

Contents lists available at [ScienceDirect](https://www.sciencedirect.com)

Finance Research Letters

journal homepage: www.elsevier.com/locate/frl

Stock market effects of corporate malpractices and misconduct: Evidence from the short-seller Hindenburg

Bruno Albuquerque^a, António Miguel Martins^{a,b,c}, Nuno Moutinho^{d,e,*}^a University of Madeira, Faculty of Social Sciences, Caminho da Penteada, 9020-105 Funchal, Portugal^b Centre of Applied Economic Studies of the Atlantic (CEEApLA), Ponta Delgada, Azores, Portugal^c CEFAGE-UE and University of Évora, School of Social Sciences, Évora, Portugal^d Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal^e Unidade de Investigação Aplicada em Gestão (UNIAG), Portugal

ARTICLE INFO

JEL classifications:

G12

G14

Keywords:

Short-selling

Malpractices and misconduct

Financial market analysis

Event study

Abnormal returns

ABSTRACT

This study used event study methodology to examine the impact Hindenburg Research short-seller reports on targeted firms. The results show negative abnormal returns in firms when those reports reveal bad news about malpractices and misconduct. Our results show a higher negative stock market reaction to the Hindenburg reports when target firms are small, have higher leverage, higher Tobin's Q, and corporate malpractice involves financial fraud. Our findings evidence that adverse information disclosed in the Hindenburg report led to a "torpedo effect", resulted in sharp, immediate, and persistent share price drops.

1. Introduction

Corporate malpractices and misconduct in financial reporting may damage the firm's reputation with negative effects on its market value. For instance, the Indian Adani Group faced allegations of accounting fraud and stock manipulation through opaque offshore entities, resulting in a substantial decrease in the stock market value of over \$70 billion (Sapra et al., 2024). There is also news¹ that Clover Health went public but did not disclose a Department of Justice investigation, negatively affecting 72 % of stock price; Block overstated user numbers, facilitating fraudulent activity, also dropped 22 %; Super Micro Computer faced accusations of accounting manipulation, undisclosed related party transactions, and failures to comply with sanctions and export regulations, leading to decrease about 20 % in value, and; Roblox inflated user data on the online gaming platform by 25 % to over 42 %, and engagement hours by over 100 %. This bad news from corporate wrongdoings was based on the Hindenburg Research short-seller reports.

Hindenburg Research has emerged as a powerful voice in public activist short-selling, hammering firms' share prices, mainly in firms where they can "Popping bubbles where we see them". Hindenburg appears to have a talent for targeting prominent firms, consistently producing high-quality and influential research, and has been a top performer among short-sellers in recent years, renowned for their public reports, plays a significant whistleblowing role, and has overcome SEC investigations.² This short-seller

* Corresponding author at: Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal.

E-mail addresses: bruno.albuquerque14@outlook.pt (B. Albuquerque), antonio.martins@staff.uma.pt (A.M. Martins), nmoutinho@ipb.pt (N. Moutinho).

¹ <https://markets.businessinsider.com/news/stocks/carl-icahn-hindenburg-research-short-seller-adani-group-nikola-block-2023-5>

² <https://www.cnbc.com/2024/03/19/hindenburg-research-is-making-a-name-for-itself-by-taking-on-carl-icahn-gautam-adani-and-others.html>

<https://doi.org/10.1016/j.frl.2024.106495>

Received 28 August 2024; Received in revised form 20 November 2024; Accepted 20 November 2024

Available online 21 November 2024

1544-6123/© 2024 Elsevier Inc. All rights are reserved, including those for text and data mining, AI training, and similar technologies.

belongs to a new generation who launch high-profile public short-selling campaigns to drive down the shares of a target firm and provide evidence of malpractice and misconduct (Liu et al., 2024). Short-sellers are like “financial detectives, sniffing out corporate wrongdoing or inflated stock prices”.³

The market is believed to have access to all information, but reactions to introducing new relevant data are often unpredictable. Jiang et al. (2022) emphasize that short-sellers have an advantage in processing public information accurately and efficiently, as well as accessing private information not available to all market participants (Christophe et al., 2010). Short-sellers have an advantage in identifying and shorting stocks of firms that later experience public exposure, often sharing new information through reports identifying overvaluations, weaknesses, or irregularities. Karpoff and Lou (2010) evidence that these firms were highly proficient in identifying financial misconduct before it became public and could anticipate bad news. Short interest is a reliable predictor of financial misconduct by corporate managers and often reveals financial misconduct, resulting in sharp share price drops (Liu et al., 2024; Karajian and Ullah, 2022) to reflect unfavourable information more quickly (Li and Zhang, 2015; Gao and Ding, 2019; Guan et al., 2022). Ni and Xu (2023) highlight that short-selling threats may contribute to an increase in corporate default risk. Thus, Jiang et al. (2022) highlight the “torpedo effect” of negative earnings news on stock prices triggered by short-seller information. Based on it, this study analyses the following research question: How did corporate malpractices and misconduct published in short-seller reports affect the market value of firms?

The present study differs from previous studies on the financial market impact of bad news related to malpractices and misconduct by extending the analysis of abnormal returns to the reports published by the Hindenburg short-seller. To the best of our knowledge, this is the first study that analyse a set of firm’s reports provided by a single short-seller. Other studies use databases from official entities that may sometimes have already disseminated outdated information on firms’ stock markets. Additionally, the market increasingly sees Hindenburg’s reports as credible and impactful due to their recognition as trustworthy and media exposure. Since, Liu et al. (2024) explain that the Hindenburg belongs to a new generation who launch high-profile public short-selling campaigns (PSC), we add evidence based on more reliable, trustful, credible, and timely reports. Finally, we also contribute to the literature by distinguishing the impacts of corporate malpractices and misconduct related to financial and non-financial fraud. It enables investors and stakeholders to identify which type of wrongdoing has a greater effect.

