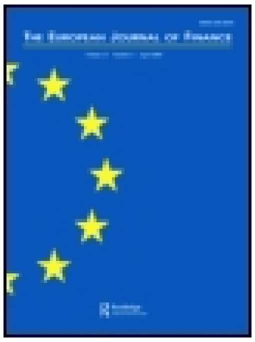

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Women on boards and corporate social irresponsibility: evidence from a Granger style reverse causality minimisation procedure

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ABSTRACT
We hypothesise bi-directional causality between gender diversity on boards and corporate social irresponsibility (CSI). Firms exposed to CSI incidents are likely to increase their board gender diversity for reputational purposes. Simultaneously, gender diversity adds skills and networks to boards which supports their monitoring function and should reduce CSI incidents. Econometrically, this relationship is plagued with reverse causality. Consequently, we propose a Granger-style reverse causality minimisation procedure. Our procedure involves three steps. Firstly, we regress board diversity (BD) on lagged CSI to separate diversity into two components, one driven by CSI (BDDCS) and another unrelated to CSI (BDUCS), with the latter being the sum of the intercept and the disturbance term. Secondly, we confirm that BDUCS experiences a near-zero correlation to CSI and that a Granger causality F-test for CSI affecting BDUCS is clearly insignificant. Thirdly, we regress CSI on lagged BDUCS, lagged CSI and its interaction term. Applying our procedure to 2,880 US firms between 2007 and 2016, we find that boards with higher diversity, for reasons other than CSI, were significantly better than their lower diversity counterparts in reducing CSI incidents once encountering them. This effect is economically stronger for diversity unrelated to CSI than for overall diversity.

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1. Introduction

The issue of board gender diversity has been a subject of increasing importance in recent years. Politically, moves have been taken to increase female board representation, including mandatory female board quotas (e.g. Norway, France, Italy, Belgium, Iceland, Spain, Pakistan, Netherlands, Israel, California) or comply-or-explain regulations (e.g. Australia, UK). We locate the present study in the parallel, burgeoning literature on the effects of increased female board representation. To date, this has included studies on the relationship between female board representation and firm performance (e.g. Bennouri et al. 2018; Lins et al. 2019; Liu, Wei, and Xie 2014; Post and Byron 2015), corporate costs of debt (Pandey et al. 2019; Usman et al. 2019), mergers and acquisitions behaviour (e.g. Levi, Li, and Zhang 2014), firm risk (Lin and Poon 2019; Sila, Gonzalez, and Hagendorff 2016), earnings quality (Srinidhi, Gul, and Tsui 2011), accounting quality (García Lara et al. 2017), lawsuits (Adhikari, Agrawal, and Malm 2019), fines (Jain and Zaman 2020), leverage (Faccio, Marchica, and Mura 2016), or board attendance (e.g. Adams and Ferreira 2009).

We locate the present study in one domain of the wider field of board gender diversity, namely, the study of the relationship between female board representation and corporate social responsibility (CSR), defined broadly as encompassing principles which relate to an organisation's societal relationships (Wood 1991). Several different metrics of CSR have been linked to female board representation, for instance, the MSCI CSR ratings, formerly

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known as Kinder, Lynderberg and Domini (KLD) (Harjoto, Laksmana, and Lee 2015), and the Rankins CSR metrics for Chinese firms (McGuinness, Vieito, and Wang 2017). Isidro and Sobral (2015) examine the relationship between female board representation and whether a firm has a separate committee for ethics or social responsibility, and Liao, Luo, and Tang (2015) examine its relationship to greenhouse gas disclosure. While there are many studies on the internal social responsibility impact of board gender diversity (e.g. Byron and Post 2016; Harjoto, Laksmana, and Lee 2015; Isidro and Sobral 2015; Liao, Luo, and Tang 2015; McGuinness, Vieito, and Wang 2017), the positive external reputation effects are discussed comparatively seldom in the literature; in this field, we find a UK specific study (Brammer, Millington, and Pavelin 2009), a health care sector specific study (Bear, Rahman, and Post 2010) and a financial services sector focused study (Baselga-Pascual et al. 2018).

Crucially, we do not find any previous studies dedicated to the potentially mutually reinforcing relationship between board gender diversity and the negative external reputational effects usually referred to as 'corporate social irresponsibility (CSI)'. Such CSI incidents are exogeneous shocks to corporate reputation usually exposed by third party media sources (Harjoto, Hoepner, and Li 2020; Kölbel, Busch, and Jancso 2017). While a literature on CSI does exist, it is still in its infancy with most studies appearing in the last 3–5 years and understandably focuses on the risk (Kölbel, Busch, and Jancso 2017) or return component of financial performance (Harjoto, Hoepner, and Li 2020; Hoepner, Li, and Muzanenhamo 2018; Lenz, Wetzel, and Hammerschmidt 2017; Price and Sun 2017).

Inspired by recent cases on corporate gender diversity and reputational risk[1], we investigate whether corporate gender diversity is evidentially related to the reduction of CSI incidents. We hypothesise a bi-directional causality. In terms of the 'CSI to diversity' direction of causality, firms exposed to CSI incidents are likely to increase their board gender diversity for reputational purposes, and there is extensive evidence of such behaviour (e.g. Bernardi, Bosco, and Vassill 2006, 2009; Kabongo, Chang, and Li 2013). Essentially, issue lifecycle theory (Zyglidopoulos 2003) argues that companies may seek to enhance their reputation and legitimacy by leading societal expectations, in addressing particular issues such as board gender diversity. One of the characteristics of high-reputation companies is a high level of female board representation, for which there is exhaustive empirical evidence: Bernardi, Bosco, and Columb (2009) find a positive relation between the number of female directorships and a company's inclusion in the Ethisphere Magazine's 'World's Most Ethical Companies, and Bear, Rahman, and Post (2010) find that female board representation significantly predicts firm inclusion in the Fortune 'Most Admired Companies' list. Similarly, in the UK, Brammer, Millington, and Pavelin (2009) find a positive association between female board representation and inclusion in 'Britain's most admired companies'.

In terms of the 'diversity to CSI' direction of causality, however, board gender diversity helps to diversify board skills and networks according to resource dependence theory (Hillman and Dalziel 2003). This builds board capital and enhances its monitoring function, which in turn should result in the ability to reduce CSI incidents. This direction of reasoning is also supported by extensive evidence: female directors are more likely than male backgrounds to come from expert backgrounds outside of business, are much more likely to hold a doctoral degree, (Hillman, Cannella, and Harris 2002), and add to the diversity of life experiences among board members (Dezsö and Ross 2012). Female board presence is also associated with increased monitoring and strategy involvement (Post and Byron 2015). The underlying driver appears to be that female board directors tend to have different behavioural and attitudinal characteristics to male board directors, and that these characteristics encourage companies to behave in a more ethical manner. For instance, Bernardi and Threadgill (2011) find a positive association between the number of female directors and corporate social behaviour such as charitable giving, community involvement and outside recognition of employee benefits, while Harjoto, Laksmana, and Lee (2015) find board diversity to be positively associated with CSR performance.

Consequently, as both directions of causality (i.e. 'CSI to diversity' and 'diversity to CSI') are supported by valid theoretical arguments backed up by considerable empirical evidence, our study of the relationship between women on the board and corporate social irresponsibility faces the essence of a 'chicken or egg' problem: more women on boards may reduce the propensity of corporations to be exposed to negative news, while (simultaneously) the occurrence of negative news may have led corporations to reflect on their culture and appoint more women in the first place. In other words, endogeneity, and in particular, reverse causality, constitute a severe problem for this type of research.

To address this problem, we propose a Granger-style reverse causality minimisation procedure. While Granger (1969, 1980, 1988) causality was established decades ago, it remains a very important concept that can be suitable in both a time series (White and Lu 2010) and a cross sectional/panel regression framework (Lu, Su, and White 2017). In addition to using Granger causality to test for the presence of reverse causality, our procedure is inspired by an increased use of orthogonalization as a means of eliminating unwanted effects from variables (e.g. Adcock et al. 2017; Elton et al. 1993; Ferguson and Shockley 2003; Hoepner, Rammal, and Rezec 2011; Lawrence et al. 2019; Liesen et al. 2017; Priestley and Ødegaard 2007). The unwanted effect that we seek to eliminate will be reverse causality. Technically, our procedure involves three steps.

First, we regress board diversity (BD) on the lagged CSI variable, to separate diversity into two components, the one driven by CSI (BDDCS), and the other unrelated to CSI (BDUCS). The former, BDDCS, represents the product of lagged CSI and its coefficient, while the latter, BDUCS, is the sum of the intercept and disturbance term of the regression. Second, we confirm two important statistical properties of BDUCS: (i) It experiences a near-zero correlation to CSI. (ii) A Granger causality F-test for CSI affecting BDUCS is clearly insignificant. Third, as our main model, we regress CSI on lagged BDUCS, lagged CSI and its interaction term. Conceptually, our approach can be understood as two stage least squares approach (e.g. Antonakis et al. 2010), where instead of estimating BD from variables we assume to be exogeneous in the first step, we decompose BD into an endogenous and an exogeneous component in the first step, and use the latter in the second step.

We apply our Granger-style reverse causality procedure to 2,880 US firms between 2007 and 2016. As measure of CSI incidents, we employ the firms' number of negative news incidents recorded by RepRisk, following Kölbel, Busch, and Jancso (2017) and Wang and Li (2019). With respect to our first hypothesis, we find CSI to increase board gender diversity, as expected, for reputation management reasons. Regarding our second hypothesis, we find the lagged CSI-unrelated component of board diversity to be strongly negatively interacted by lagged CSI, in explaining next year's CSI. Our result implies that boards with higher diversity, for reasons other than CSI, were better than their lower diversity counterparts in reducing CSI, once they had encountered them. In terms of economic substance, we find that a one unit increase in board gender diversity unrelated to CSI leads to a reduction of CSI by 20.1% in the following year, which spares the firm a return loss due to CSI of 58 basis points on average per annum. Crucially, we find the impact on both CSI and avoided economic loss is larger (i.e. by 10 basis points or about 20%) for board diversity unrelated to CSI than for board diversity itself. This provides additional support for our second hypothesis, as it indicates that genuinely appointed female board members have a stronger impact than those appointed for signalling purposes. Consequently, our results provide strong support for the resource dependence theory view that board gender diversity diversifies board skills and networks (Hillman and Dalziel 2003). Our results are robust to various econometric specifications, multiple operationalisations of the CSI variable, sectoral sub-samples, and GMM estimators. They also hold when subjected to a sensitivity analysis using board diversity driven by CSI and based on two alternative identification strategies (quasi-discontinuity regression, Heckman model).

We argue that our study contributes to our understanding of the effects of board gender diversity for four reasons: First, we propose a procedure inspired by Granger causality and an increased knowledge of orthogonalization, which can mitigate the challenge of reverse causality. Second, equipped with our Granger style reverse causality minimisation procedure, we are able to confidently hypothesise bi-directional causality and subsequently all but eliminate one direction of causality (i.e. the effect of CSI on board diversity) from our test of the opposite direction. Third, we are, to the best of our knowledge, the first to study dedicated to the bi-directional effect of board gender diversity on CSI, and find that (i) CSI increases board diversity while (ii) boards which have become diverse for other reasons than CSI reduce CSI incidents overproportionally, once they have encountered them. Fourth, we believe this to be the first study to differentiate between board diversity caused by CSI, CSR or risk and board diversity unrelated to CSI, CSR or risk, and find that the latter appears more important than the former and the overall concept itself.

The rest of the paper is structured as follows: Section 2 reviews the prior literature and develops our hypotheses, Section 3 describes data used in this paper and explores the economic value of CSI data, Section 4 explains the research method, Sector 5 presents and discusses the results, as well as robustness tests, sensitivity analysis and alternative identification strategies before Section 6 concludes.

2. Prior literature and hypotheses development

2.1. Board gender diversity and corporate social irresponsibility

The effect of board gender diversity has been widely discussed in academic studies. The most intensively-studied board gender diversity impact is on firm performance (e.g. corporate rate of return and firm value). Research to date finds evidence of a positive impact on corporate return (e.g. Bennouri et al. 2018; Conyon and He 2017; Isidro and Sobral 2015; Nguyen, Locke, and Reddy 2015), although mixed results are also found in several studies (e.g. Abdullah, Ismail, and Nachum 2016; Gipson et al. 2017; Gregory-Smith, Main, and O'Reilly 2014). Other aspects of board gender diversity impact have also been studied, e.g. the relationship between board diversity and firm business risk appetite (Hillier, Korczak, and Korczak 2015; Huang and Kisgen 2013; Marquardt and Wiedman 2016), corporate governance (Elstad and Ladegard 2012), board composition (Elsaid and Ursel 2011), choice of accounting method (Francis et al. 2015), etc. A general finding is that more gender-diverse boards tend to be more risk averse than male-dominated boards, reducing potential damages to the firm.

Relating to firm risk, a growing strand of literature explores the relationship between board gender diversity and corporate reputation. These studies focus on internal corporate reputation, mostly using corporate social responsibility as an internal measure. Research in general finds a positive relationship between a company's board gender diversity and its corporate reputation (Baselga-Pascual et al. 2018; Bear, Rahman, and Post 2010; Brammer, Millington, and Pavelin 2009), and also its social responsibility (Byron and Post 2016; Harjoto, Laksmana, and Lee 2015; Isidro and Sobral 2015; Liao, Luo, and Tang 2015; McGuinness, Vieito, and Wang 2017; Zhang, Zhu, and Ding 2013).

