mass theory."<sup>3</sup>

The results of this section provide further evidence of the effectiveness of female directors as monitors compared to their male counterparts, as documented in prior research (Adams & Ferreira, 2009; Alkalbani et al., 2019).

## 5. Additional analysis

### 5.1. Gender-diverse boards and cash holdings during crises: Does experience matter?

In this section, we examine whether firms with more experienced female directors are better positioned to boost firms' cash holdings during crises periods. We posit that directors with prior experience are not only better monitors but are also more useful advisors to top managers (Kroll et al., 2008). Alternatively, experience can lead to over-confidence, which can subsequently lead to making value-destroying decisions (Malmendier & Tate, 2008).

<sup>2</sup> According to Specification (2) in Table 7, it is observed that a 1% increase in the proportion of female directors reduced  $\ln(\text{Total Compensation})$  by 66.86%. This implies that Total Compensation is reduced by  $(e^{0.6686} - 1) * 100$ , which is approximately 81.74%.

<sup>3</sup> In addition, we also used "at least one female director" as yet another alternative measure of gender-diversity since studies that have examined the relationship between female directors and firm performance during the global financial crisis have used this measure (Papangkorn et al., 2021). Our results remain robust even after using this measure as a proxy for gender-diversity in boardrooms. In the interest of brevity, we have not displayed the results of this analysis.

**Table 8**  
Impact of experienced female directors on corporate cash holdings during COVID-19.

Dependent Variable	Ln (Cash & Short-Term Investments)
FracFemale	1.0347* (0.086)
ExpFemDir x FracFemale	-0.3564 (0.540)
CEO Duality	-1.1205 (0.142)
Ln (Board Size)	0.2883 (0.407)
M/B	0.0219** (0.040)
Leverage	-0.9829 (0.158)
Size	0.7135*** (0.000)
Constant	3.1549*** (0.001)
N	663
R <sup>2</sup>	0.7733
Industry Fixed Effects	YES

Notes: A difference-in-difference estimation is used to analyse the incremental impact of experienced female directors on corporate cash holdings compared to female directors with less board experience. All variables are defined in Appendix A. p-values are shown in parentheses. Standard errors are clustered by firm. Statistical significance at the 1%, 5%, and 10% levels are denoted as \*\*\*, \*\*, and \* respectively.

To test this conjecture, we run the following difference-in-difference regression:

$$Ln(Cash\&ShortTermInvestments) = \alpha + \beta_1 FracFemale + \beta_2 (FracFemale \times ExpFemDir) + \beta_3 CEODuality + \beta_4 Ln(BoardSize) + \beta_5 \left(\frac{M}{B}\right) + \beta_6 Leverage + \beta_7 Size + \varepsilon_{it} + f_{ind} \quad (12)$$

The dependent variable in Eq. (12),  $Ln(Cash\&ShortTermInvestments)$  is the natural logarithm of the cash and short-term investments. The key variable of interest is  $FracFemale \times ExpFemDir$ , which measures the incremental value of the presence of a more experienced female director in gender-diverse boards compared to gender-diverse boards with less experienced female directors. The results are presented in Table 8.

Based on the results presented in Table 8, we observe that firms with a higher proportion of female directors had greater cash reserves during the COVID-19 pandemic, which supports our main hypothesis. However, we do not find any additional benefit for firms that had an experienced female director, as evidenced by the statistically insignificant coefficient of our key variable of interest. We argue that this could be due to the potential existence of overconfidence bias among experienced female directors, a bias that has been well-documented in the psychological literature (Fracara, 1999; Heath & Tversky, 1991). While our results do not indicate any value destruction, we also do not find evidence of any incremental value creation from having experienced female directors on the board during crisis.

### 5.2. Testing for endogeneity: Do cash-rich firms attract female directors?

In this section, we examine the possibility of whether gender-diverse boards increased cash holdings during COVID-19, or whether firms that were already cash-rich became natural targets for female directors. To test this conjecture, we extend our data to include accounting information, from January 2019 until February 2020, of the firms in our initial sample. We collect quarterly financial data of these firms from Worldscope. After removing missing observations and outliers, our sample consists of 440 observations.