2. Short-selling effects

Brendel and Ryans (2021) evidence that short-sellers get profit after reports are disclosed and the stock price of the targeted firms falls. Activist short-sellers are expected to publish mostly truthful reports to enhance their track record and boost the market’s reaction to future reports.⁴ So, the market’s response is influenced by the credibility of the new information and the firm’s reputation (Benabou and Laroque, 1992; Ljungqvist and Qian, 2016). As new reports emerge with credible information, and the previous statements have led to a decrease in the value of the targeted firms, publishing a new report will have a greater impact on the market. Thus, since credible media reports on misconduct provoke negative investor reactions (Carberry et al., 2018; Sun et al., 2021), the stock market effects of Hindenburg reports are further amplified if used by the media.

Liu et al. (2024) show that short-selling impacts stock market participants’ perceptions and unfavourably influences key stakeholders’ views, which potentially affects negatively the target firms, like: damage the firm reputation⁵ and its management (Brendel and Ryans, 2021); feeling strong doubt and anger towards the management (Paugam et al., 2021); harder to increase external capital to finance investment (Grullon et al., 2015); higher borrowing costs and more financial covenants (Deng et al., 2014); decrease operating performance due to higher selling costs and lower revenues (Johnson et al., 2014); less new product introductions, related with less committed employees and costumers loss (Liu et al., 2024).

Nearly 10 % of the largest listed firms each year engage in securities fraud (Dyck et al., 2024), an unethical behaviour that is difficult to overcome because the fraud perpetrators are rewarded (Klimczak et al., 2022). In this context, financial literature discusses short-sellers’ role in the financial market. On the one hand, short-sellers are speculative traders who play a negative role in society by manipulating stock prices, inducing market volatility, generating unwanted selling pressure, and limiting market efficiency (Goldstein and Guembel, 2008; Ljungqvist and Qian, 2016). On the other hand, short-sellers contribute positively to price discovery, stock market efficiency, and disciplining corporate managers by gathering information from various public and private sources (Boehmer et al., 2008; Diether et al., 2009). Short-selling can help to reduce the incentives to commit such crimes and improve price efficiency (Fang et al., 2016; Gao and Ding, 2019), may also help prevent corporate misconduct and fraud (Fang et al., 2016; Karpoff and Lou, 2010; Meng

³ <https://www.nytimes.com/2021/08/16/business/short-seller-wall-street-scams-hindenburg.html>

⁴ Somaya and You (2024) explain that a specific firm tried to raise a substantial amount of capital in the market but could not be due to the impact of a recent Hindenburg report, which reports concerns about the firm’s strategies and future prospects. Thus, Hindenburg reports appear to be credible and recognized by the market.

⁵ Corporate fraud’s reputational costs outweigh direct legal penalties (Johnson et al., 2014; Karpoff et al., 2008). Despite the legal consequences, fraud harms a firm’s reputation and market value, especially with media coverage that amplifies the effect (Amiram et al., 2018; Armour et al., 2017).

Table 1
Determinants of cumulative abnormal returns (CARs): variable definition and expected relationship.

Variable	Notation	Measure	Author(s)	Expected effect
Size	SIZE	Market capitalization in USD (natural logarithm)	Brav et al. (2008)	±
Leverage	LEV	Ratio of total liabilities to total assets (%)	Brav et al. (2008)	–
Profitability	ROA	Ratio of operating income to total average assets (%)	Sun and Xu (2024)	–
Institutional ownership	INST	Percentage of stock that are owned by institutional investors (%)	Di Maggio et al. (2024) Gao and Ding (2019)	–
Tobin's Q	Tobin's Q	Ratio of market value to total average assets (%)	Sun and Xu (2024)	–
Financial fraud dummy	FRAUD	Dummy variable that takes the value of one if the firm malpractice is due to the practice of financial fraud in firm i , and 0 otherwise (i.e., malpractice is due to the practice of other reasons of fraud, non-financial fraud)	Liu et al. (2024)	–

This table presents the definitions, notation, and the expected effect of explanatory variables of Eq. (4) on CARs (target firms). Accounting data are from the year prior to the firm's Hindenburg report disclosure, obtained from Eikon Refinitiv. The *FRAUD* variable was built based on information collected on the Hindenburg website.

et al., 2023) and facilitates the identification of corporate financial fraud (Cao et al., 2023).

In addition to financial misconduct, also nonfinancial malpractice may be relevant for short-sellers and is harmful to financial markets⁶, where the excessive pollutant emissions from Volkswagen cars (Marino et al., 2024), regulatory violations, lawsuits, and regulatory enforcement in American pharmaceutical industry (Unsal and Hippler, 2024), disasters related to fraudulent safety procedures in Boeing 737 Max aircraft (Collings et al., 2022) and failures in BP's operational activity and inability to contain or control the subsequent Gulf oil spill (Humphrey et al., 2016) are excellent examples. All these cases had a strong negative impact on their firms' stock market. However, in these malpractices and misconduct types, firms seem to have better accounting and financial practices (Yang and Liu, 2024).

3. Data and methodology

This paper uses adjusted daily observations of 50 stock market firms⁷ with a Hindenburg report, which uses the date on which the report is disclosed to the market as the event date to calculate abnormal returns (ARs). To maximize forecast accuracy as much as possible, we have chosen a forecast period of 140 days before the event date. Firm's stock returns and the market return benchmark were obtained from Eikon Refinitiv and calculated using the natural logarithm of returns ($R_{it} = \ln \frac{P_{it}}{P_{i,t-1}}$) for each target firms. Appendix 1 presents the sample.