While the above study the impact of board gender diversity on internal social responsibility, the effects on external perception (i.e. reputation) are to date seldom discussed in the literature. We have only been able to find a UK-specific study (Brammer, Millington, and Pavelin 2009), a healthcare sector-specific study (Bear, Rahman, and Post 2010) and a financial services sector-focused study (Baselga-Pascual et al. 2018). Crucially, we do not observe any previous studies on the relationship between board gender diversity and corporate social *irresponsibility* events (i.e. exogeneous shocks to corporate reputation). Minimising external shocks to corporate reputation is crucial in corporate governance, because recent evidence shows that those shocks (e.g. corporate scandals or more generally corporate social irresponsibility) are related to corporate (default) risk (Kölbel, Busch, and Jancso 2017).

Apart from Kölbel, Busch, and Jancso's (2017) work on the risk implications of corporate social irresponsibility, the literature on the dark side of corporate social responsibility is still in its infancy. Most early studies demonstrate effects on firm value or stock market performance (Harjoto, Hoepner, and Li 2020; Hoepner, Li, and Muzanenhamo 2018; Lenz, Wetzel, and Hammerschmidt 2017; Price and Sun 2017), while Strike, Gao, and Bansal (2006) find CSI incidents to result from complexity and Bouslah et al. (2018) identify CEO risk-taking behaviour as a source of CSI incidents. Consequently, the relationship between board gender diversity and corporate social irresponsibility incidents is underexplored and allows for a relevant contribution to the literature, both theoretically and empirically.

2.2. Reverse causality challenges in gender diversity research

Endogeneity, and especially, reverse causality is frequently observed to be the principal research design problem in studies researching the effect of gender board diversity on corporate outcomes (Adams 2016; Adams, Hermalin, and Weisbach 2010). As Adams, Hermalin, and Weisbach (2010, page 96) note with reference to the study of boards,

> [t]he two questions most asked about boards concern what determines their makeup, and what determines their actions. These questions are, however, fundamentally intertwined— the makeup of boards is interesting because it affects what the board does; and, consequently, their makeup is influenced by a desire to affect what they do. This problem of joint endogeneity is vexing for both theoretical and empirical research on boards; research that focuses on one side of the equation while ignoring the other is necessarily incomplete and the results misleading.

The solution Adams, Hermalin, and Weisbach (2010) advise is to look for natural experiments, in which an exogenous shock serves to create an event which is unaffected by any of the other variables. Arguably, however, natural experiments may not be available for all relationships that researchers wish to study. Adams (2016) dives deeper into sources of endogeneity and argues that, whereas omitted variable bias can be remedied to some extent by using fixed effects in panel regressions, reverse causality remains as the principal research design challenge in the study of board gender diversity.

There are manifold examples of reverse causality problems being discussed in the literature examining the relationship between board diversity and financial risk: Pandey et al. (2019) discuss reverse causality regarding the cost of debt, Lu and Boateng (2018) regarding credit risk, Lanis, Richardson, and Taylor (2017) regarding tax aggressiveness, Farag and Mallin (2017) regarding financial fragility, and Sila, Gonzalez, and Hagendorff (2016) for firm total risk, systematic risk and idiosyncratic risk. Reverse causality also affects studies of the relationship between female board representation and the fines or penalties received by a firm (Jain and Zaman 2020). Reverse causality is also identified as a key methodological issue by Zalata et al. (2019) regarding female board representation and managerial opportunism, Hollindale et al. (2019) on Greenhouse Gas emissions, Macaulay et al. (2018) regarding firm CSR performance, and Kabongo, Chang, and Li (2013) on corporate philanthropy.

In summary, reverse causality concerns are ubiquitous in the literature on board gender diversity. Technically, reverse causality is a source of endogeneity and can be defined, accordingly, as the correlation between the explanatory variable and the regression residuals. It is perhaps the most recognised concern in empirical studies, because it potentially leads to biased regression estimation and inconsistent statistical inference (Roberts and Whited 2013). While previous studies use various approaches to address reverse causality (e.g. instrumental variable or two-stage least squares (Huang and Kisgen 2013), fixed effect models for unobserved firm effects (Sila, Gonzalez, and Hagendorff 2016)), we concur with Adams (2016) that, apart from natural experiments, these are often not entirely satisfactory. That being said, natural experiments are not always available.

In the present paper, we identify a serious reverse causality challenge, as there are good reasons to suspect a bidirectional relationship between board diversity and corporate social irresponsibility. We find plausible theories (e.g. reputation management) for why companies with a higher risk of CSI incidents should wish to hire more female board directors. However, we also find plausible theories (e.g. resource dependence on board capital) for why increased female board representation should help to reduce the risk of future CSI incidents. Hence, we propose a Granger-style reverse causality minimisation procedure, to address reverse causality econometrically and measure the sufficiency of our approach, while also testing the robustness of our conclusions with the best available alternatives: a quasi-discontinuity regression and a Heckman (1979) model.

2.3. Incentives for CSI exposed firms to increase board gender diversity

Firstly, from the point of view of reputation management, a firm exposed for its corporate social irresponsibility may seek to engage in reputation management by imitating some of the characteristics of well-regarded firms. The issue life-cycle theory (Zyglidopoulos 2003) argues that companies may seek to enhance their reputation and legitimacy by leading societal expectations in addressing particular issues, and conversely, companies that lag behind may lose organisational legitimacy. One of the characteristics of high-reputation companies is a high level of female board representation. There is exhaustive empirical evidence of this effect. Bernardi, Bosco, and Vassill (2006) find a positive correlation between the number of female directorships and a company's inclusion in the Fortune '100 Best Companies to Work For', Bernardi, Bosco, and Columb (2009) find a positive relation between the number of female directorships and a company's inclusion in the Ethisphere Magazine's 'World's Most Ethical Companies, and Bear, Rahman, and Post (2010) find that female board representation significantly predicts firm inclusion in the Fortune Most Admired Companies list. In the UK, Brammer, Millington, and Pavelin (2009) find a positive association between female board representation and inclusion in 'Britain's most admired companies'. Landry, Bernardi, and Bosco (2016) find that companies which appeared in the lists of 'Most Admired Companies', 'Most Ethical Companies', the 'Best Companies to Work For', and the 'Best Corporate Citizens', have higher female board representations than those firms which do not appear in them. Baselga-Pascual et al.

(2018) find that the ethical reputation of financial institutions is positively associated with board size, gender diversity, and CEO duality.

Furthermore, a CSI incident-hit firm may seek to increase female board representation as a signal to potential employees of its willingness to retain women and provide a positive work environment (Greening and Turban 2000). Bernardi et al. (2002) find that companies which include pictures of their directors in their annual reports have higher female board representation than those which do not, suggesting that firms with greater female board representation actively signal their gender diversity.

Accordingly, we form a research hypothesis:

> H1: Firms exposed to corporate social irresponsibility incidents will tend to subsequently increase female board representation, relative to not exposed firms.

2.4. Reasons why board gender diversity may reduce CSI incidents

Resource dependence theory argues that the provision of resources is a function of board capital, with the board serving as a provider of legitimacy, advice and counsel, and links to other organisations (Hillman and Dalziel 2003). Accordingly, board risk management functions are improved by diversifying its human capital. Agency theory, furthermore stresses the board's role critical function of monitoring management. Carpenter and Westphal (2001) analyse the effects of board ties, and find that a board's monitoring capability is related to directors' appointments which can provide strategic knowledge and perspective. Based on these perspectives, it may be argued that women bring essentially different leadership qualities and skills to the boardroom compared to men. From this point of view, increasing female board representation is likely to reduce CSI incidents by introducing the positive features of female leadership, and mitigating the negative behaviours exhibited by exclusively male leadership. Among these positive features of female leadership are (i) increased levels of risk aversion, (ii) higher levels of pro-social skills (e.g. better cooperation, reduced overconfidence), (iii) better board monitoring, and (iv) higher standards of ethical judgment.

Firstly, as regards risk aversion, the consistent finding is that women are more risk-averse than men, particularly as regards financial decision-making. This is found by Croson and Gneezy (2009) in their surveys of experiments involving financial payoff (e.g. Eckel and Grossman 2008b; Hartog, Ferrer-i-Carbonell, and Jonker 2002; Holt and Laury 2002; Powell and Ansic 1997). If this is so, an increase in female board representation is likely to lead to less risky (financial) decisions by the board. In their extensive literature review, Eckel and Grossman (2008a) find that women exhibit greater financial risk aversion in a broad range of both experimental and practical financial decisions, and also, hold a greater percentage of their wealth in riskless assets. The phenomenon appears international in its nature: Charness and Greezy (2012) survey 15 sets of experiments of a simple investment game conducted internationally, and find that women invest less, and appear to be more financially risk-averse than men, while Almenberg and Dreber (2015) find that women report themselves as being significantly less willing to take risk in general in a Swedish consumer survey. Dohmen et al. (2011), in a wide-scale survey of German households, find that women are more risk averse, and Hartog, Ferrer-i-Carbonell, and Jonker (2002), survey Dutch households and chartered accountants, and find that females are significantly more risk averse when faced with a lottery question.

Interestingly, other surveys have found that this increased female risk aversion extends to many domains beyond the financial: Weber, Blais, and Betz (2002) find that women considered potentially hazardous activities to be more risky than men, and felt that engaging in these activities was associated with fewer benefits, across many domains: not only in financial investment, but also in health and safety, recreation and ethics. Again, Byrnes, Miller, and Schafer (1999) conduct a meta-study of 150 studies, and find that men are significantly more likely to take risks in the domains of drinking and drug use, in sexual activities, in driving, gambling, risky experiments, intellectual risk taking and in physical skills. If women tend to engage in less risky behaviour than men across a wide range of domains, then it is strongly plausible that increased female board representation should lead to increased risk aversion, and a reduction in risky board behaviour, across a wide range of board activities related to financial and extra-financial aspects.

Secondly, as regards personal qualities, there is evidence that women exhibit higher levels of pro-social skills compared to men, and it has been argued that women have a more transformational management style compared to men (Roesner 1990). Falk et al. (2018) survey 80,000 people from 76 countries, and find that women exhibit significantly more positive reciprocity, significantly less negative reciprocity, and significantly higher trust and altruism. For example, Niederle and Vesterlund (2007, 2008) find that men and women behave differently in competitive environments: men embrace competition, whereas women tend to avoid it. Niederle and Vesterlund (2011) further find that men prefer to be compensated under a tournament scheme, whereas women prefer a non-competitive piece-rate scheme, and argue that this may lead to sub-optimal negotiation outcomes for men, as they may be less likely to give into demands, even when doing so would be beneficial for both parties. From this point of view, an increase in female board representation could plausibly lead to higher levels of cooperation.

The relationship of gender to overconfidence in financial decisions has also been studied: Barber and Odean (2001) find that men trade 45 percent more than women, reducing their net trading returns, and attribute this to overconfidence in their trading abilities. Niederle and Vesterlund (2007) additionally find that men are more overconfident about their relative performance than women, and that that this leads men to enter their experimental tournaments at a higher rate on this basis. Huang and Kisgen (2013) show that this tendency to overconfidence among men leads to male executives undertaking more acquisitions and issuing debt more often than female executives, which leads to firm financial underperformance: Acquisitions made by firms with male executives have announcement returns approximately 2% lower than those made by female executive firms, and debt issues also have lower announcement returns for firms with male executives. On this basis, it could be argued that an increase in female board representation could lead to a decrease in board overconfidence, less radical decision-making and increased firm performance.

Thirdly, with regard to the board monitoring function, there is evidence that female board presence is associated with increased monitoring and strategy involvement (Post and Byron 2015). Further, Adams and Ferreira (2009) find that female directors have better attendance records than male directors, that an increase in board diversity is associated with increased attendance by male directors, and that women are more likely to join monitoring committees. Carpenter and Westphal (2001) analyse the effects of board ties, and find that a board's monitoring capability is related to directors' appointments which can provide strategic knowledge and perspective. Regarding board resources, female directors are more likely than male peers to come from expert backgrounds outside of business, are much more likely to hold a doctoral degree, (Hillman, Cannella, and Harris 2002), and add to the diversity of life experiences among board members (Dezsö and Ross 2012).

Finally, it has also been argued that female board directors tend to have different attitudinal characteristics to male board directors, and that these encourage companies to behave in a more ethical manner. Bernardi, Bosco, and Vassill (2006) suggest that one reason for the appointment of women to corporate boards is the belief that they have greater social sensibility (Burgess and Tharenou 2002). Luthar, DiBattista, and Gautschi (1997) find that female subjects surveyed have significantly more favourable attitudes towards ethical behaviours than men, and Betz, O'Connell, and Shepard (1989) find that the male business students surveyed were more than twice as likely as women to engage in actions regarded as unethical. Bernardi and Threadgill (2011) find a positive association between the number of female directors and corporate social behaviour such as charitable giving, community involvement and outside recognition of employee benefits. Similarly, Harjoto, Laksmana, and Lee (2015) find that board diversity is positively associated with CSR performance.

In summary, we argue that an increase in board gender diversity brings distinctive leadership qualities and skills to the boardroom which lead to greater risk aversion, higher levels of pro-social skills (e.g. better cooperation, reduced overconfidence), a reduction in risky board behaviour across a wide range of activities through better board monitoring, and higher standards of ethical judgment and cooperation. These arguments could explain the association of greater board gender diversity with higher firm reputation (Brammer, Millington, and Pavelin 2009) and increased firm performance (Liu, Wei, and Xie 2014). Taken together, these factors would serve to reduce the likelihood of CSI incidents.

Accordingly, we propose a second hypothesis:

H2: Unrelated to the signalling effect in H1, female board members are able to reduce corporate social irresponsibility incidents once confronted by them.

3. Data

3.1. Main variables

Our corporate news is obtained from RepRisk. RepRisk is a business intelligence provider specialising in dynamic environmental, social, and governance risk analytics and metrics. Using a Big Data approach, RepRisk systematically screens a broad range of media, stakeholder, and other third-party sources on a daily basis, and identifies negative news items (i.e. CSI incident count) of the firms on corporate social irresponsibility (CSI) issues such as environmental degradation, human rights abuses, and corruption. RepRisk removes duplicates and only records each item once. Moreover, RepRisk data is only based on reports from media and external stakeholders, and RepRisk itself does not create an item unless it is reported in the global media. In line with previous papers based on RepRisk, we conceptualise these news items as episodes of corporate social irresponsibility. (Harjoto, Hoepner, and Li 2019; Kölbel, Busch, and Jancso 2017; Wang and Li 2019.)