We then calculate the median value of the cash and short-term investments of our entire sample. We classify the firms into CashRich and

CashPoor samples. The former includes firms with cash and short-term investments above the median value and the latter includes firms with cash and short-term investments below the median value.

To determine the probability of female directors joining firms that were already cash-rich prior to COVID-19, we run the following probit model:

$$Pr(MoreGenderDiverse = 1) = \Phi(X'\beta) \quad (13)$$

where  $\Phi(\cdot)$  is the cumulative distribution function (CDF) of the standard normal distribution and,

$$X'\beta = \alpha + \beta_1 Cash\ Rich + \beta_2 CEODuality + \beta_3 Ln(BoardSize) + \beta_4 \left(\frac{M}{B}\right) + \beta_5 Leverage + \beta_6 Size + \varepsilon_{it} + f_{ind} \quad (14)$$

The dependent variable in Eq. (13) is the *MoreGenderDiverse* variable that takes the value of 1 if the firm has a more gender-diverse board and 0 otherwise. The key variable of interest is *CashRich*, which takes the value of 1 for firms with cash and short-term investments above the median value and 0 otherwise. The results of the probit estimation is provided in Table 9.

As shown in Table 9, our analysis provides no evidence, which supports the notion that firms with high cash reserves prior to the COVID-19 pandemic were more likely to have more gender-diverse boards. On the contrary, our findings show that the probability of a board being more gender-diverse increased for firms that had lower cash reserves before the pandemic, as shown by the negative and statistically significant coefficient of the *Cash Rich* variable.

Thus, we rule out any self-selection bias and conclude that gender diversity at the board level is an important factor in enhancing firms' ability to increase cash reserves during times of economic crisis.

**Table 9**  
Did cash-rich firms attract female directors prior to COVID-19?

Dependent Variable	Coefficient	Coefficient
	(1)	(2)
	MoreGenderDiverse	Marginal Effects at Mean
Cash Rich	-0.3651* (0.076)	-0.1172* (0.074)
Ln (Board Size)	0.5323 (0.130)	0.1709 (0.127)
M/B	0.0089 (0.326)	0.0029 (0.326)
Leverage	-0.6499 (0.299)	-0.2087 (0.297)
Size	0.2409** (0.016)	0.0773** (0.015)
DivestedAssets	-1.5913 (0.560)	-0.5110 (0.559)
AcquiredAssets	-0.5611 (0.800)	-0.1801 (0.800)
Capex/Assets	-5.8606** (0.029)	-1.8819** (0.028)
Ln (Cash Dividends)	0.1210 (0.169)	0.0389 (0.167)
Ln (Total Compensation)	-0.2542*** (0.000)	-0.0816*** (0.000)
Constant	-5.9206*** (0.000)	
N	440	440
R <sup>2</sup>	0.1767	
Industry Fixed Effects	YES	

Notes: A probit model is used to examine whether cash-rich firms had more gender-diverse boardrooms prior to COVID-19. All variables are defined in Appendix A. The number of observations is different from previous tables because we use a different sample period that spans from January 2019 to February 2020. p-values are shown in parentheses. Standard errors are clustered by firm. Statistical significance at the 1%, 5%, and 10% levels are denoted as \*\*\*, \*\*, and \* respectively.



**Table 10**

Do firms with a higher proportion of female directors have higher cash holdings during the global financial crisis?

Dependent Variable	Ln (Cash & Short-Term Investments)
FracFemale	1.6251** (0.011)
CEO Duality	-0.6979* (0.073)
Ln (Board Size)	0.3581 (0.169)
M/B	0.0497** (0.043)
Leverage	-0.9119** (0.049)
Size	0.6969*** (0.000)
DivestedAssets	2.9517*** (0.0004)
AcquiredAssets	-1.2048** (0.015)
Capex/Assets	-0.7529 (0.553)
Ln (Cash Dividends)	0.1950*** (0.009)
Ln (Total Compensation)	-0.0072 (0.840)
Constant	0.2152 (0.785)
N	1298
R <sup>2</sup>	0.7815
Industry Fixed Effects	YES

Notes: An OLS regression is used to estimate the relationship between corporate cash holdings and the proportion of female directors in the boardroom. All variables are defined in Appendix A. The number of observations is different from previous tables because we use a different sample period that spans from January 2007 to December 2009, which represents the period of the Global Financial Crisis. p-values are shown in parentheses. Standard errors are clustered by firm. Statistical significance at the 1%, 5%, and 10% levels are denoted as \*\*\*, \*\*, and \* respectively.