We use the standard abnormal returns technique based on the market model and the Fama and French (1993) three-factor model to measure the magnitude of stock price reaction to the Hindenburg report disclosure.⁸ We calculate the normal rate of return as follows:

$$E(R_{it}) = a_i + b_i R_{mt} + e_{it} \quad (1)$$

where, $E(R_{it})$ is the expected rate of return of stock market firm i on the trading day t ; R_{mt} is the benchmark index; a_i and b_i are the regression coefficients of the daily rate of return of stock market firm i and the market rate of return, respectively. e_{it} is the error term.

The Fama and French (1993) three-factor abnormal returns (FF3) are measured as the residual returns from estimating the following regression equation:

$$R_{i,t} - R_{f,t} = \alpha + \beta_1 [R_{m,t} - R_{f,t}] + \beta_2 SMB_t + \beta_3 HML_t + \varepsilon_{i,t} \quad (2)$$

where, $R_{f,t}$ is the risk-free rate of return at time t ; R_{mt} is the benchmark index; *SMB* is the small minus large market capitalization risk factor, *HML* is the high book-to-value minus low-book-to-value risk factor. The Fama–French factors *SMB*, *HML* and the risk-free rate return are obtained from the homepage of Kenneth French at Dartmouth College.⁹

We use the date of report disclosure (day $t = 0$) as the event date to calculate abnormal returns (ARs), which are obtained by subtracting the expected return generated by the market model and Fama and French three-factor model from the observed returns of stock market firm i on day t , as follows:

⁶ Amiram et al. (2018) explain the financial reporting fraud and other forms of misconduct. Liu et al. (2024) define malpractice and misconduct in six categories: product-related issues; business or management issues; accounting or disclosure issues; financing issues; legal or fraud issues; no specific issue. Brendel and Ryans (2021) present the following allegation types: accounting issues; disclosure issues; business issues (that includes business, product, acquisitions and divestitures, and management issues).

⁷ From a total of 59 target firms from the Hindenburg short-seller with reports disclosure, 9 target firms were removed due to insufficient sample size, integration into other firms, market trading suspension, or limited data access for various reasons.

⁸ For more details, please see MacKinlay (1997).

⁹ http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html.

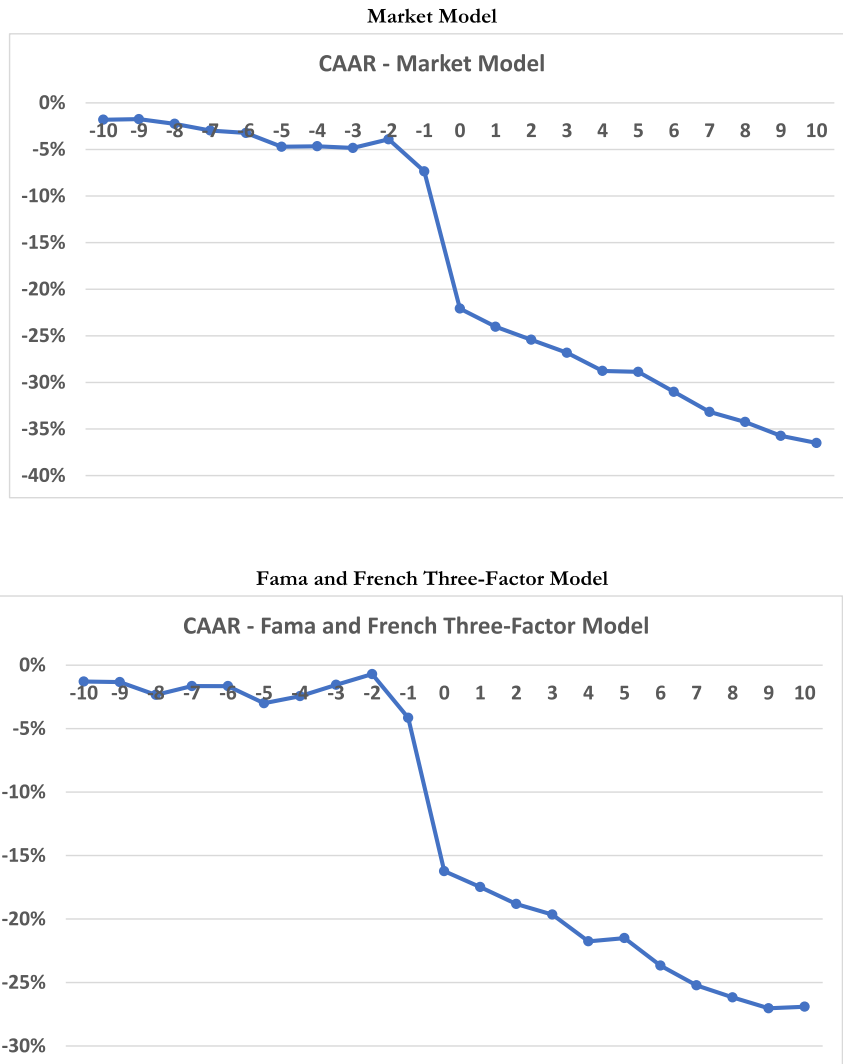


Fig. 1. CAARs around the Hindenburg Reports.

$$AR_{it} = R_{it} - E(R_{it}) \tag{3}$$

Daily returns are collected for the period ($t=-140$ to 10). The estimation and event periods were defined respectively as $[-140, -21]$ and $[-10, 10]$. Martins et al. (2023) adopted identical estimation and event windows. The benchmark index used to calculate the abnormal returns was the daily rate of return of country’s stock market indexes. By cumulating the ARs over a particular time interval, we obtain the cumulative abnormal returns (CARs) as follows:

$$CAR[t_1, t_2] = \sum_{t_1}^{t_2} AR_t \tag{4}$$

We use six different time intervals (event windows) to calculate the CARs: $[-1,+1]$, $[-1,+5]$, $[-1,+10]$, $[-5,+5]$, $[-5,+10]$ and $[-10,+10]$ – event day and post-event windows.