Corporate board director information is obtained from BoardEx, including the gender of directors, and the size of the board of directors. BoardEx records corporate directors' tenure and their general background such as name, gender, age etc. For each year-end, we match firm and directors' tenure to determine the yearly board composition and board gender diversity. In this study, our sample is restricted to US firms, because both corporate social irresponsibility and board information are comparatively complete in the US. We merge RepRisk and BoardEx datasets using each firm's main ISIN code, and we have 2880 matched firms in our final sample.

Since the data frequency of RepRisk is daily while board information is annual, we aggregate the daily CSI data into annual data by counting the number of the CSI occurrence for the firm during each calendar year. Hence, we have 27,565 firm-year observations for our 2880 firms spanning from 2007 to 2016. In addition, we replace missing CSI observations by zero values, because the firm has no CSI events reported in that year. Such a replacement assumes that RepRisk comprehensively screens news exposure. Additionally, other company annual fundamental/accounting information is obtained from the CRSP/Compustat merged database via WRDS.

3.2. Control variables and descriptive statistics

Table 1 reports the descriptive statistics for the firm-year observations. The average CSI count is 1.81 per firm-year observation. The median of CSI count is zero, implying that that the distribution of CSI is lognormal. We therefore continue our analysis with the logged version of our CSI variable. We also report the descriptive statistics of firm board and fundamental variables. The average board size is about 9 persons, with, on average, one female member on the board. The medians for the board size and female board variables are similar, indicating that there is a small degree of skewness. The female board ratio on average is 12%, with a minimum of 0% (no women on the board) and a maximum of 80%.

Furthermore, we find that the CSI count is firm-heteroscedastic in our sample. For example, Walmart, in 2014, contributes the maximum (269), roughly 170 times more than the sample average, implying that large firms tend to have a higher CSI count. Hence, we further control for firm characteristics in our regressions. In line with the literature in gender studies such as Sila, Gonzalez, and Hagendorff (2016) and Lin and Poon (2019), we include the following variables to control for firm characteristics: firm's total assets (Assets), number of board directors (Board), Leverage, Sales, Dividends, and Net Income. These variables capture different types of size information. Total assets proxies for the size of firms' operations in sectors with high levels of tangible fixed assets such as property, plant and equipment (e.g. utilities). With respect to sectors with few fixed assets and many intangible value drivers that are usually not represented on balance sheets, and hence result in low book values of equity relative to market value (e.g. technology), the book value of total assets is a less suitable proxy for size, whereas sales is more appropriate. More generally, sales can be viewed as a proxy for the joint quantity and quality of corporate production. Board directors is used to capture board size. Leverage is to capture firm's insolvency risk. Dividend and Net Income are included to capture firm's business performance. Since we also

Table 1. Descriptive statistics.

	Firm-Year Obs.	Mean	Median	STD	Max
CSI Count	27565	1.81	0.00	9.55	269.00
log (1 + CSI Count)	27565	0.35	0.00	0.78	5.60
Female in Board (Number)	27565	1.12	1.00	1.07	7.00
Female in Board (Ratio)	27565	0.12	0.11	0.11	0.80
Board Size	27565	8.91	9.00	2.40	32.00
Total Assets ($M)	25551	15,300.20	1,671.90	97,430.11	2,573,126.00
Total Liabilities ($M)	25487	11,704.49	886.20	87,041.09	2,341,061.00
Sales ($M)	23806	5,904.90	1,184.76	19,755.08	483,521.00
Dividend Paid ($M)	25217	177.64	0.00	746.16	13,001.00
Net Income ($M)	23806	399.36	54.96	2,035.40	53,394.00

Notes: This table reports descriptive statistics of the annual RepRisk CSI counts and other firm fundamental variables for the 2880 firms from 2007 to 2017, including sample mean, median, standard deviation, and maximum. Minima are not reported as they are rather obvious except for board size (i.e. 2), total assets (i.e. 0.8) and net income (i.e. −99,289).

observe autocorrelation in our dependent variable, we further lag the dependent variable as an additional control variable.

In terms of expected coefficient exposures, we expect lagged board diversity to be positively related to CSI due to signalling, and lagged CSI to be positively related to CSI due to the autoregressive nature of CSI. In contract, we expected lagged board diversity unrelated to CSI (i.e. BDUCS) to represent a negative predictor of CSI when challenged with CSI events as per hypothesis 2. We expect firm's total assets, sales and the number of board directors (Board) to display positive coefficients because larger firms tend to have more CSI occurrences (Kent and Stewart 2008; Kölbel, Busch, and Jancso 2017; Wang and Li 2019). On the other hand, we expect negative coefficients for Dividend and Net Income, as a firm with better business performance or more cash to distribute is likely to have more resources to prevent incidents leading to negative news (Chung and Zhang 2011; Kölbel, Busch, and Jancso 2017). We do not conjecture the sign of Leverage, as we see reasonable arguments for each sign. On the one hand, firms with higher leverage may exhibit more financial distress (i.e. bankruptcy risk) and therefore engage in more risk taking (Bansal and Clelland 2004; Eisdorfer 2008 Kölbel, Busch, and Jancso 2017). On the other hand, high leverage may make the firms more cautious due to effective bondholder monitoring and result in less negative news (Gilje 2016). These two effects of leverage oppose each other and hence cloud our expectation as to the sign of Leverage. In Table 2, we provide the list of variables with their detailed definitions and their expected signs.

Table 3 reports the correlation coefficients for firm annual counts of CSI and firm board diversity, measured by the ratio of female board members to the total number of board members. We find positive correlation coefficients, suggesting that a more gender diverse board is positively correlated with the number of a firm's CSI events (26%).[2] The direction of causality is, however, entirely unclear from observing this correlation, and we have good reasons to believe that either direction is relevant. Higher gender diversity on boards could reduce the exposure to CSI incidents. Conversely, however, the occurrence of CSI may encourage corporations to reflect on their board culture and hence appoint more women. In our research design, we will strive to minimise one side of this simultaneity challenge and thereby address reverse causality.

3.3. Economic relevance of CSI data

While the literature on corporate social irresponsibility (CSI) has been developing considerably in very recent years (e.g. Kölbel, Busch, and Jancso 2017; Wang and Li 2019), it is still at an emerging stage and consequently the economic relevance of CSI data is not yet fully established.[3] Hence, we conduct an initial exploratory analysis of the effect of CSI on financial performance (i.e. return and risk) ourselves to assess the economic relevance of our key variables with a reasonable degree of robustness.

Specifically, we follow Kölbel, Busch, and Jancso (2017) to study how CSI affects the stock market. We use annual stock return and volatility along with our firm-year observations of CSI occurrences and study how CSI affects firm's financial performance and risk. Different from prior studies, which link CSI intuitively to downside

Table 2. List of variables.

Variable	Definition and Expected Coefficient Sign
CSI	The logarithm of one plus the CSI counts in one year. We will include a lagged term as independent variable and expect this to have a positive coefficient due to the autoregressive nature of CSI. As per hypothesis 1, we also expect lagged CSI to be positively related to BD.
BD	Board gender diversity, defined as the number of female board members divided by the total number of board members. We expert board diversity on its own to be positively related to CSI, as firms affected by CSI may aim to signal a better image to the market.
BDUCS	Board gender diversity unrelated to corporate social irresponsibility, in which the effect of firm endogeneity is removed. BDUCS is calculated as $\beta_0 + \varepsilon_{i,t}$ in Equation (2). As per hypothesis 2, we expect the coefficient to be negative when interacted with lagged CSI.
BDDCS	Board gender diversity related to corporate social irresponsibility. BDDCS is calculated as $\boldsymbol{\beta x'}$ in Equation (2), where $\boldsymbol{\beta}$ is a vector of coefficients $[\beta_1, \ldots, \beta_n]$ and $\boldsymbol{x}$ is the matrix of independent variables. We will only investigate this variable in a sensitivity analysis but expect its coefficient to be positive when interacted with lagged CSI due to corporate signalling.
Assets	The logarithm of firm's total assets. We expect a positive coefficient.
Board	Number of directors on the board. We expect a positive coefficient.
Leverage	Firm total liabilities divided by total assets. We would expect a positive sign from a financial distress perspective (Eisdorfer, 2008), yet a negative sign from bond holder monitoring perspective (Gilje, 2016).
Sales	Firm sales divided by total assets. We expect a positive coefficient.
Dividend	Firm dividend payment divided by total assets. We expect a negative coefficient.
Net Income	Firm net income divided by total assets. We expect a negative coefficient.

Notes: This table provides definitions of the key variables used in regressions.

Table 3. Firm CSI and Broad Gender Diversity Correlation Coefficients.

		[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]
CSI	[1]	0.60	0.39	0.16	−0.03	0.06	0.02	0.26	0.01
Assets	[2]		0.59	0.30	−0.12	0.04	0.07	0.26	−0.01
Board	[3]			0.23	−0.02	0.03	0.01	0.29	0.04
Leverage	[4]				0.06	0.11	−0.02	0.14	0.06
Sale	[5]					0.05	0.03	0.07	0.09
Dividend	[6]						0.03	0.02	0.01
Net Income	[7]							0.02	0.01
BD	[8]								0.95
BDUCS	[9]								

Notes: This table reports correlation coefficients for the CSI and corporate gender diversity.

risk, we study the impact on stock volatility to understand how CSI affects the overall financial variation. We lag our independent variables and also control for firm and year fixed effects.[4]

Table 4 reports the exploratory regression results for stock return (Models 1–3) and stock return volatility (Models 4–6). Notably, we document a significantly negative impact of CSI on stock returns and a significantly positive impact on stock return volatility.[5] These impacts are not only statistically significant but also of economic magnitude, as one additional unit of CSI leads to an annual loss of 2.9% p.a., which means that the worst CSI offender performs ceteris paribus 16.24% worse p.a. than firms without CSI incidents. On the volatility side, one additional unit of the CSI variable increases volatility by 1%, which results in a difference of 5.6% between firms without CSI incidents and the worst offender. Both of these impacts are highly undesirable to investors and clearly demonstrate the economic relevance of CSI data as a proxy for economic value destruction in financial markets.[6]

4. Research design

We investigate the impact of female board members on the number of a firm's CSI incidents, and we conjecture that female board members can reduce the number of a firm's CSI incidents. However, since previous literature suggests that there may be a mutually reinforcing effect in the gender-CSI association (e.g. Adams 2016), we cannot directly regress the number of a firm's CSI incidents on board gender diversity without being challenged

Table 4. Economic relevance of Corporate Social Irresponsibility (CSI).

	Dependent Variables					
	Annual Stock Return (1–3)			Annual Stock Return Volatility (4–6)		
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
CSI (t−1)	−0.019** [−2.22]		−0.029*** [−3.92]	0.011** [2.19]		0.010*** [2.47]
BD (t−1)		−0.125** [−2.08]	−0.146*** [−2.53]		0.009 [0.26]	0.002 [0.05]
Assets (t−1)			−0.296*** [−6.79]			−0.027* [−1.76]
Board(t−1)			0.007* [1.78]			0.001 [0.64]
Leverage (t−1)			0.118 [1.49]			0.098*** [3.43]
Sales (t−1)			0.041 [1.11]			−0.036*** [−2.59]
Dividends (t−1)			−0.253 [−1.58]			−0.164*** [−2.50]
Net Income (t−1)			0.001*** [6.44]			0.000* [−1.77]
StoVol (t−1)			0.356*** [4.57]			0.079 [1.49]
StoRet (t−1)			−0.199*** [−11.70]			−0.041*** [−5.04]
R^2	0.0002	0.0001	0.07	0.0007	5.E-06	0.03
N	20,598	19,910	17,707	20,598	19,910	17,707

Notes: This table reports the firm CSI impact on annual stock return (Models 1–3) and annual stock return volatility (Model 4–6). Both firm and year fixed effects are controlled for in the regression. Robust-clustered standard errors are used, and the corresponding t-statistics are reported in parentheses.

by reverse causality. Nevertheless, we run the baseline regression as an interaction model with both constitutive components (Brambor, Clark, and Golder 2006; Southwood 1978) as an exploration of our data and for comparability with previous studies as displayed in Equation (1):

$$\boldsymbol{CSI_{i,t}} = \boldsymbol{\beta}_0 + \boldsymbol{\beta}_1\ \boldsymbol{CSI_{i,t-1}} + \boldsymbol{\beta}_2\ \boldsymbol{BD_{i,t-1}} + \boldsymbol{\beta}_3\ \boldsymbol{CSI_{i,t-1}} \times \boldsymbol{BD_{i,t-1}} + \boldsymbol{\beta}_N \boldsymbol{Controls_{i,t-1}} + \boldsymbol{\varepsilon}_{i,t}. \quad (1)$$

Given our discussion regarding the hypotheses, we do not expect a specific sign for the BD coefficient, but a negative sign for the coefficient of interactive term $CSI \times BD$. We also expect a positive sign for CSI_{t-1} since we expect a momentum in the number of CSI occurrences.