### 5.3. Gender-diverse boards and cash holdings during crises: Is it specific to COVID-19?

We further investigate the relationship between board gender diversity and firms' cash holdings, during crisis periods, to determine whether the observed influence of female directors on cash holdings is unique to the context of the COVID-19 pandemic or can be seen in other crisis periods as well. For this purpose, we turn our attention to the global financial crisis (GFC) spanning from 2007 to 2009.

To facilitate this analysis, we augment our dataset to incorporate accounting details of firms for 2007 through 2009. We collect quarterly financial data of the firms from Worldscope. After removing missing variables and outliers, our GFC sample consists of 1298 observations. We then implement the regression outlined in Eq. (1), using the GFC sample. The findings are summarized in Table 10.

Table 10 suggests that firms governed by boards with female representation bolstered their cash holdings even during the GFC. More precisely, a 1% increment in the ratio of female board members corresponded to an increase in cash and short-term investments by 171.83%.<sup>4</sup> This reinforces our primary conclusion: the propensity of female directors to amplify cash holdings during turbulent times is a consistent phenomenon, not confined solely to the backdrop of the Covid-19 pandemic.

<sup>4</sup> According to Table 10, it is observed that a 1% increase in the proportion of female directors increased Ln (Cash & Short-Term Investments) by 162.51%. This implies that the cash and short-term investments is increased by  $(e^{1.6251}-1) * 100$ , which is approximately 171.83%.

## 6. Conclusion

In this study, we investigate the role of female directors in preserving cash holdings during times of crisis. Using a sample of UK firms from March 2020 to June 2021, we found that gender-diverse boards were associated with higher cash reserves during the COVID-19 pandemic. This was achieved through a reduction in overall board compensation, rather than sacrificing shareholder value or curtailing investments. We also found that these firms paid higher cash dividends. Our findings provide support for the view that gender-diverse boards create firm value and underscore the importance of mandating gender quotas to achieve this goal.

The contributions of this paper are threefold. Firstly, the study identifies the mechanism through which female directors boost their firms' cash holdings, thereby bridging a gap in the literature on the role of gender-diverse boards during crises. Secondly, the paper contributes to the ongoing debate on the ability of female directors to create value by demonstrating that gender-diverse boards can guide their firms through economic crises without sacrificing shareholder value. These findings provide further evidence supporting the mandate of gender quotas, particularly during times of crisis. Finally, the study suggests that gender-diverse boards served not only as a mechanism for boosting firms' social value (Kara et al., 2022) but also as an effective corporate governance mechanism during COVID-19.

In light of our findings, we offer several implications for policymakers and corporations. First, the FTSE Women-Leaders Review's target of achieving 40% representation of women on the boards of FTSE 350 companies by 2025 is supported by our research. Our study provides concrete evidence for policymakers to mandate gender quotas at boardrooms as opposed to having them be voluntary. This would ensure that corporations are actively working towards improving their gender diversity and, as we have shown, potentially benefitting from increased cash reserves and value creation, especially during crises. Furthermore, we also lend support to the "critical mass theory," which suggests that the impact of gender-diverse boards becomes effective when there are three or more female directors on the board. As such, policymakers, while seeking to mandate gender-diverse boards, should be mindful that for such boards to be effective, there should be at least three female directors in the board. Second, our study provides corporations in the U. K. with a blueprint for building an effective corporate governance mechanism during times of crisis. Gender-diverse boards, as we have shown, are an effective mechanism for boosting cash holdings without sacrificing shareholder value. Corporations can use our findings to improve their corporate governance practices, thereby also improving their resilience during crises. Overall, our research contributes to the ongoing discussion on the importance of gender diversity in corporate governance and provides actionable insights for policymakers and corporations to improve their gender diversity and corporate governance practices.