We use Ordinary Least Squares (OLS) to analyse how firm-specific characteristics impact the variation of abnormal returns across different firms, following the specified model:

$$CAR_{iw} = \beta_0 + \beta_1 \ln(SIZE_{iw}) + \beta_2 LEV_{iw} + \beta_3 ROA_{iw} + \beta_4 INST_{iw} + \beta_5 TOBIN's Q_{iw} + \beta_6 FRAUD_{iw} + \epsilon_{iw} \tag{5}$$

where, CAR_i is the cumulative abnormal returns, calculated using the Fama and French three-factor model for firm’s Hindenburg report i for event window w . Table 1 presents the control variables used in the cross-sectional analysis. These variables were chosen since target firms seem to be smaller ($SIZE$), have lower leverage (LEV), lower profitability (ROA) and higher Tobin’s Q ($TOBIN$) (Brendel and Ryans, 2021). The disclosure of bad news affects more quickly and negatively target firms with institutional investors

Table 2
Descriptive statistics of CARs and variables and abnormal returns tests.

Variable	Model	Mean	SD	25th perc.	Median	75th perc.	θ_1	τ_1
Panel 1: Descriptive statistics of CARs and results of abnormal returns tests - all sample								
CAR [-1,1]	MM	-20.117 %	25.412 %	-34.015 %	-14.660 %	-6.181 %	-12.681***	-3.911***
	FF3	-16.773 %	22.263 %	-24.238 %	-13.399 %	-7.618 %	-8.607***	-3.506***
CAR [-1,5]	MM	-24.960 %	34.079 %	-44.893 %	-24.321 %	-5.130 %	-10.300***	-2.676***
	FF3	-20.794 %	31.236 %	-39.498 %	-23.808 %	-5.112 %	-6.985***	2.672***
CAR [-1,10]	MM	-32.589 %	39.934 %	-55.212 %	-31.014 %	-7.452 %	-10.272***	-2.841***
	FF3	-26.201 %	36.950 %	-48.466 %	-29.133 %	-7.227 %	-6.723***	-2.696***
CAR [-5,5]	MM	-25.639 %	37.373 %	-46.451 %	-23.528 %	-3.655 %	-8.440***	-2.964***
	FF3	-19.848 %	38.024 %	-39.420 %	-15.483 %	-5.907 %	-5.319***	-3.088***
CAR [-5,10]	MM	-33.268 %	40.263 %	-58.386 %	-27.173 %	-5.942 %	-9.081***	-3.161***
	FF3	-25.255 %	38.593 %	-45.600 %	-24.616 %	-7.844 %	-5.612***	-2.954***
CAR [-10,10]	MM	-36.501 %	46.728 %	-62.374 %	-27.971 %	-0.555 %	-8.697***	-2.673***
	FF3	-26.907 %	46.042 %	-58.194 %	-23.788 %	-3.800 %	-5.219***	-2.419***
Panel 2: Descriptive statistics of control variables – all sample								
SIZE		\$63,650 k	\$20,786 k	\$11,143 k	\$27,792 k	\$47,164 k		
LEV		58.9 %	44.4 %	21.8 %	45.6 %	72.8 %		
ROA		1.3 %	36.1 %	-2.7 %	0.0 %	3.6 %		
INST		21.7 %	22.2 %	2.15 %	9.1 %	35.5 %		
Tobin's Q		54.3 %	19.3 %	39.0 %	57.9 %	66.6 %		
FRAUD		50.0 %	50.0 %	0	0.5	1		

This table presents the descriptive statistics of CARs and results of abnormal returns tests (Panel 1) and descriptive statistics of CARs and control variables (Panel 2). The CARs for target firms were calculated using market model (MM) and Fama-French three-factor model (FF3). All figures of firm-specific control variables in Panel 2 are calculated from the previous year-end accounting figures. $SIZE_i$ is the market capitalization in USD (natural logarithm) for firm i ; $LEVi$ is the ratio of debt to total assets (%) for firm i ; $ROAi$ is the ratio of operating income to total average assets (%) for firm i ; $INSTi$ is the percentage of stock that are in possession of institutional investors (%) for firm i ; $Tobin's Qi$ is the ratio of market value to total average assets (%) for firm i ; $FRAUDI$ is a dummy variable that takes the value 1 if the corporate malpractice is due to the practice of financial fraud in firm i , and 0 otherwise. θ_1 and τ_1 are the t -test statistics and Corrado rank test statistics, respectively of Brown and Warner (1980) and Corrado (1989) (see Serra, 2004, for more details). *, ** and *** denote statistical significance at the 10 %, 5 % and 1 % level, respectively.

(INST) (Gao and Ding, 2019), and they often respond to short-selling by delaying transactions (Di Maggio, et al., 2024). Regarding FRAUD variable, although we found no studies distinguishing its effects, based on nonfinancial wrongdoing studies (e.g., Marino et al., 2024; Unsal and Hippler, 2024), we expect a negative CAR reaction to both types of misconduct but of higher magnitude for financial compared to nonfinancial misconduct (Liu et al., 2024; Yang and Liu, 2024).

4. Results

4.1. Abnormal return

Fig. 1 plots the CARs during the event period, indicating a negative stock price reaction around the firm's report disclosure events. These trends suggest that the market views these events as harmful.