However, regression specification (1) may not address the reverse causality effect from firm's CSI count onto board gender diversity. Hence, when we investigate the gender's impact on firm's CSI further, we attempt to isolate the reverse effect from CSI onto gender. Specifically, we propose a Granger-style reverse causality minimisation procedure. While Granger (1969, 1980, 1988) causality has been established for decades, it remains a highly important concept that can be relevant in a time series (White and Lu 2010) and a cross sectional/panel regression framework (Lu, Su, and White 2017). In addition to using Granger causality to test the presence of reverse causality, our procedure is inspired by an increased use of orthogonalization as a means of eliminating unwanted effects from variables (e.g. Adcock et al. 2017; Elton et al. 1993; Ferguson and Shockley 2003; Hoepner, Majoch, and Zhou 2019; Hoepner, Rammal, and Rezec 2011; Lawrence et al. 2019; Liesen et al. 2017; Priestley and Ødegaard 2007) The unwanted effect that we seek to eliminate will be reverse causality. Technically, our procedure involves three steps:

In **Step 1**, we regress board diversity (BD) on lagged CSI as shown in Equation (2) below:

$$\boldsymbol{BD_{i,t} = \beta_0 + \beta_1 CSI_{i,t-1} + \beta_2\ Board_{i,t-1} + \beta_3\ Assets_{i,t-1} + \varepsilon_{i,t}} \quad (2)$$

This regression allows us to separate diversity into two components, the one driven by CSI (BDDCS) and the other unrelated to CSI (BDUCS). The former, BDDCS, represents the product of lagged CSI and its coefficient, while the latter, BDUCS, is the sum of the intercept and disturbance term of the regression. Mathematically, both components can be written as displayed in Equation (3) and (4), respectively.

$$\boldsymbol{BDDCS_{i,t}} = \hat{\beta}_1 CSI_{i,t-1} + \hat{\beta}_2 Board_{i,t-1} + \hat{\beta}_3 Assets_{i,t-1} \quad (3)$$

$$\boldsymbol{BDUCS_{i,t}} = \hat{\beta}_0 + \hat{\varepsilon}_{i,t} \quad (4)$$

In **Step 2**, we confirm two important statistical diagnostic tests of BDUCS:

- $BDUCS_{i,t}$ experiences a near zero correlation to CSI.
- A Granger causality F-test for $CSI_{i,t-1}$ affecting $BDUCS_{i,t}$ is clearly insignificant.

Achieving both properties above, and hence passing the diagnostics tests, provides us with confidence that the possibility of reverse causality has been successfully excluded from $BDUCS_{i,t}$.[7] While 'exclusion' is a theoretically strong word that not every reader may favour, we would argue that we have, at least, minimised the possibility of reverse causality to the 'best possible' extent by passing these diagnostic tests.

In **Step 3**, we develop our main model. Specifically, we regress CSI on lagged BDUCS, lagged CSI and their interaction term as shown in Equation (5) below:

$$\boldsymbol{CSI_{i,t} = \beta_0 + \beta_1\ BDUCS_{i,t-1} + \beta_2\ CSI_{i,t-1} + \beta_3\ (BDUCS_{i,t-1} \times CSI_{i,t-1}) + \beta_N\ Controls_{i,t-1} + \varepsilon_{i,t}} \quad (5)$$

Since the effects of CSI on board gender diversity have been removed by definition from the term $\boldsymbol{BDUCS_{i,t-1}}$, we expect that the model design will capture only the effect of board gender diversity on firm's CSI, which are unrelated to previous CSI. Board gender diversity effects driven by previous CSI, i.e. BDDCS, are explicitly excluded from our main model. Conceptually, our approach can be understood as a two stage least squares approach (e.g. Antonakis et al. 2010), where instead of estimating BD from variables we assume to be exogeneous in the first step, we decompose BD into an endogenous and an exogeneous component in the first step and use the latter in the second step. To test our expectations, we calculate final diagnostic statistics of our main model to gauge the potential presence of endogeneity and especially reverse causality. Specifically, we test if the estimated error term experiences a zero mean, conditional on the key explanatory variable (Roberts and Whited 2013) by conducting an F-test for the regression of $\boldsymbol{\varepsilon_{i,t}}$ on $\boldsymbol{BDUCS_{i,t-1}}$. Subsequently, we also compute the correlation between $\boldsymbol{BDUCS_{i,t-1}}$. and the estimated error term $\boldsymbol{\hat{\varepsilon}_{i,t}}$.[8]

5. Discussion of main results

5.1. Main results from Granger style reverse causality minimisation procedure

Table 5 reports the results based on the naïve regression Equation (1). We find that the interaction terms are indeed statistically negative. This result of Model 1 supports our expectation that board gender diversity can reduce the number of a firm's future CSI in the face of existing CSI. In Model 2, we control for more firm-fundamental variables, including firm's leverage, sales, dividend pay-out, and net income. The significance is the same. As a robustness check, we include $t-2$ lagged variables, and, again, the results are qualitatively the same.[9]

This naïve regression model provides statistical evidence supporting the resource dependence reasoning that board capital reduces CSI incidents. In the full model specification, a one unit increase in board gender diversity reduces CSI the following year by 16.7%,[10] thereby, reducing a firm's return loss due to CSI by 48 basis points on average per annum.[11] These naïve results indicate that adding female directors to corporate boards may indeed

Table 5. Board gender diversity and firm's CSI.

	Dependent Variable = CSI	
	Model 1	Model 2
BD (t−1) × CSI (t−1)	−0.327***	−0.281***
	[−3.22]	[−2.52]
BD (t−1)	0.125***	0.114**
	[2.45]	[2.04]
CSI (t−1)	0.314***	0.310***
	[18.63]	[16.56]
Assets (t−1)	0.065***	0.069***
	[5.59]	[5.21]
Board (t−1)	0.007	0.009***
	[1.48]	[3.70]
Leverage (t−1)		0.027
		[0.88]
Sales (t−1)		0.025
		[1.27]
Dividend (t−1)		−0.001
		[−0.03]
Net Income (t−1)		−0.007***
		[−6.30]
R^2	0.070	0.072
N	22,841	21,159

Notes: This table reports naïve regression models for gender-CSI association. Both firm and year fixed effects are controlled in the regression. Robust-clustered standard errors are used (clustered by firm's sectors), and the corresponding t-statistics are reported in parentheses.

lead to direct economic gains, both in terms of a reduction in CSI, and in terms of avoiding economic loss of 48 basis points annually as a consequence of CSI. Hence, female board presence may indeed increase monitoring and strategy involvement as suggested by Post and Byron (2015). That said, these results originate from a naïve regression without any procedures to minimise reverse causality.

Hence, we need to refer to the results of the three-step Granger style reverse causality minimisation procedure, which are reported in Table 6. Panel A reports the first step. Consistent with the previous literature and in support of our hypothesis 1, we find that firms tend to enhance their board gender diversity in the year following CSI incidents. The results are in line with the prior findings of studies such as Bear, Rahman, and Post (2010) and Bernardi, Bosco, and Columb (2009), which documented social responsibility considerations to impact board gender diversity. They also support the issue life-cycle theory of Zyglidopoulos (2003), which argues that companies may seek to enhance their reputation and legitimacy by adhering to societal expectations.

Panel B reports the statistical properties for *BDUCS* (board gender diversity unrelated to corporate social irresponsibility) and corporate social irresponsibility. The correlation coefficients matrix shows a 1% statistically significant and reasonably large correlation of 0.26 between BD and CSI, while the correlation between BDUCS and CSI is very small (i.e. 0.01) and clearly insignificant. The results indicate that BDUCS appears to represent board gender diversity after the removal of the reverse causality effects caused by CSI. In the Granger causality test results, as we expect, we do not find any statistical evidence that firm's CSI Granger-causes BDUCS. The results confirm that the probability of reverse Granger causality appears to be removed, or is at the very least severely reduced.

Table 6. Board Gender Diversity Impact Controlled for Mutual Effect.

	Model 1	Model 2
Panel A: (Step 1) Dependent Variable = BD		
Constant	0.007**	−0.014***
	[2.07]	[−3.61]
CSI (t−1)	0.018***	0.018***
	[18.45]	[17.23]
Assets (t−1)	0.006***	0.004***
	[10.95]	[7.36]
Board (t−1)	0.007***	0.009***
	[21.25]	[22.68]
Leverage (t−1)		0.020***
		[7.43]
Sales (t−1)		0.010***
		[11.81]
Dividend (t−1)		0.003
		[0.23]
Net Income (t−1)		0.000
		[0.12]
R^2	0.108	0.118
N	22,669	20,999
Panel B: (Step 2) Correlation Coefficient and Granger Causality Test		
Correlation Coefficient:		CSI
BD		0.26***
BDUCS		0.01
Granger Causality Test		F-statistics
CSI Granger causes BDUCS		2.508
BDUCS Granger causes CSI		5.455***
Panel C: (Step 3) Dependent Variable = CSI		
BDUCS (t−1) × CSI (t−1)	−0.472***	−0.470***
	[−4.05]	[−3.70]
BDUCS (t−1)	0.253***	0.269***
	[4.38]	[4.18]
CSI (t−1)	0.216***	0.208***
	[12.45]	[11.27]
Assets (t−1)	0.074***	0.087***
	[5.01]	[4.48]
Board (t−1)	0.007	0.010***
	[1.38]	[3.28]
Leverage (t−1)		0.032
		[0.84]
Sales (t−1)		0.067**
		[2.25]
Dividend (t−1)		0.045
		[1.10]
Net Income (t−1)		−0.008***
		[−6.77]
R^2	0.044	0.046
N	19,956	18,238
Endogeneity Estimations:		
P-value of *F*-Test (Residual regressed on BDUCS)	0.46	0.42
Correlation (BDUCS, Residual)	1.47×10^{-11}	-4.29×10^{-12}

Notes: This table reports results for board gender diversity's impact, after controlling for mutual effects from CSI. In the step 3 regression, both firm and year fixed effects are controlled for in the regression. Robust-clustered standard errors are used, and the corresponding *t*-statistics are reported in parentheses.

Panel C reports equivalent results to Panel A after controlling for potential reverse causality. The coefficients for the interactive term *BDUCS* × *CSI* are statistically significantly negative, suggesting that female board members appointed for other reasons than CSI can help reduce the number of a firm's CSI occurrences in the coming year, when facing the CSI occurrences in the current year. This result clearly supports our hypothesis 2. Two further observations come to light when interpreting Panel C of Table 5. First, the absolute effect size of the interaction term appears economically meaningful. It is slightly larger than the autoregressive CSI term in model 1 and slightly smaller in model 2, while it dwarfs the standalone *BDUCS* variable in both models .[12] Second, when comparing the magnitude of the interaction term effect of BD in Table 5 with BDUCS in Table 6, the latter is significantly more pronounced. This might indicate (i) that the effect that a more diverse board reduces CSI occurrences when faced with them is genuinely authentic, and (ii) that the reverse causality effects are, in fact, confounding. In terms of gender diversity impact, the result predicts that a one unit increase in board gender diversity unrelated to CSI leads to a reduction of CSI by 20.1% in the following year.[13] This spares the firm a return loss due to CSI of 58 basis points on average per annum.[14]

Consequently, we do not only find statistically significant support of our hypothesis 2, but also economically substantial reductions in CSI, and especially in forgone return. An avoided loss of 58 basis points per annum on a hypothetical $10 billion corporate valuation, roughly the median market capitalisation in the Russell 1000 index, represents an avoided loss of $58 million per firm. Crucially, the impact on both CSI and avoided economic loss is larger (i.e. by 10 basis points or about 20%) for board diversity unrelated to CSI than for board diversity itself. This provides additional support for our hypothesis 2, as it signals that genuinely-appointed female board members have a stronger impact than those appointed for signalling purposes. In summary, our results provide strong support for the resource dependence theory view, that board gender diversity diversifies board skills and networks (Hillman and Dalziel 2003). Indeed, we find that board gender diversity enhances the board's monitoring function and reduces CSI incidents as well as the economic loss associated with these.

Furthermore, a curious observation is the positive coefficient for the non-interacted BDUCS variable. It appears as if, absent external challenges to a firm's behaviour, ethically and operationally poor practice tends to become accepted and normalised over time, resulting in the phenomenon of 'the normalization of deviance' coined by Vaughan (Vaughan 1996) in her study of the Challenger disaster. This phenomenon has since been to operate in domains as diverse as healthcare (Price and Williams 2018; Banja 2010), project management (Pinto 2014), the oil and gas industry (Bogard et al. 2015) and marine safety studies (Manuel 2018). As Courtois and Gendron (2017) note, the normalisation of deviance may proliferate for many years in the presence of internal control systems which ostensibly ensure probity and ethical behaviour but evidently fail to do so in practice. The acceptance of institutional operation with known flaws is a pervasive trait in organisations. Hence, it is plausible that corporate social irresponsibly festers, until revealed by publicity, and that a correction will only begin once scrutiny of external stakeholders is unavoidable.

Finally, we conduct two diagnostics tests that could indicate the presence of endogeneity. While we understand that these tests are not necessarily sufficient to detect the absence of endogeneity given that we can only observed the estimated instead of the true error term (Roberts and Whited 2013), we would still consider it negligent to not conduct them. First, we observe the F-test of regressions of the estimated error terms of each of the models in Panel C on *BDUCS* to be clearly insignificant. Likewise, the t-tests for the intercept and the coefficient of these regressions are insignificant too. Second, we report the correlation coefficient between *BDUCS* and these estimated error terms. The correlation coefficients are extremely small (e.g. 1.47×10^{-11}) and statistically indistinguishable from zero. These final diagnostic tests indeed suggest that, after applying our proposed procedure, endogeneity and especially reverse causality are likely to have predominantly disappeared from the estimated model.

5.2. Robustness tests

By way of robustness tests, we include two-way effects (firm and year) with sector clustered standard errors in Equations (1) and (5). We also repeat our regressions of Equations (1) and (5) with two-way (firm and year) clustered standard errors and include further lags of the key variables in additional models. Our results remain qualitatively the same. To test the robustness to specifications of our CSI variable, we employ three separate

Table 7. GMM Estimates of Board Gender Diversity Impact.