Our study opens up a number of avenues for future research. Firstly, our study focuses only on a sample of UK firms during a specific period (March 2020 to June 2021), and therefore the generalizability of our findings to other contexts and time periods needs to be examined. Future research can explore the role of gender-diverse boards in preserving cash holdings, during crisis periods, across different countries. Secondly, our study explores only gender-diverse boards. However, diversity extends beyond just female representation. Future research can therefore, explore the impact of other forms of diversity, such as racial or ethnic diversity, on cash holdings during crises. Thirdly, our study focuses on the impact of gender-diverse boards on the preservation of cash holdings. It would be interesting to examine whether gender-diverse boards also have an impact on other aspects of firm performance during crises, such as innovation or market share. Lastly, our study does not examine the consequences behind the reduction in board compensation initiated by gender-diverse boards. Future research can explore the underlying motivations and consequences of such actions, and whether they have

any long-term impact on firm performance or the composition of the board.

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animals performed by any of the authors.

### Declaration of competing interest

The authors declared no potential conflicts of interest.

### Data availability

Data available on request from the authors.

## Appendix A. Definition of variables

Variable	Definition
Cash&ShortTermInvestments	Total cash and short-term investments of the firm (WorldScope item 2001)
Ln (Cash&ShortTermInvestments)	Natural logarithm of the total cash and short-term investments
FracFemale	Proportion of the total directors in a firm who are female
DivestedAssets	Ratio of total divested assets (Worldscope Item 4351) to total assets of the firm (WorldScope Item 2999)
AcquiredAssets	Ratio of total acquired assets (Worldscope Item 4355) to total assets of the firm (WorldScope Item 2999)
Capex/Assets	Ratio of total capital expenditures (Worldscope Item 4601) to total assets of the firm (WorldScope Item 2999)
Ln (Total Compensation)	Natural logarithm of the Total Cash Compensation of the director (BoardEx item Total Compensation)
Ln (Board Size)	Natural logarithm of the number of directors
CEO Duality	Dummy variable that takes the value of 1 if the CEO is also the Chairman of the firm and 0 otherwise
M/B	Market-to-book ratio, measured by the ratio of Market Capitalization (Worldscope item 7210) to the total shareholders' equity (Worldscope Item 3999 – Worldscope Item 3351)
Leverage	Total debt-to-assets ratio, measured as total debt (Worldscope Item 3251) divided by Total Assets (Worldscope Item 2999)
Size	Natural logarithm of total assets (Worldscope Item 2999)
Ln (Cash Dividends)	Natural logarithm of total cash dividends paid out (Worldscope Item 4551)
ExpFemDir	Dummy variable that takes the value of 1 if the total board experience of a female director is above the median value of total board experience of the sample and 0 if the total board experience of the female director is below the median value.
Cash Rich	Dummy variable that takes the value of 1 if the cash and short-term investments of the firm is above the median value of the sample and 0 if the cash and short-term investments of the firm is below the median value

## Appendix B. Correlation matrix

	Frac_Female	Duality	Ln (Board Size)	M/B	Leverage	Size	Acquired Assets	Capex/ Assets	Divested Assets	Ln (Total Compensation)	Ln (Cash Dividends)
Frac_Female	1.0000										
Duality	0.0734	1.0000									
Ln (Board Size)	0.2290	0.0595	1.0000								
M/B	0.0266	-0.0238	0.1739	1.0000							
Leverage	0.1166	0.0279	0.3722	0.0023	1.0000						
Size	0.3987	0.0333	0.6575	-0.0819	0.4421	1.0000					
AcquiredAssets	-0.0112	-0.0220	0.0912	0.1383	0.0190	-0.0555	1.0000				
Capex/Assets	-0.0092	-0.0191	0.1534	0.0395	0.2706	0.1556	-0.0719	1.0000			
DivestedAssets	0.0013	0.0087	0.0446	-0.0727	0.1037	0.0435	0.0177	0.1270	1.0000		
Ln (Total Compensation)	-0.0014	0.0858	0.4565	0.1808	0.2404	0.3368	0.0900	0.1256	-0.0101	1.0000	
Ln (Cash Dividends)	0.3994	0.0292	0.5618	0.0730	0.3460	0.8424	-0.0792	0.1464	0.0230	0.3170	1.0000

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