Table 2 shows the CARs for targeted firms based on the Hindenburg report around the disclosure dates. The results evidence a negative and statistically significant stock price reaction to the reports for the six-time intervals. The table present CARs of -20.11 %, -24.96 %, -32.59 %, -25.64 %, -33.27 % and -36.50 % (market model) and -16.77 %, -20.79 %, -26.20 %, -19.85 %, -25.26 % and -26.91 % (Fama-French three-factor model) for the time window [-1;1], [-1;5], [-1;10], [-5;5], [-5;10], [-10;10], respectively. The parametric and non-parametric tests show a statistical significance of 1 % for all intervals. These values are much higher than those found in other empirical studies, which can be attributed to our sample belonging to a single short-seller with high-profile public short-selling campaign, recognised for its credibility by the market and media. Karajian and Ullah (2022) found a CAR of -13.43 % during the three-day window, and Liu et al. (2024) found a CAR of -4.03 % during the [0;+5] time window. The results show that the negative effect of disclosure reports persists over time, and evidence the market seriously considers the new adverse information credibly. Therefore, disclosing wrongdoing reports due to significant financial, reputational, and legal damage, leading to decreased revenues, customer relations, access to capital, and higher borrowing costs, negatively impacting future cash flow. Following the release of the Hindenburg report, the target firm's share prices experienced sharp, immediate, and persistent declines, indicating that the market heavily penalizes these stocks. This also suggests that investors trust the negative information presented by the short-seller.

Regarding the market reaction to the credibility of Hindenburg reports,¹⁰ Panel 1 from Table 3 shows a lack of statistically significant abnormal returns for older reports subsample. Regarding recent reports subsample, the CARs are negative and statistically

¹⁰ Based on the more recent examples, "Hindenburg Research has demonstrated comprehensive investigative skills and has had a solid track record so far", that is explained in <https://www.cmcmarkets.com/en/news-and-analysis/who-is-hindenburg-research-forensic>, as requested by Ljungqvist and Qian (2016).

Table 3

Firm's CAARs by report age and type of corporate malpractice and difference test for CAARs.

			[-1; +1]		[-5; +5]		[-5; +10]		[-10; +10]	
			MM	FF3	MM	FF3	MM	FF3	MM	FF3
Panel 1: Older vs recent subsamples										
# Firms										
Older subsample	12	CAAR	-8.923 %	-6.217 %	-9.695 %	-7.397 %	-13.392 %	-9.102 %	-23.567 %	-15.868 %
		θ_1	-1.652	-1.393	-1.391	-0.865	-1.594	-0.883	-1.640	-1.344
		τ_1	-0.823	-0.714	-0.571	-0.623	-0.597	-0.490	-0.475	-0.311
Recent subsample	13	CAAR	-17.086 %	-15.457 %	-36.461 %	-38.247 %	-43.201 %	-43.358 %	-47.057 %	-49.509 %
		θ_1	-8.894***	-4.325***	-9.912***	-5.589***	-9.738***	-5.253***	-9.259***	-5.236***
		τ_1	-3.121***	-2.878***	-3.146***	-3.041***	-3.129***	-2.979***	-2.995***	-2.875***
Difference		CAAR	-8.163 %	-9.240 %	-26.766 %	-30.850 %	-29.809 %	-34.256 %	-23.490 %	-33.641 %
		z-test	0.024**	0.018**	0.044**	0.017**	0.040**	0.011**	0.019**	0.021**
		(p-value)								
Panel 2: Type of corporate malpractice										
# Firms										
Financial fraud	26	CAAR	-19.261 %	-15.935 %	-28.831 %	-25.323 %	-41.177 %	-36.254 %	-43.758 %	-38.375 %
		θ_1	-7.787***	-5.025***	-6.086***	-4.170***	-7.312***	-4.950***	-6.686***	-4.573***
		τ_1	-3.326***	-3.141***	-2.908***	-3.091***	-3.372***	-2.319**	-3.082***	-3.061***
Other reason	24	CAAR	-21.045 %	-17.682 %	-22.181 %	-13.917 %	-24.061 %	-13.339 %	-28.638 %	-14.484 %
		θ_1	-10.849***	-8.552***	-5.972***	-3.515***	-5.371***	-2.794***	-5.580***	-2.748***
		τ_1	-3.154***	-2.967***	-2.477**	-2.491**	-2.213**	-2.052**	-2.171**	-2.066**
Difference		CAAR	1.783 %	1.747 %	-6.650 %	-11.406 %	-17.706 %	-22.915 %	-15.120 %	-23.891 %
		z-test	0.401	0.389	0.401	0.141	0.020**	0.013**	0.039**	0.028**
		(p-value)								

This table presents the firm's cumulative average abnormal returns (CAARs) to Hindenburg reports and the differences in the CAARs across different subsamples. Panel 1 presents the firm's CAARs for two subsamples of firms in terms of Hindenburg report age: (i) older firms reports from Hindenburg Research (the quartile of oldest reports) and (ii) recent firms reports from Hindenburg Research (the quartile of most recent reports). Panel 2 presents the firm's CAARs for two subsamples of firms in terms of the type of corporate malpractice: (i) the Hindenburg report results from a financial fraud by the firm; (ii) the Hindenburg report results from other reasons. The CAARs were estimated using the market model (MM) and Fama-French three-factor model (FF3), and daily returns for four different time windows [-1;+1]; [-5;+5]; [-5;+10] and [-10,+10] around the release of the Hindenburg firm's reports. θ_1 and τ_1 are the t-test statistics and Corrado rank test statistics, respectively of Brown and Warner (1980) and Corrado (1989) (see Serra, 2004, for more details). The significance of the differences in CAARs is determined via two-sample z-test. *, ** and *** denote statistical significance at the 10 %, 5 % and 1 % level, respectively.