Dependent Variable: CSI			
	Model 1	Model 2	Model 3
BD ($t-1$) × CSI ($t-1$)	−3.082***	−3.048***	−3.048***
	[−5.68]	[−5.52]	[−5.26]
BD ($t-1$)	0.660***	0.607***	0.563***
	[2.91]	[2.68]	[2.41]
CSI ($t-1$)	0.732***	0.730***	0.741***
	[9.06]	[8.65]	[8.50]
Assets ($t-1$)		−0.008	−0.006
		[−0.40]	[−0.30]
Board ($t-1$)		−0.004	−0.001
		[−0.60]	[−0.10]
Leverage ($t-1$)			0.024
			[0.72]
Sales ($t-1$)			0.007
			[0.52]
Dividends ($t-1$)			−0.014
			[−0.20]
Net Income ($t-1t-1$)			−0.002
			[−1.16]
N	22,334	20,831	19,057

Note: This table reports the GMM estimates for the regression Equation (1) in an equivalent manner to Table 5. Both year and firm fixed effects are controlled in the regression. Robust standard errors are used, and the corresponding t-statistics are reported in parentheses. Due to the lagged dependent variables used within the GMM estimation algorithm, the number of observations is marginally lower than in Table 5.

approaches. First, since the existence of CSI news per firm may be dependent on the media coverage of the respective firm, we estimate the probability of CSI news exposure and then add this to our stage 3 regression using a Heckman (1979) two step approach. Second, we only include the negative news classified by RepRisk as having a high severity into our CSI count. Third, we use the number of CSI counts to replace the logarithm of CSI counts. Our conclusions are qualitatively the same.[15]

Furthermore, we employ Generalised Method of Moments (GMM) estimation to conduct another robustness test of our main results. The benefit of using GMM estimates is that these do not depend on such strong estimation assumptions as traditional linear regression models (Jagannathan, Skoulakis, and Wang 2002). We report the GMM estimates for our regression Equation (1) in Table 7 and present results equivalent to those presented in Table 5. In support of our results, we find a strongly negative estimate on the interaction term of interest. Our results remain robust when we include firm-specific control variables.

Finally, we repeat our analyses in Table 6 for different sectors. The sub-sample results are reported in Table 8. To save space, we only report the 3rd-step results. We divide our sample firms into six sectors – Consumer, Manufacturing, Energy, Technology, Retail, and other sectors.[16] We find that all sectors show negative coefficients on the interaction term between lagged board diversity and lagged CSI, which are highly statistically significant with the exception of the Consumer sector. Hence, we consider our results robust to various different types of corporate business models.

5.3. Sensitivity analysis using BDDCS

To set up our sensitivity analysis, we recall that when comparing the magnitude of the interaction term effect of BD in Table 5 with BDUCS in Table 6, the latter is significantly more pronounced. This appears to imply that the effect of more diverse boards reducing CSI occurrences when faced with them is genuinely authentic, and that the reverse causality effects are, in fact, confounding. Hence, if we repeat the analysis of Panel B and C in Table

Table 8. Subsamples by Sector.

	Dependent Variable = CSI					
	Consumer	Manufacturing	Energy	Tech	Retail	Other
BDUCS ($t-1$) × CSI ($t-1$)	−0.124	−0.313**	−0.559***	−0.449***	−0.556***	−0.501***
	[−0.63]	[−2.15]	[−3.27]	[−3.43]	[−4.13]	[−3.40]
BDUCS ($t-1$)	0.412	0.217	0.323	0.123	0.219	0.294*
	[1.43]	[1.04]	[0.94]	[0.91]	[1.39]	[1.70]
CSI ($t-1$)	0.151***	0.110***	0.202***	0.238***	0.234***	0.194***
	[4.97]	[5.13]	[7.58]	[13.44]	[13.27]	[9.56]
Assets ($t-1$)	0.154***	0.048	0.124***	0.076***	0.037	0.105***
	[3.17]	[1.52]	[2.70]	[3.69]	[1.58]	[3.93]
Board ($t-1$)	−0.001	0.006	0.011	0.008	0.007	0.015*
	[−0.06]	[0.62]	[0.90]	[1.14]	[0.91]	[1.90]
Leverage ($t-1$)	−0.286*	0.000	0.207	0.028	−0.007	−0.046
	[−1.84]	[−0.00]	[1.36]	[0.49]	[−0.16]	[−0.59]
Sales ($t-1$)	0.103	−0.009	0.157**	0.091**	0.016	0.077
	[1.43]	[−0.19]	[2.25]	[2.37]	[0.60]	[1.63]
Dividends ($t-1$)	−0.005	0.047	−0.591	0.038	0.014	0.240
	[−0.01]	[0.13]	[−0.62]	[0.31]	[0.10]	[1.10]
Net Income ($t-1$)	−0.022	−0.172	−0.194	−0.099*	−0.058	−0.008***
	[−0.11]	[−1.58]	[−1.53]	[−1.83]	[−1.24]	[−2.41]
R^2	0.028	0.017	0.061	0.063	0.048	0.047
N	1,591	2,750	1,901	4,407	4,335	3,254

Notes: This table reports the sectoral subsample results for board gender diversity's impact, after controlling for mutual effects from CSI. Sector are classified using the Fama-French sector classification code and merged into 6 sector groups to ensure sufficient and broadly equivalent degrees of freedom in each group. Consumer includes the Consumer Durables and the Consumer Non-durables of the Fama-French sectors; Manufacturing includes the Manufacturing and Chemicals sectors; Energy includes the Energy and the Utilities sectors; Tech includes Telecoms and Business Equipment, Retail includes the Shops and Healthcare sectors, and Other includes the rest of the sectors. We only report the results for step 3 regression, both firm and year fixed effects are controlled for in the regression. Robust-clustered standard errors are used, and the corresponding t-statistics are reported in parentheses.

6 with board diversity driven by corporate social irresponsibility (*BDDCS*) instead of board diversity unrelated to corporate social irresponsibility (*BDUCS*), we thereby conduct a sensitivity analysis, which should show the coefficient of the interaction *BDDCS* × *CSI* to be (much) weaker in significance and effect size.

That said, regressing CSI on the board diversity driven by previous CSI is obviously not minimising reverse causality but maximising it, and hence we do not display the results of this analysis here. [17] Nevertheless, we consider these results an interesting comparison and hence discuss them in the following, while cautioning not to draw any robust conclusions from them. When replacing *BDUCS* with *BDDCS*, we find the correlation between CSI and *BDDCS* to be 0.73 and highly statistically significant. For comparison, *BD* correlates significantly with CSI with an effect size of 0.26, while *BDUCS* has a clearly insignificant effect size of 0.01. CSI clearly significantly Granger causes *BDDCS* with an F-statistic of 652.9, which is hundreds of times larger than the equivalent for *BDUCS*. The interaction term *BDDCS* × *CSI* is in both models insignificant and even slightly positive. While such an endogeneity-plagued result has to be, of course, interpreted with enormous care, it certainly does not reduce our confidence in the authenticity of the effect that more diverse boards reduce corporate irresponsibility when faced with them. Unsurprisingly, the absolute correlation between the estimated error terms of Equation (5) run with *BDDCS* is several hundred percent larger than the *BDUCS* equivalents presented for both models in Table 6, because our *BDDCS* based sensitivity analysis suffers from endogeneity by design.

5.4. Alternative identification strategies

In our main model, we identify the direction of causality in our Granger style reverse causality minimisation procedure through removing any influence of lagged CSI from our 'board diversity unrelated to CSI variable'

(BDUCS). We confirm our minimisation of reverse causality with a Granger causality test and further specification tests. In comparison, the classic instrumental variable approach would aim to identify the direction of causality between board diversity and CSI by expressing board diversity as a function of one or more instrumental variables which are theoretically unrelated to CSI and empirically are likely to capture some, though not all, of the variation in board diversity that is unrelated to CSI. Consequently, our Granger style reverse causality minimisation procedure is conceptually related to the classic instrumental variables approach, although it is likely to more closely approximate the variation in board diversity than can a small number of instruments (e.g. passing the Durbin-Wu-Hausman test seamlessly).

Hence, in aiming to present an alternative identification strategy, an instrumental variable approach is not truly an alternative, as it is closely related to a Granger style reverse causality minimisation procedure. Furthermore, finding a valid instrument in corporate governance is chronically challenging and frequently impossible (e.g. Adams and Mehran 2012). We also struggle to identify one or more instruments that are related to board diversity but unrelated to CSI other than through variables already controlled for in our model.[18] Similarly, a difference-in-difference approach is not suitable as an alternative identification strategy for our context, since we utilise annualised data, and any potential candidate for even an exogenous shock would have occurred several months before or after the calendar year end.

Consequently, we need to look elsewhere for alternative identification strategies of the direction of causality, albeit these possibly only allow weaker claims. In other words, we acknowledge that some readers may not consider them as strong as our Granger style reverse causality minimisation procedure, which for all practical

Table 9. Quasi Discontinuity Regression.

Dependent Variable = CSIdummy			
	Model 1	Model 2	Model 3
BD_1or0 (t−1) * CSI (t−1)	−1.957**	−1.737*	−1.896**
	[−2.10]	[−1.88]	[−2.05]
BD_1or0 (t−1)	1.728***	1.324***	1.214**
	[3.57]	[2.48]	[2.26]
CSI (t−1)	2.266***	1.654***	1.641***
	[27.44]	[19.91]	[19.71]
Assets (t−1)		0.602***	0.617***
		[23.98]	[23.07]
Board (t−1)		0.023	0.016
		[1.46]	[0.99]
Leverage (t−1)			0.233**
			[2.03]
Sales (t−1)			0.164***
			[4.87]
Dividends (t−1)			0.186
			[0.38]
Net Income (t−1)			0.034
			[0.15]
Constant	−2.185***	−6.636***	−6.956***
	[−49.89]	[−35.41]	[−34.89]
N	11,788	11,788	11,788

Note: This table presents regression results based on Equation (1) and hence is equivalent to Table 5. To exploit the discontinuity between no women on the board and one woman on the board, we limit the sample to include only firm-year observations with zero or one woman on the board. Consequently, the variable *BD* transforms into *BD_1or0*, which displays the actual number of women on the board. To focus the discontinuity effect identification on the most relevant discontinuity in our dependent variable, the inexistence or existence of CSI events, we transform our dependent variable into a *CSIdummy*, which equals 0 in case of no evidence of negative news and 1 otherwise. Consequently, we perform a logit regression. The corresponding t-statistics are reported in parentheses.

purposes eliminates the direction of causality that we do not intend to study. However, other readers may be comforted to see multiple identification strategies supporting the same ultimate interpretation. In searching for alternative, feasible identification strategies, we draw inspiration from regression discontinuity designs (e.g. Arvate, Galilea, and Todescat 2018; Flammer 2015) and Heckman approaches to identification (e.g. Briggs 2004; Heckman and Vytlacil 2007a, 2007b).

While our research setting does not permit a classic regression discontinuity design exploiting natural discontinuities presented in, for example, binary election vote counts (i.e. the threshold to achieve a majority), our key concept of interest, board diversity, possesses a relevant natural discontinuity, namely the difference between boards with zero women and boards with exactly one woman. We can focus our identification on the effect of this discontinuity of introducing the first woman to an entirely male board by limiting our sample to only those firm-year observations with zero or one women on the board. In line with Arvate, Galilea, and Todescat (2018, 538), '[o]ur causal identification strategy, therefore, is to detect the "jump" in the dependent variable at the discontinuity point that can be attributed to the effect of crossing the discontinuity point', whereby crossing the discontinuity point in our case means introducing the first woman to an entirely male board. To furthermore focus the discontinuity effect identification on the most relevant discontinuity in our dependent variable, the inexistence or existence of CSI events, we transform our dependent variable into a *CSIdummy*, which equals 0 in case of no evidence of negative news and 1 otherwise. Table 9 displays the results of the 'quasi discontinuity regression' in an equivalent manner to the GMM results presentation in Table 7. The interaction term coefficients across all three specifications remain statistically significant, which supports the robustness of our results.[19]

Table 10. Heckman (1979) model.

	Dependent Variable = CSI
BD (*t*−1) * CSI (*t*−1)	−0.329*** [−2.76]
BD (*t*−1)	0.140 [0.79]
CSI (*t*−1)	0.277*** [14.55]
Assets (*t*−1)	0.084*** [4.26]
Board (*t*−1)	0.009*** [3.31]
Leverage (*t*−1)	0.026 [0.68]
Sales (*t*−1)	0.059** [2.09]
Dividend (*t*−1)	0.003 [0.07]
Net Income (*t*−1)	−0.008*** [−5.57]
Inv Mills Ratio	−0.005 [−0.23]
R^2	0.048
N	17,941

Note: This table reports the Heckman test for sample selection bias. Both firm and year fixed effects are controlled for in the regression. Robust-clustered standard errors are used, and the corresponding *t*-statistics are reported in parentheses. The inverse Mills ratio is calculated from the following Probit regression:

$$Dummy\_BD_{i,t} = Probit(\beta_0 + \beta_1 BD_{i,t-1} + \beta_1 CSI_{i,t-1} + \beta_N Controls_{i,t-1} + \varepsilon_{i,t})$$

where $Dummy\_BD_{i,t}$ is a dummy variable, equals to 1 if above sample average; 0 otherwise.

Given that this approach does not represent the classic regression discontinuity approach, but approximates to an equivalent causal identification strategy based on the best discontinuities available in our research setting, we complement our two previous identification strategies with a third approach. Although it is commonly not as popular as some of the above discussed methods to use a Heckman (1979) selection model for identification strategy purposes, it remains a conceptually valid option (e.g. Briggs 2004; Heckman and Vytlacil 2007a, 2007b). Following Heckman and Vytlacil (2007a, 4851) '[u]nobservables, including missing data, are at the heart of the identification problem for causal inference.' Controlling for such unobservables as well as possible consequently enhances the identification of the direction of causality in a similar manner to matching to equivalent counterfactuals, if our research design setting were to provide a natural treatment and control group. The key unobserved variables in our context are those contributing to a firm's decision to have more or less board diversity. To control for these at least to some extent, we estimate a Heckman (1979) selection model of the binary choice of the firm to have above or below average board diversity, in which we also include lagged CSI. We extract the Inverse Mills Ratio from this first step selection equation, which can be interpreted as the probability of a firm selecting to have above average board diversity. Adding the Inverse Mills ratio as a control to our results estimated with Equation (1) supports the robustness of our results and conclusions, as shown in Table 10.

6. Conclusion

In this paper, we study the relationship between board gender diversity and corporate social irresponsibility (CSI), measured by the number of negative news items that appeared in the media. We hypothesise a bi-directional causality. Firms exposed to CSI incidents are likely to increase their board gender diversity for reputational purposes. At the same time, board gender diversity diversifies board skills and networks, thereby building board capital and enhancing its monitoring function, which in turn should result in the ability to reduce CSI incidents. In econometric terms, this relationship is plagued with a reverse causality issue, which has caused severe problems in previous research (e.g. Adams 2016).

To address the problem, we propose a three-step Granger style reverse causality minimisation procedure. Technically, we first separate board diversity into two components, the one driven by CSI incidents (BDDCS) and the other unrelated to CSI incidents (BDUCS). Second, we confirm BDUCS to be statistically well-behaved, i.e. BDUCS experiences a near-zero correlation with CSI incidents and a Granger causality F-test for CSI incidents affecting BDUCS is clearly insignificant. Finally, we use BDUCS to replace the normal board diversity variable in regressions, to analyse the impact of board gender diversity on corporate social irresponsibility incidents.

Applying our Granger-style reverse causality minimisation procedure to 2,880 US firms and their CSI incidents as recorded by RepRisk between 2007 and 2016, we find in our first step that firms tend to enhance their board gender diversity in the year following CSI incidents, which supports hypothesis 1. In support of our hypothesis 2, we also find in the third step of our procedure that the lagged CSI unrelated component of board diversity is strongly negatively interacted by lagged CSI in explaining next year's CSI incidents. Our result implies that boards with higher diversity, for reasons other than CSI, were better than their lower diversity counterparts in reducing CSI incidents once encountering them. More specifically, we find that a one unit increase in board gender diversity unrelated to CSI leads to a reduction of CSI by 20.1% in the following year, which spares the firm a return loss due to CSI of 58 basis points on average per annum. Crucially, this effect is stronger for board gender diversity unrelated to CSI than for board gender diversity itself. Consequently, our results provide strong support for the resource dependence theory view that board gender diversity diversifies board skills and networks (Hillman and Dalziel 2003). Our results are robust to various econometric specifications, multiple operationalisations of the CSI variable, sectoral sub-samples, and GMM estimators. They also hold when subjected to a sensitivity analysis using board diversity driven by CSI and based on two alternative identification strategies (quasi-discontinuity regression, and Heckman model).

We contribute to the understanding of the effects of board gender diversity in three respects. First, we propose a procedure inspired by Granger causality and an increased knowledge of orthogonalization that can mitigate the challenge of reverse causality. Second, equipped with our Granger style reverse causality minimisation procedure, we are confident in hypothesising bi-directional causality and subsequently all but eliminate one direction (i.e. CSI on board diversity) from our test of the opposite direction. Third, we are, to the best of our knowledge, the first to study the effect or board gender diversity on corporate social irresponsibility and to observe that diverse boards reduce CSI incidents when facing them. Fourth, we believe to be the first study to differentiate between board diversity caused by CSI, CSR or risk and board diversity unrelated to CSI, CSR or risk, and find that the latter appears more important than the former and the overall concept itself.

Finally, our study provides insights for policy makers, investors, senior management and corporate board chairs. In line with issue life-cycle theory (Zyglidopoulos 2003) which argues that companies may seek to enhance their reputation and legitimacy by leading societal expectations, gender diversity has also risen significantly in importance for policy makers of the last decade. The European Commission has even been reported to be advocating for a quota of 40% of women on corporate boards.[20] Many other jurisdictions already introduced such quotas (e.g. California, France, Iceland, Israel, Norway or Pakistan). Our results hence imply to policy makers globally that increasing the board gender diversity is likely to protect corporations and in turn society from reputation damage through corporate social irresponsibility.

Similarly, our results imply to investors, especially those deeply committed to gender diversity such as CalPERS, Calvert, the Norwegian Sovereign Wealth Fund or the Japanese Government Pension Fund, that enhancing gender diversity reduces incidents of corporate social irrresponsibility and thereby avoids actual losses. For senior managers, our results imply that more gender board diversity will offer them enhanced monitoring, which those senior managers with aligned incentives can be expected to appreciate. For corporate board chairs, both male and female, our results imply that enhanced gender diversity builds board capital and thereby enhances the board's monitoring ability. Hence, chairs are advised to enhance board gender diversity until they reach a satisfactory level. What this satisfactory level is, however, our study cannot address. While the highest gender board diversity values in our sample exceed 50% by far, the mean and median are only 12% and 11% with a standard deviation of 11%, respectively. Consequently, we simply do not have sufficient numbers of observations in the sample that are close to the 40% mark.

Future research may also wish to explore the bi-directional relationship of board gender diversity to CSI more globally across different cultures and/or legal origins, thereby relaxing our limitation of initially focusing purely on US data. Potentially more importantly, the relationship between senior management gender diversity (as opposed to board gender diversity) and CSI, CSR or equivalent concepts is largely underexplored. We would have been delighted to study senior management gender diversity in addition to board gender diversity, but could not overcome the limitation that apparently no large scale data set exists for senior management diversity. The best proxy we identified are the five best paid executives, but we consider this group hardly equivalent to senior management. As the CSI literature is still in its infancy, future research would have much opportunity to understand the bi-directional relationship between other corporate governance aspects and CSI. Last but not least, future research can also employ our Granger-style reverse causality minimisation procedure in any relevant context (e.g. Cojoianu et al. 2020).

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Notes

1. Possibly the most prominent example of how a female leader was able to reduce corporate risk is that of Ms. Mary Barra and General Motors. Mary was appointed as the General Motors CEO in 2014, and in the first year of her tenure, she endeavored to resolve concerns regarding vehicle safety emerging from society and regulatory bodies. The relevant accounts can be found in, e.g. USA Today ('GM reverses openness pledge: Our view': https://eu.usatoday.com/story/opinion/2014/07/23/gm-ignition-senate-mary-barra-editorials-debates/13068081/) and New Corner ('Rebuilding a Giant: Mary Barra, CEO, General Motors': http://www.new-corner.com/rebuilding-a-giant-mary-barra-ceo-general-motors/) for more details.
2. In addition, we also run a VIF (Variance Inflation Factor) analysis for all the explanatory variables used in the regressions. Conventionally, multicollinearity concerns are raised when VIF is larger than 7 (Green, Hand, and Frank Zhang 2017). Our VIFs range from 1.01 to 2.42, well below 7. Consequently, we do not expect any multicollinearity concern in our regression analyses. The results are available upon request from the contact author.
3. We are very grateful for an anonymous referee for suggesting this additional section on the economic relevance of CSI.
4. We also run a version of Table 4 with contemporaneous independent variables and arrive at qualitatively the same results, which are available upon request from the contact author.
5. We note that the R-squared values are relatively low. This is because (1) all the R-squared values are 'within R-squared', and (2) all the regressors are lagged by one year. Hence the low explanatory power is expected. However, the F-statistics (not reported) show that all models, except Model 5, are meaningful in predicting stock returns and volatility at statistically significant levels. The full R-squared values with all the fixed effects being added are between 25% and 30% for stock return and around 50% for stock volatility.
6. Curiously, we also observe a statistically significantly negative effect of board diversity on stock returns. While this is socially undesirable, it is by no means unprecedented in the board diversity literature (e.g. Adams and Ferreira 2009).
7. It is important to note that we do not intend *BDUCS* to proxy as a synthetic instrument for BD as it might occur in an Instrumental Variables approach. Instead, we intend to replace the concept of board diversity (BD), which is plagued by reverse causality, with the concept of board diversity unrelated to CSI. In other words, *BDUCS* is intended to represent a subset of *BD* and not a vector of instruments for estimating or replicating *BD* in the sense of a Durbin-Wu-Hausman test. Nevertheless, we can subject *BDUCS* to a Durbin-Wu-Hausman test, which it passes seamlessly as one would expect, given that *BDUCS* represents a substantial proportion of the variation in *BD*. The results are available upon request from the contact author.
8. While we concur with Roberts and Whited (2013, 498) 'that there is no way to empirically test whether a variable is correlated with the regression error term because the [true regression] error term is unobservable', the estimated error term *is* observable and we would consider ourselves negligent, if we did not at least gauge the presence of endogeneity in general and reverse causality, in particular, by (i) regressing the estimated error term on the key independent variable and reporting the F-test as well as the correlation coefficient between both variables.
9. The results are not reported here, but are available upon request.
10. Based on values presented in Table 5, the computation is as follows: $-0.167 = -0.281 + 0.114$.
11. Interacting the 16.7% CSI reduction with the 2.9% return reduction per unit of CSI presented in Table 4, results in a loss reduction of 48 basis points ($0.48\% = -0.167 \times -2.9\%$).
12. Somewhat surprisingly, *BDUCS* as standalone variable is significant and positive, which may suggest that firms with a high gender diversity on boards but no contemporaneous CSI are not as cautious as they should be. We further investigate this standalone *BDUCS* coefficient though and find that it drops into more marginal significance levels when the interaction term is not included in the regression.
13. Based on values presented in Table 6 Panel C, the computation is as follows: $-0.201 = -0.47 + 0.269$.
14. Interacting the 20.1% CSI reduction with the 2.9% return reduction per unit of CSI presented in Table 4, results in a loss reduction of about 58 basis points ($0.5829\% = -0.201 \times -2.9\%$).
15. The results discussed in this paragraph are not reported here, but are available upon request from the contact author.
16. We use Fama and French's twelve industry portfolios for this purpose.
17. These results are nevertheless available upon request for the interested reader, with the health warning that they have been deliberately endogeneity maximised.
18. We find the instrument introduced by Adams and Ferreira (2009, 306) as 'the fraction of male directors on the board who sit on other boards on which there are female directors' to be suitable when the independent variable represents financial and governance related performance. Since we have CSI as an independent variable, however, it seems natural to assume that male directors' exposure to female board members via other boards is related to CSI via corporate culture and especially corporate integrity, for which we have no appropriate controls.
19. We also run a version of Model 3 in Table 9 where we control for the time varying average level of board diversity beyond our discontinuity focused sample (i.e. the average board diversity for all firms with more than one women on the board). Our interaction term remains statistically significant.

20. https://www.theguardian.com/world/2017/nov/20/eu-to-push-for-40-quota-for-women-on-company-boards.

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References

Abdullah, Shamsul N, Ku Nor Izah Ku Ismail, and Lilac Nachum. 2016. “Does Having Women on Boards Create Value? The Impact of Societal Perceptions and Corporate Governance in Emerging Markets.” *Strategic Management Journal* 37 (3): 466–476.

Adams, B. Renée 2016. “Women on Boards: The Superheroes of Tomorrow?” *The Leadership Quarterly, Special Issue: Gender and Leadership* 27 (3): 371–386. doi:10.1016/j.leaqua.2015.11.001.

Adams, B. Renée, and Daniel Ferreira. 2009. “Women in the Boardroom and Their Impact on Governance and Performance.” *Journal of Financial Economics* 94 (2): 291–309. doi:10.1016/j.jfineco.2008.10.007.

Adams, B. Renee, Benjamin E. Hermalin, and Michael S. Weisbach. 2010. “The Role of Boards of Directors in Corporate Governance: A Conceptual Framework and Survey.” *Journal of Economic Literature* 48 (1): 58–107. doi:10.1257/jel.48.1.58.

Adams, B. Renée, and Hamid Mehran. 2012. “Bank Board Structure and Performance: Evidence for Large Bank Holding Companies.” *Journal of Financial Intermediation* 21 (2): 243–267.

Adcock, Chris, Xiuping Hua, Khelifa Mazouz, and Shuxing Yin. 2017. “Derivative Activities and Chinese Banks’ Exposures to Exchange Rate and Interest Rate Movements.” *European Journal of Finance* 23 (7–9): 727–751. doi:10.1080/1351847X.2014.899260.

Adhikari, K. Binay, Anup Agrawal, and James Malm. 2019. “Do Women Managers Keep Firms out of Trouble? Evidence from Corporate Litigation and Policies.” *Journal of Accounting and Economics* 67 (1): 202–225. doi:10.1016/j.jacceco.2018.09.004.

Almenberg, Johan, and Anna Dreber. 2015. “Gender, Stock Market Participation and Financial Literacy.” *Economics Letters* 137 (December): 140–142. doi:10.1016/j.econlet.2015.10.009.

Antonakis, John, Samuel Bendahan, Philippe Jacquart, and Rafael Lalive. 2010. “On Making Causal Claims: A Review and Recommendations.” *The Leadership Quarterly* 21 (6): 1086–1120.

Arvate, Paulo Roberto, Gisele Walczak Galilea, and Isabela Todescat. 2018. “The Queen Bee: A Myth? The Effect of Top-Level Female Leadership on Subordinate Females.” *The Leadership Quarterly* 29 (5): 533–548.

Banja, John. 2010. “The Normalization of Deviance in Healthcare Delivery.” *Business Horizons, Special Issue on Healthcare and the Life Sciences in Transition* 53 (2): 139–148. doi:10.1016/j.bushor.2009.10.006.

Bansal, Pratima, and Iain Clelland. 2004. “Talking Trash: Legitimacy, Impression Management, and Unsystematic Risk in the Context of the Natural Environment.” *Academy of Management Journal* 47 (1): 93–103.