Table 4

Cross-sectional analysis.

	CAR [-1;1]	CAR [-5;5]	CAR [-5;10]	CAR [-10;10]
Constant	-0.324 (-1.511)	0.171 (0.433)	0.327 (0.874)	0.093 (0.198)
Ln(SIZE)	0.012* (1.830)	0.012* (1.890)	0.023** (2.184)	0.018* (1.799)
LEV	-0.111** (-2.179)	-0.198** (-2.430)	-0.228** (-2.420)	-0.177** (-2.296)
ROA	0.123 (1.009)	0.117 (0.934)	0.135 (1.455)	0.150 (1.530)
INST	-0.027 (-0.228)	-0.110 (-0.570)	-0.035 (-0.187)	-0.028 (-0.424)
Tobin's Q	-0.037** (-2.416)	-0.034** (-2.314)	-0.033** (-2.339)	-0.042** (-2.409)
FRAUD	-0.037 (-0.511)	-0.124*** (-2.955)	-0.235*** (-3.805)	-0.222*** (-3.497)
Year fixed effects	Yes	Yes	Yes	Yes
# Obs.	50	50	50	50
R ²	0.441	0.529	0.527	0.542
Adj. R ²	0.348	0.420	0.422	0.435

This table presents the cross-sectional estimates for the CARs for the 50 analysed firms targeted in a Hindenburg report. The dependent variables are the firm's CARs for four different time windows: [-1;+1]; [-1;+5]; [-5;+5] and [-1,+10], calculated using Fama-French three-factor model (FF3). The firm-specific variables are the following: $SIZE_i$ is the market capitalization in USD (natural logarithm) for firm i; LEV_i is the ratio of debt to total assets (%) for firm i; ROA_i is the ratio of operating income to total average assets (%) for firm i; $INST_i$ is the percentage of stock that are in possession of institutional investors (%) for firm i; $Tobin's Q_i$ is the ratio of market value to total average assets (%) for firm i; $FRAUD_i$ is a dummy variable that takes the value 1 if the corporate malpractice is due to the practice of financial fraud in firm i, and 0 otherwise. *, ** and *** denote statistical significance at the 10 %, 5 % and 1 % level, respectively. Standard errors adjusted for heteroskedasticity and clustering at the country level are reported in parentheses. # Obs. denotes the number of observations used in the estimation.

significant. For the event window $[-10;+10]$, we observe a CAAR of -47.06% (market model) and -49.51% (Fama-French three-factor model) for the quartile of most recent reports. The results of two-sample z-test for difference of means show a larger negative abnormal return for recent firm reports. These results may be explained by the increasingly trustful and credible new information from the Hindenburg reports over time, leading to an improved reputation as short-seller (e.g., Paugam et al., 2021). The market's reaction to bad news in recent reports seems more negative than on the older reports, suggesting an improvement in the short-seller track record and greater market recognition.

Panel 2 from Table 3 evidence the market reaction to different types of malpractice. Although all types evidence significant negative CAARs, we show that financial fraud reports have a greater negative effect compared to other reasons of fraud (e.g., -43.76% (MM) and -38.38% (FF3) vs -28.64% (MM) and -14.48% (FF3) for $[-10;+10]$ time window). However, on the shorter window period $[-1;+1]$ the negative CAARs for other reasons of fraud surplus the one of financial fraud. So, both financial and non-financial frauds have negative stock price effects on the target firms. We also compute the two-sample z-test for difference of means, that show higher negative abnormal returns for financial fraud reports, except on the shorter time-window where the negative effect on CAAR is not statistically different. This pattern of market price behaviour is in accordance with the financial literature (e.g., Yang and Liu, 2024; Liu et al., 2024).

4.2. Cross-sectional analysis

We performed the cross-section impact of firm-specific characteristics variables on the abnormal returns of Hindenburg reports. The results in Table 4 show a higher negative stock market impact to the Hindenburg reports for smaller target firms with a higher Tobin's Q, consistent with Brendel and Ryans (2021). We also found a higher negative stock market reaction for higher leverage firms, aligning with the idea that short sellers target levered firms (Li, 2024), and short-selling threats are linked to higher corporate default risk (Hi and Xu, 2023).

Malpractice and misconduct related to financial fraud have a more negative short-term impact on the target firm's stock market than malpractice related to other reasons of fraud. This result aligns with the idea of Yang and Liu (2024) and Liu et al. (2024) that market reactions penalize more financial fraud. However, because the *FRAUD* variable's coefficient does not significantly affect CAR for $[-1;+1]$ time window, announcing malpractices around the three-day event date has similar negative effects on firms' abnormal returns in both cases.

5. Concluding remarks

This paper analyses the short-term market impact of Hindenburg Reports on target firms. We show that target firms experience significant negative abnormal returns around the report disclosure date that appears like a torpedo effect. All wrongdoings, either caused by financial or non-financial fraud, seem to be adverse news for target firms. The abnormal returns observed for target firms tend to be higher when they involve financial fraud and for more recent firm reports. Finally, our findings also evidence that the stock market reaction is more negative when target firms are small, highly leveraged and have a higher Tobin's Q. Thus, managers, analysts, and investors should heed news of financial and nonfinancial malpractice and misconduct from short-sellers, as it can significantly affect the firm's market value.

CRedit authorship contribution statement

Bruno Albuquerque: Writing – original draft, Software, Methodology, Investigation, Formal analysis, Data curation. **António Miguel Martins:** Writing – review & editing, Validation, Supervision, Investigation. **Nuno Moutinho:** Writing – original draft, Methodology, Investigation, Formal analysis.

Declarations of interest

None.