Barber, M. Brad, and Terrance Odean. 2001. “Boys Will Be Boys: Gender, Overconfidence, and Common Stock Investment.” *Quarterly Journal of Economics* 116 (1): 261–292.

Baselga-Pascual, Laura, Antonio Trujillo-Ponce, Emilia Vähämaa, and Sami Vähämaa. 2018. “Ethical Reputation of Financial Institutions: Do Board Characteristics Matter?” *Journal of Business Ethics* 148 (3): 489–510. doi:10.1007/s10551-015-2949-x.

Bear, Stephen, Noushi Rahman, and Corinne Post. 2010. “The Impact of Board Diversity and Gender Composition on Corporate Social Responsibility and Firm Reputation.” *Journal of Business Ethics* 97 (2): 207–221. doi:10.1007/s10551-010-0505-2.

Bennouri, Moez, Tawhid Chtioui, Haithem Nagati, and Mehdi Nekhili. 2018. “Female Board Directorship and Firm Performance: What Really Matters?” *Journal of Banking & Finance* 88 (March): 267–291. doi:10.1016/j.jbankfin.2017.12.010.

Bernardi, A. Richard, David F. Bean, and Kristen M. Weippert. 2002. “Signaling Gender Diversity through Annual Report Pictures: A Research Note on Image Management.” *Accounting, Auditing & Accountability Journal* 15 (4): 609–616.

Bernardi, A. Richard, Susan M. Bosco, and Veronica L. Columb. 2009. “Does Female Representation on Boards of Directors Associate with the ‘Most Ethical Companies’ List?” *Corporate Reputation Review* 12 (3): 270–280.

Bernardi, A. Richard, Susan M. Bosco, and Katie M. Vassill. 2006. “Does Female Representation on Boards of Directors Associate with Fortune’s ‘100 Best Companies to Work For’ List?” *Business & Society* 45 (2): 235–248.

Bernardi, A. Richard, and Veronica H. Threadgill. 2011. “Women Directors and Corporate Social Responsibility.” *EJBO : Electronic Journal of Business Ethics and Organizational Studies* 15 (2): 15–21.

Betz, Michael, Lenahan O’Connell, and Jon M. Shepard. 1989. “Gender Differences in Proclivity for Unethical Behavior.” *Journal of Business Ethics* 8 (5): 321–324. doi:10.1007/BF00381722.

Bogard, Kevin, Timothy D. Ludwig, Chris Staats, and Danielle Kretschmer. 2015. “An Industry’s Call to Understand the Contingencies Involved in Process Safety: Normalization of Deviance.” *Journal of Organizational Behavior Management* 35 (1–2): 70–80. doi:10.1080/01608061.2015.1031429.

Bouslah, Kais, José Liñares-Zegarra, Bouchra M’Zali, and Bert Scholtens. 2018. “CEO Risk-Taking Incentives and Socially Irresponsible Activities.” *British Accounting Review* 50 (1): 76–92. doi:10.1016/j.bar.2017.05.004.

Brambor, Thomas, William Roberts Clark, and Matt Golder. 2006. “Understanding Interaction Models: Improving Empirical Analyses.” *Political Analysis* 14 (1): 63–82. doi:10.1093/pan/mpi014.

Brammer, Stephen, Andrew Millington, and Stephen Pavelin. 2009. "Corporate Reputation and Women on the Board." *British Journal of Management* 20 (1): 17–29. doi:10.1111/j.1467-8551.2008.00600.x.

Briggs, C. Derek 2004. "Causal Inference and the Heckman Model." *Journal of Educational and Behavioral Statistics* 29 (4): 397–420.

Burgess, Zena, and Phyllis Tharenou. 2002. "Women Board Directors: Characteristics of the Few." *Journal of Business Ethics* 37 (1): 39–49. doi:10.1023/A:1014726001155.

Byrnes, P. James, David C. Miller, and William D. Schafer. 1999. "Gender Differences in Risk Taking: A Meta-Analysis." *Psychological Bulletin* 125 (3). US: American Psychological Association: 367–383. doi:10.1037/0033-2909.125.3.367.

Byron, Kris, and Corinne Post. 2016. "Women on Boards of Directors and Corporate Social Performance: A Meta-Analysis." *Corporate Governance: An International Review* 24 (4): 428–442. doi:10.1111/corg.12165.

Carpenter, A. Mason, and James D. Westphal. 2001. "The Strategic Context of External Network Ties: Examining the Impact of Director Appointments on Board Involvement in Strategic Decision Making." *Academy of Management Journal* 44 (4): 639–660. doi:10.2307/3069408.

Charness, Gary, and Uri Gneezy. 2012. "Strong Evidence for Gender Differences in Risk Taking." *Journal of Economic Behavior & Organization* 83 (1): 50–58.

Chung, H. Kee, and Hao Zhang. 2011. "Corporate Governance and Institutional Ownership." *Journal of Financial and Quantitative Analysis* 46 (1): 247–273.

Cojoianu, F. Theodor, Gordon L. Clark, Andreas GF Hoepner, Paolo Veneri, and Dariusz Wójcik. 2020. "Entrepreneurs for a Low Carbon World: How Environmental Knowledge and Policy Shape the Creation and Financing of Green Start-Ups." *Research Policy* 49 (6): 103988.

Conyon, J. Martin, and Lerong He. 2017. "Firm Performance and Boardroom Gender Diversity: A Quantile Regression Approach." *Journal of Business Research* 79 (October): 198–211. doi:10.1016/j.jbusres.2017.02.006.

Courtois, Cynthia, and Yves Gendron. 2017. "The 'Normalization' of Deviance: A Case Study on the Process Underlying the Adoption of Deviant Behavior." *Auditing: A Journal of Practice* 36 (3): 15–43. doi:10.2308/ajpt-51665.

Croson, Rachel, and Uri Gneezy. 2009. "Gender Differences in Preferences." *Journal of Economic Literature* 47 (2). American Economic Association: 448–474.

Dezsö, L. Cristian, and David Gaddis Ross. 2012. "Does Female Representation in Top Management Improve Firm Performance? A Panel Data Investigation." *Strategic Management Journal* 33 (9): 1072–1089. doi:10.1002/smj.1955.

Dohmen, Thomas, Armin Falk, David Huffman, Uwe Sunde, Jürgen Schupp, and Gert G. Wagner. 2011. "Individual Risk Attitudes: Measurement, Determinants, and Behavioral Consequences." *Journal of the European Economic Association* 9 (3). Oxford Academic: 522–550. doi:10.1111/j.1542-4774.2011.01015.x.

Eckel, C. Catherine, and Philip J. Grossman. 2008a. "Men, Women and Risk Aversion: Experimental Evidence." Chap. 113 in *Handbook of Experimental Economics Results*, edited by Charles R. Plott, and Vernon L. Smith, 1:1061–1073. Elsevier. doi:10.1016/S1574-0722(07)00113-8.

Eckel, C. Catherine, and Philip J. Grossman. 2008b. "Differences in the Economic Decisions of Men and Women: Experimental Evidence." Chap. 57 in *Handbook of Experimental Economics Results*, edited by Charles R. Plott, and Vernon L. Smith, 1:509–519. Elsevier. doi:10.1016/S1574-0722(07)00057-1.

Eisdorfer, Assaf. 2008. "Empirical Evidence of Risk Shifting in Financially Distressed Firms." *Journal of Finance* 63 (2): 609–637. doi:10.1111/j.1540-6261.2008.01326.x.

Elsaid, Eahab, and Nancy D. Ursel. 2011. "CEO Succession, Gender and Risk Taking." *Gender in Management: An International Journal* 26 (7): 499–512. doi:10.1108/17542411111175478.

Elstad, Beate, and Gro Ladegard. 2012. "Women on Corporate Boards: Key Influencers or Tokens?" *Journal of Management & Governance* 16 (4): 595–615. doi:10.1007/s10997-010-9165-y.

Elton, J. Edwin, Martin J. Gruber, Sanjiv Das, and Matthew Hlavka. 1993. "Efficiency with Costly Information: A Reinterpretation of Evidence from Managed Portfolios." *Review of Financial Studies* 6 (1): 1–22. doi:10.1093/rfs/6.1.1.

Faccio, Mara, Maria-Teresa Marchica, and Roberto Mura. 2016. "CEO Gender, Corporate Risk-Taking, and the Efficiency of Capital Allocation." *Journal of Corporate Finance* 39 (August): 193–209. doi:10.1016/j.jcorpfin.2016.02.008.

Falk, Armin, Anke Becker, Thomas Dohmen, Benjamin Enke, David Huffman, and Uwe Sunde. 2018. "Global Evidence on Economic Preferences." *Quarterly Journal of Economics* 133 (4). Oxford Academic: 1645–1692. doi:10.1093/qje/qjy013.

Farag, Hisham, and Chris Mallin. 2017. "Board Diversity and Financial Fragility: Evidence from European Banks." *International Review of Financial Analysis* 49 (January): 98–112. doi:10.1016/j.irfa.2016.12.002.

Ferguson, F. Michael, and Richard L Shockley. 2003. "Equilibrium 'Anomalies.'." *Journal of Finance* 58 (6): 2549–2580.

Flammer, Caroline. 2015. "Does Corporate Social Responsibility Lead to Superior Financial Performance? A Regression Discontinuity Approach." *Management Science* 61 (11): 2549–2568.

Francis, Bill, Iftekhar Hasan, Jong Chool Park, and Qiang Wu. 2015. "Gender Differences in Financial Reporting Decision Making: Evidence from Accounting Conservatism." *Contemporary Accounting Research* 32 (3): 1285–1318. doi:10.1111/1911-3846.12098.

García, Juan, Beatriz García, Araceli Mora, and Mariano Scapin. 2017. "The Monitoring Role of Female Directors over Accounting Quality." *Journal of Corporate Finance* 45 (August): 651–668. doi:10.1016/j.jcorpfin.2017.05.016.

Gilje, P. Erik 2016. "Do Firms Engage in Risk-Shifting? Empirical Evidence." *Review of Financial Studies* 29 (11): 2925–2954.

Gipson, N. Asha, Danielle L. Pfaff, David B. Mendelsohn, Lauren T. Catenacci, and W. Warner Burke. 2017. "Women and Leadership: Selection, Development, Leadership Style, and Performance." *The Journal of Applied Behavioral Science* 53 (1): 32–65. doi:10.1177/0021886316687247.

Granger, C. W. J. 1969. "Investigating Causal Relations by Econometric Models and Cross-Spectral Methods." *Econometrica* 37 (3): 424–438. doi:10.2307/1912791.

Granger, C. W. J. 1980. "Testing for Causality: A Personal Viewpoint." *Journal of Economic Dynamics and Control* 2 (January): 329–352. doi:10.1016/0165-1889(80)90069-X.

Granger, C. W. J. 1988. "Some Recent Development in a Concept of Causality." *Journal of Econometrics* 39 (1): 199–211. doi:10.1016/0304-4076(88)90045-0.

Green, Jeremiah, John RM Hand, and X. Frank Zhang. 2017. "The Characteristics that Provide Independent Information about Average US Monthly Stock Returns." *Review of Financial Studies* 30 (12): 4389–4436.

Greening, W. Daniel, and Daniel B. Turban. 2000. "Corporate Social Performance as a Competitive Advantage in Attracting a Quality Workforce." *Business & Society* 39 (3): 254–280. doi:10.1177/000765030003900302.

Gregory-Smith, Ian, Brian G. M. Main, and Charles A. O'Reilly. 2014. "Appointments, Pay and Performance in UK Boardrooms by Gender." *The Economic Journal* 124 (574): F109–F128. doi:10.1111/ecoj.12102.

Harjoto, M. A., A. G. F. Hoepner, and Q. Li. 2019. "Corporate Social Irresponsibility and Portfilio Performance: Evidence across 42 Developed and Emerging Markets", *Working Paper*.

Harjoto, Maretno Agus, Andreas G. F. Hoepner, and Qian Li. 2020. "A Resource-based View of Corporate Social Irresponsibility: Evidence from Shareholder Value Destruction in China", *Working Paper*.

Harjoto, Maretno, Indrarini Laksmana, and Robert Lee. 2015. "Board Diversity and Corporate Social Responsibility." *Journal of Business Ethics* 132 (4): 641–660. doi:10.1007/s10551-014-2343-0.

Hartog, Joop, Ada Ferrer-i-Carbonell, and Nicole Jonker. 2002. "Linking Measured Risk Aversion to Individual Characteristics." *Kyklos* 55 (1). Wiley-Blackwell: 3–26. doi:10.1111/1467-6435.00175.

Heckman, J. James. 1979. "Sample Selection Bias as a Specification Error." *Econometrica* 47 (1): 153–161. doi:10.2307/1912352.

Heckman, J. James, and Edward J. Vytlacil. 2007. "Econometric Evaluation of Social Programs, Part I: Causal Models, Structural Models and Econometric Policy Evaluation." *Handbook of Econometrics*, Chapter 70.

Heckman, J. James, and Edward J. Vytlacil. 2007. "Econometric Evaluation of Social Programs, Part I: Causal Models, Structural Models and Econometric Policy Evaluation." *Handbook of Econometrics*, Chapter 71.

Hillier, David, Adriana Korczak, and Piotr Korczak. 2015. "The Impact of Personal Attributes on Corporate Insider Trading." *Journal of Corporate Finance* 30 (February): 150–167. doi:10.1016/j.jcorpfin.2014.12.003.

Hillman, J. Amy, Albert A. Cannella, and Ira C. Harris. 2002. "Women and Racial Minorities in the Boardroom: How Do Directors Differ?" *Journal of Management* 28 (6): 747–763. doi:10.1177/014920630202800603.