Acknowledgement

This paper is financed by Portuguese national funds through FCT – Fundação para a Ciência e a Tecnologia, I.P., projects numbers UIDB/00685/2020 (António Martins) and FCT/MCTES (PIDDAC): UNIAG, UIDB/04752/2020 and UIDP/04752/2020 (Nuno Moutinho).

Appendix

Appendix 1

Sample distribution.

#	Firm name	Report date	Headquarters	#	Firm name	Report date	Headquarters
1	Opko Health	17/11/17	USA	26	Clover Health	04/02/21	USA
2	Riot Blockchain	11/12/17	USA	27	Ormat	01/03/21	USA
3	Marathon Patent Group	13/12/17	USA	28	The Lordstown Motors	12/03/21	USA
4	Soul Entertainment	14/02/18	USA	29	Ebang	06/04/21	USA
5	Pulse Biosciences	24/04/18	USA	30	PureCycle	06/05/21	USA
6	Inpixon	30/04/18	USA	31	HUMBL	20/05/21	USA
7	Apollo Medical	04/09/18	USA	32	DraftKings	15/06/21	USA
8	Genworth Financial	01/11/18	USA	33	Tecnoglass	09/12/21	USA
9	Yangtze River Port and Logistics Ltd	06/12/18	USA	34	Standard Lithium	03/02/22	USA
10	Eros International Media Limited	09/06/19	INDIA	35	Natera	09/03/22	USA
11	Predictive Technology Group	11/07/19	USA	36	Mullen Automotive	06/04/22	USA
12	DaVita	13/08/19	USA	37	Singularity Future Technology	05/05/22	USA
13	Bloom Energy	17/09/19	USA	38	EBIX	16/06/22	USA
14	Opera	16/01/20	USA	39	Establishment Labs	19/10/22	USA
15	Nextech	10/02/20	USA	40	Welltower	07/12/22	USA
16	PharmaCielo	02/03/20	USA	41	Adani Enterprises Ltd	24/01/23	INDIA
17	HF Foods	23/03/20	USA	42	Adani Green Energy	24/01/23	INDIA
18	New Pacific Metals Corp	20/04/20	CANADA	43	Adani Ports and SEZ	24/01/23	INDIA
19	China Metal Resources Utilization Ltd	17/05/20	CHINA	44	Adani Power	24/01/23	INDIA
20	Sorrento Therapeutics	20/05/20	USA	45	Adani Total Gas	24/01/23	INDIA
21	Ideanomics	26/06/20	USA	46	Adani Wilmar	24/01/23	INDIA
22	GrowGeneration	21/08/20	USA	47	Block Inc.	23/03/23	USA
23	Nikola	10/09/20	USA	48	Icahn Enterprises	02/05/23	USA
24	Loop Industries	13/10/20	USA	49	Tingo Group	06/06/23	USA
25	Kandi	30/11/20	USA	50	Freedom Holding Corp.	15/08/23	RUSSIA

This table presents the list of firms with a short seller report disclosure to the financial market. This list is based on Hindenburg Research report, that are available here: <https://hindenburgresearch.com/>.

Data availability

Data will be made available on request.

References

- Amiram, D., Bozanic, Z., Cox, J.D., Dupont, Q., Karpoff, J.M., Sloan, R., 2018. Financial reporting fraud and other forms of misconduct: a multidisciplinary review of the literature. *Rev. Account. Stud.* 23 (2), 732–783.
- Armour, J., Mayer, C., Polo, A., 2017. Regulatory sanctions and reputational damage in financial markets. *J. Financ. Quant. Anal.* 52 (4), 1429–1448.
- Benabou, R., Laroque, G., 1992. Using privileged information to manipulate markets: insiders, gurus, and credibility. *Q. J. Econ.* 107 (3), 921–958.
- Boehmer, E., Jones, C.M., Zhang, X., 2008. Which shorts are informed? *J. Finance* 63 (2), 491–527.
- Brav, A., Jiang, W., Partnoy, F., Thomas, R., 2008. Hedge fund activism, corporate governance, and firm performance. *J. Finance* 63 (4), 1729–1775.
- Brendel, J., Ryans, J., 2021. Responding to activist short sellers: allegations, firm responses, and outcomes. *J. Account. Res.* 59 (2), 487–528.
- Brown, S.J., Warner, J.B., 1980. Measuring security price performance. *J. Financ. Econ.* 8 (3), 205–258.
- Cao, G., Geng, W., Zhang, J., Li, Q., 2023. Financial constraints, short selling and corporate fraud: evidence from China. *Aust. Econ. Pap.* 62 (2), 297–320.
- Carberry, E.J., Engelen, P.J., Van Essen, M., 2018. Which firms get punished for unethical behavior? Explaining variation in stock market reactions to corporate misconduct. *Bus. Ethics Q.* 28 (2), 119–151.
- Christophe, S.E., Ferri, M., Hsieh, J., 2010. Informed trading before analyst downgrades: evidence from short sellers. *J. Financ. Econ.* 95 (1), 85–106.
- Collings, D., Corbet, S., Hou, Y.G., Hu, Y., Larkin, C., Oxley, L., 2022. The effects of negative reputational contagion on international airlines: the case of the Boeing 737-MAX disasters. *Int. Rev. Financ. Anal.* 80, 102048.
- Corrado, C.J., 1989. A nonparametric test for abnormal security-price performance in event studies. *J. Financ. Econ.* 23 (2), 385–395.
- Deng, S., Willis, R.H., Xu, L., 2014. Shareholder litigation, reputational loss, and bank loan contracting. *J. Financ. Quant. Anal.* 49 (4), 1101–1132.
- Di Maggio, M., Franzoni, F., Massa, M., Tubaldi, R., 2024. Strategic trading as a response to short sellers. *J. Financ. Markets* 69, 100911.
- Diether, K.B., Lee, K.H., Werner, I.M., 2009. Short-sale strategies and return predictability. *Rev. Financ. Stud.* 22 (2), 575–607.
- Dyck, A., Morse, A., Zingales, L., 2024. How pervasive is corporate fraud? *Rev. Account. Stud.* 29 (1), 736–769.
- Fama, E.F., French, K.R., 1993. Common risk factors in the returns on stocks and bonds. *J. Financ. Econ.* 33 (1), 3–56.
- Fang, V.W., Huang, A.H., Karpoff, J.M., 2016. Short selling and earnings management: a controlled experiment. *J. Finance* 71 (3), 1251–1294.
- Gao, K., Ding, M., 2019. Short-sale refinancing and price adjustment speed to bad news: evidence from a quasi-natural experiment in China. *China J. Account. Res.* 12 (4), 379–394.
- Goldstein, I., Guembel, A., 2008. Manipulation and the allocational role of prices. *Rev. Econ. Stud.* 75 (1), 133–164.
- Grullon, G., Michenaud, S., Weston, J., 2015. The real effects of short-selling constraints. *Rev. Financ. Stud.* 28 (6), 1737–1767.
- Guan, J., Lam, B.M., Lam, C.C., Liu, M., 2022. CEO overconfidence and the level of short-selling activity. *Rev. Quant. Finance Account.* 58 (2), 685–708.
- Humphrey, P., Carter, D.A., Simkins, B., 2016. The market's reaction to unexpected, catastrophic events: the case of oil and gas stock returns and the gulf oil spill. *J. Risk Finance* 17 (1), 2–25.

- Jiang, H., Habib, A., Hasan, M.M., 2022. Short selling: a review of the literature and implications for future research. *Eur. Account. Rev.* 31 (1), 1–31.
- Johnson, W.C., Xie, W., Yi, S., 2014. Corporate fraud and the value of reputations in the product market. *J. Corp. Finance* 25, 16–39.
- Karajian, S., Ullah, S., 2022. Consequences of fraud and overcoming negative market reaction. *Glob. Finance J.* 52, 100635.
- Karpoff, J.M., Lee, D.S., Martin, G.S., 2008. The cost to firms of cooking the books. *J. Financ. Quant. Anal.* 43 (3), 581–611.
- Karpoff, J.M., Lou, X., 2010. Short sellers and financial misconduct. *J. Finance* 65 (5), 1879–1913.
- Klimeczak, K.M., Sison, A.J.G., Prats, M., Torres, M.B., 2022. How to deter financial misconduct if crime pays? *J. Bus. Ethics* 179 (1), 205–222.
- Li, K. (2024). Do short sellers search for signals from other markets? Evidence from option trading. Available at SSRN: <https://ssrn.com/abstract=4698787>.
- Li, Y., Zhang, L., 2015. Short selling pressure, stock price behavior, and management forecast precision: evidence from a natural experiment. *J. Account. Res.* 53 (1), 79–117.
- Liu, C., Low, A., Putnins, T., 2024. The real impacts of public short campaigns: evidence from stakeholders. *J. Corp. Finance* 88, 102624.
- Ljungqvist, A., Qian, W., 2016. How constraining are limits to arbitrage? *Rev. Financ. Stud.* 29 (8), 1975–2028.
- MacKinlay, A.C., 1997. Event studies in economics and finance. *J. Econ. Lit.* 35 (1), 13–39.
- Marino, M., Parrotta, P., Sala, D., Valletta, G., 2024. The Volkswagen emissions scandal: exploring the role of environmental concern and social norms. *J. Environ. Econ. Manage.* 127 (103019), 1–20.
- Martins, A.M., Correia, P., Gouveia, R., 2023. Russia-Ukraine conflict: the effect on European banks' stock market returns. *J. Multinat. Financ. Manage.* 67, 100786.
- Meng, Q., Huang, H., Li, X., Wang, S., 2023. Short-selling and corporate default risk: evidence from China. *Int. Rev. Econ. Finance* 87, 398–417.
- Ni, X., Xu, H., 2023. Are short selling threats beneficial to creditors? Insights from corporate default risk. *Pac.-Basin Finance J.* 81, 102117.
- Paugam, L., Stolowy, H., Gendron, Y., 2021. Deploying narrative economics to understand financial market dynamics: an analysis of activist short sellers' rhetoric. *Contemp. Account. Res.* 38 (3), 1809–1848.
- Sapra, N., Kakran, S., Sidhu, A., Kumar, A., 2024. Unmasking market turmoil by decoding stock market dynamics post-fraud allegations: evidence from Adani-Hindenburg case. *J. Corp. Account. Finance* 35 (3), 75–88.
- Serra, A.P. (2004). Event study tests: a brief survey. *Manage. Org-Electron. J. Organ. Manage.*, 2(3), 248–255.
- Somaya, D., You, J., 2024. Scalability, venture capital availability, and unicorns: evidence from the valuation and timing of IPOs. *J. Bus. Ventur.* 39 (1), 106345.
- Sun, M., Xu, W., 2024. Short selling and readability in financial disclosures: a controlled experiment. *Financ. Rev.* 59, 265–292.
- Sun, Y., Sun, X., Wu, W., 2021. Who detects corporate fraud under the thriving of the new media? Evidence from Chinese-listed firms. *Account. Finance* 61, 1313–1343.
- Unsal, O., Hippler, W., 2024. Corporate misconduct and innovation: evidence from the pharmaceutical industry. *Res. Int. Bus. Finance* 71, 102490.
- Yang, Y., Liu, W., 2024. Corporate non-financial misconduct and accounting conservatism. *Account. Finance* 00, 1–36.