Hillman, J. Amy, and Thomas Dalziel. 2003. "Boards of Directors and Firm Performance: Integrating Agency and Resource Dependence Perspectives." *Academy of Management Review* 28 (3): 383–396. doi:10.2307/30040728.

Hoepner, G. F. Andreas, Qian Li, and Penelope Muzanenhamo. 2018. "Corporate Social Irresponsibility of African Firms across the Continent: Does Leaving the Path of Africapitalism Hurt Shareholder Value?", *Working Paper*.

Hoepner, G. F. Andreas, Arleta A. A. Majoch, and Xiao Y. Zhou. 2019. "Does an Asset Owner's Institutional Setting Influence Its Decision to Sign the Principles for Responsible Investment?" *Journal of Business Ethics* June), doi:10.1007/s10551-019-04191-y.

Hoepner, G. F. Andreas, Hussain G. Rammal, and Michael Rezec. 2011. "Islamic Mutual Funds' Financial Performance and International Investment Style: Evidence from 20 Countries." *European Journal of Finance* 17 (9–10): 829–850. doi:10.1080/1351847X.2010.538521.

Hollindale, Janice, Pamela Kent, James Routledge, and Larelle Chapple. 2019. "Women on Boards and Greenhouse Gas Emission Disclosures." *Accounting & Finance* 59 (1): 277–308. doi:10.1111/acfi.12258.

Holt, A. Charles, and Susan K. Laury. 2002. "Risk Aversion and Incentive Effects." *The American Economic Review* 92 (5). American Economic Association: 1644–1655.

Huang, Jiekun, and Darren J. Kisgen. 2013. "Gender and Corporate Finance: Are Male Executives Overconfident Relative to Female Executives?" *Journal of Financial Economics* 108 (3): 822–839. doi:10.1016/j.jfineco.2012.12.005.

Isidro, Helena, and Márcia Sobral. 2015. "The Effects of Women on Corporate Boards on Firm Value, Financial Performance, and Ethical and Social Compliance." *Journal of Business Ethics* 132 (1): 1–19.

Jagannathan, Ravi, Georgios Skoulakis, and Zhenyu Wang. 2002. "Generalized Methods of Moments: Applications in Finance." *Journal of Business & Economic Statistics* 20 (4): 470–481.

Jain, Tanusree, and Rashid Zaman. 2020. "When Boards Matter: The Case of Corporate Social Irresponsibility." *British Journal of Management*, doi:10.1111/1467-8551.12376.

Kabongo, D. Jean, Kiyoung Chang, and Ying Li. 2013. "The Impact of Operational Diversity on Corporate Philanthropy: An Empirical Study of U.S. Companies." *Journal of Business Ethics* 116 (1): 49–65. doi:10.1007/s10551-012-1445-9.

Kent, Pamela, and Jenny Stewart. 2008. "Corporate Governance and Disclosures on the Transition to International Financial Reporting Standards." *Accounting & Finance* 48 (4): 649–671.

Kölbel, F. Julian, Timo Busch, and Leonhardt M. Jancso. 2017. "How Media Coverage of Corporate Social Irresponsibility Increases Financial Risk." *Strategic Management Journal* 38 (11): 2266–2284. doi:10.1002/smj.2647.

Landry, E. Erynne, Richard A. Bernardi, and Susan M. Bosco. 2016. "Recognition for Sustained Corporate Social Responsibility: Female Directors Make a Difference." *Corporate Social Responsibility and Environmental Management* 23 (1): 27–36. doi:10.1002/csr.1358.

Lanis, Roman, Grant Richardson, and Grantley Taylor. 2017. "Board of Director Gender and Corporate Tax Aggressiveness: An Empirical Analysis." *Journal of Business Ethics* 144 (3): 577–596. doi:10.1007/s10551-015-2815-x.

Lawrence, M. Justin, Andrew T. Crecelius, Lisa K. Scheer, and Son K. Lam. 2019. "When It Pays to Have a Friend on the Inside: Contingent Effects of Buyer Advocacy on B2B Suppliers." *Journal of the Academy of Marketing Science* 47 (5): 837–857. doi:10.1007/s11747-019-00672-8.

Lenz, Isabell, Hauke A. Wetzel, and Maik Hammerschmidt. 2017. "Can Doing Good Lead to Doing Poorly? Firm Value Implications of CSR in the Face of CSI." *Journal of the Academy of Marketing Science* 45 (5): 677–697.

Levi, Maurice, Kai Li, and Feng Zhang. 2014. "Director Gender and Mergers and Acquisitions." *Journal of Corporate Finance, Inside the Board Room* 28 (October): 185–200. doi:10.1016/j.jcorpfin.2013.11.005.

Liao, Lin, Le Luo, and Qingliang Tang. 2015. "Gender Diversity, Board Independence, Environmental Committee and Greenhouse Gas Disclosure." *British Accounting Review* 47 (4): 409–424. doi:10.1016/j.bar.2014.01.002.

Liesen, Andrea, Frank Figge, Andreas Hoepner, and Dennis M. Patten. 2017. "Climate Change and Asset Prices: Are Corporate Carbon Disclosure and Performance Priced Appropriately?" *Journal of Business Finance & Accounting* 44 (1–2): 35–62. doi:10.1111/jbfa.12217.

Lin, Ming-Tsung, and Ser-Huang Poon. 2019. "Investing in Female Corporate Leaders", *Working Paper*.

Lins, V. Karl, Lukas Roth, Henri Servaes, and Ane Tamayo. 2019. "Does Corporate Culture Add Value? Evidence from the Harvey Weinstein Scandal and the #MeToo Movement." *Working Paper*.

Liu, Yu, Zuobao Wei, and Feixue Xie. 2014. "Do Women Directors Improve Firm Performance in China?" *Journal of Corporate Finance*, *Inside the Board Room* 28 (October): 169–184. doi:10.1016/j.jcorpfin.2013.11.016.

Lu, Jia, and Agyenim Boateng. 2018. "Board Composition, Monitoring and Credit Risk: Evidence from the UK Banking Industry." *Review of Quantitative Finance and Accounting* 51 (4): 1107–1128. doi:10.1007/s11156-017-0698-x.

Lu, Xun, Liangjun Su, and Halbert White. 2017. "Granger Causality and Structural Causality in Cross-Section and Panel Data." *Econometric Theory* 33 (2): 263–291. doi:10.1017/S0266466616000086.

Luthar, K. Harsh, Ron A. DiBattista, and Theodore Gautschi. 1997. "Perception of What the Ethical Climate Is and What It Should Be: The Role of Gender, Academic Status, and Ethical Education." *Journal of Business Ethics* 16 (2): 205–217.

Macaulay, D. Craig, Orlando C. Richard, Mike W. Peng, and Maria Hasenhuttl. 2018. "Alliance Network Centrality, Board Composition, and Corporate Social Performance." *Journal of Business Ethics* 151 (4): 997–1008. doi:10.1007/s10551-017-3566-7.

Manuel, Ekow. Michael 2018. "Safety and Risk Management Considerations for CSR." *In Corporate Social Responsibility in the Maritime Industry, Edited by Lisa Loloma Froholdt*, 5:253–278. doi:10.1007/978-3-319-69143-5_14.

Marquardt, Carol, and Christine Wiedman. 2016. "Can Shareholder Activism Improve Gender Diversity on Corporate Boards?" *Corporate Governance: An International Review* 24 (4): 443–461. doi:10.1111/corg.12170.

McGuinness, B. Paul, João Paulo Vieito, and Mingzhu Wang. 2017. "The Role of Board Gender and Foreign Ownership in the CSR Performance of Chinese Listed Firms." *Journal of Corporate Finance* 42 (February): 75–99. doi:10.1016/j.jcorpfin.2016.11.001.

Nguyen, Tuan, Stuart Locke, and Krishna Reddy. 2015. "Does Boardroom Gender Diversity Matter? Evidence from a Transitional Economy." *International Review of Economics & Finance* 37 (May): 184–202. doi:10.1016/j.iref.2014.11.022.

Niederle, Muriel, and Lise Vesterlund. 2007. "Do Women Shy Away from Competition? Do Men Compete Too Much?" *The Quarterly Journal of Economics* 122 (3). Oxford University Press: 1067–1101.

Niederle, Muriel, and Lise Vesterlund. 2008. "Gender Differences in Competition Special Section: Gender in Negotiation." *Negotiation Journal* 24 (4): 447–463.

Niederle, Muriel, and Lise Vesterlund. 2011. "Gender and Competition." *Annual Review of Economics* 3 (1): 601–630. doi:10.1146/annurev-economics-111809-125122.

Pandey, Rakesh, Pallab Kumar Biswas, Muhammad Jahangir Ali, and Mansi Mansi. 2019. "Female Directors on the Board and Cost of Debt: Evidence from Australia." *Accounting & Finance*, doi:10.1111/acfi.12521.

Pinto, K. Jeffrey 2014. "Project Management, Governance, and the Normalization of Deviance." *International Journal of Project Management* 32 (3): 376–387. doi:10.1016/j.ijproman.2013.06.004.

Post, Corinne, and Kris Byron. 2015. "Women on Boards and Firm Financial Performance: A Meta-Analysis." *Academy of Management Journal* 58 (5): 1546–1571.

Powell, Melanie, and David Ansic. 1997. "Gender Differences in Risk Behaviour in Financial Decision-Making: An Experimental Analysis." *Journal of Economic Psychology* 18 (6): 605–628. doi:10.1016/S0167-4870(97)00026-3.

Price, M. Joseph, and Wenbin Sun. 2017. "Doing Good and Doing Bad: The Impact of Corporate Social Responsibility and Irresponsibility on Firm Performance." *Journal of Business Research* 80: 82–97.

Price, R. Mary, and Teresa C. Williams. 2018. "When Doing Wrong Feels So Right: Normalization of Deviance." *Journal of Patient Safety* 14 (1): 1–2. doi:10.1097/PTS.0000000000000157.

Priestley, Richard, and Bernt Arne Ødegaard. 2007. "Linear and Nonlinear Exchange Rate Exposure." *Journal of International Money and Finance* 26 (6): 1016–1037. doi:10.1016/j.jimonfin.2007.05.001.

Roberts, R. Michael, and Toni M. Whited. 2013. "Endogeneity in Empirical Corporate Finance1." Chap. 7 in *Handbook of the Economics of Finance*, edited by George M. Constantinides, Milton Harris, and Rene M. Stulz, 2:493–572. doi:10.1016/B978-0-44-453594-8.00007-0.

Roesner, J. D. 1990. "Ways Women Lead: The Command-and-Control Leadership Styles Associated with Men Is Not the Only Way to Succeed." *Harvard Business Review* 69: 110–125.

Sila, Vathunyoo, Angelica Gonzalez, and Jens Hagendorff. 2016. "Women on Board: Does Boardroom Gender Diversity Affect Firm Risk?" *Journal of Corporate Finance* 36 (February): 26–53. doi:10.1016/j.jcorpfin.2015.10.003.

Southwood, E. Kenneth 1978. “Substantive Theory and Statistical Interaction: Five Models.” *American Journal of Sociology* 83 (5): 1154–1203.

Srinidhi, Bin, Ferdinand A. Gul, and Judy Tsui. 2011. “Female Directors and Earnings Quality.” *Contemporary Accounting Research* 28 (5): 1610–1644. doi:10.1111/j.1911-3846.2011.01071.x.

Strike, V. M., J. Gao, and P. Bansal. 2006. “Being Good While Being bad: Social and the International Responsibility Diversification of US Firms.” *Journal of International Business Studies* 37 (6): 850–862.

Usman, Muhammad, Muhammad Umar Farooq, Junrui Zhang, Muhammad Abdul Majid Makki, and Muhammad Kaleem Khan. 2019. “Female Directors and the Cost of Debt: Does Gender Diversity in the Boardroom Matter to Lenders?” *Managerial Auditing Journal* 34 (4). Emerald Publishing Limited: 374–392. doi:10.1108/MAJ-04-2018-1863.

Vaughan, Diane. 1996. *The Challenger Launch Decision: Risky Technology, Culture, and Deviance at NASA*. Chicago, IL: University of Chicago Press.

Wang, Stephanie Lu, and Dan Li. 2019. “Responding to Public Disclosure of Corporate Social Irresponsibility in Host Countries: Information Control and Ownership Control.” *Journal of International Business Studies* 50 (8): 1283–1309. doi:10.1057/s41267-019-00224-w.

Weber, U. Elke, Ann-Renée Blais, and Nancy E. Betz. 2002. “A Domain-Specific Risk-Attitude Scale: Measuring Risk Perceptions and Risk Behaviors.” *Journal of Behavioral Decision Making* 15 (4): 263–290. doi:10.1002/bdm.414.

White, Halbert, and Xun Lu. 2010. “Granger Causality and Dynamic Structural Systems.” *Journal of Financial Econometrics* 8 (2): 193–243. doi:10.1093/jjfinec/nbq006.

Wood, J. Donna 1991. “Corporate Social Performance Revisited.” *Academy of Management Review* 16 (4): 691–718.

Zalata, Alaa Mansour, Collins G. Ntim, Taufiq Choudhry, Ahmed Hassanein, and Hany Elzahar. 2019. “Female Directors and Managerial Opportunism: Monitoring Versus Advisory Female Directors.” *The Leadership Quarterly* 30 (5): 101309. doi:10.1016/j.leaqua.2019.101309.

Zhang, Q. Jason, Hong Zhu, and Hung-bin Ding. 2013. “Board Composition and Corporate Social Responsibility: An Empirical Investigation in the Post Sarbanes-Oxley Era.” *Journal of Business Ethics* 114 (3): 381–392. doi:10.1007/s10551-012-1352-0.

Zyglidopoulos, C. Stelios 2003. “The Issue Life-Cycle: Implications for Reputation for Social Performance and Organizational Legitimacy.” *Corporate Reputation Review* 6 (1): 70–81. doi:10.1057/palgrave.crr.1540191.