

RESEARCH ARTICLE

Sustainability restatements, firm risk and controversial industries: Analysing the signals based on revision type

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Abstract

This study analyses the relationship between sustainability reporting and firm risk by investigating the correlation between sustainability restatements and stock return volatility. Regression models, employed on a sample of 1580 sustainability reports by 353 European companies, evidence the risk relevance of restatement issuance. Investors interpret different signals, reacting with diverse feedbacks, based on the type of revision and whether the firm belongs to controversial industries or not. In general, restatements decrease firm risk when their purpose is to update reporting methodologies, while the opposite effect occurs when they amend errors and omissions. For companies operating in controversial industries, both types of sustainability restatement increase firm risk, with a stronger correlation when revisions redress errors or omissions. Given that sustainability reporting is still characterised by frequent standard and methodology updates, that often lead to the issuance of restatements, this study presents insights for companies and investors.

KEYWORDS

controversial industries, firm risk, restatement, sustainability report, volatility

1 | INTRODUCTION

Sustainability is a central theme in the development plans of governments, public and private institutions (European Commission, 2019). Consequently, sustainability reporting is attracting increasing attention from regulatory bodies, companies, investors and stakeholders in general (IFAC and AICPA, 2021). More than ever, advanced standards and techniques are required to adequately represent companies' behaviours and impacts on sustainability issues. To meet this need, standard-setters and regulatory bodies are committed to developing sustainability reporting frameworks (European Commission, 2021) and promoting the alignment of different standards to improve the transparency and comparability of disclosed information (IFRS Foundation, 2021).

Despite the steady development of this field, some practices have peculiarities and differences from more traditional ways of reporting. An example of one of these special cases is the issuance of

sustainability restatements. While financial reports are considered restated if they revise errors in the information disclosed during previous years, sustainability reports tend also be restated when a methodological update appears that leads to the revision of previously disclosed information. Sustainability restatements frequently occur, especially with new regulatory initiatives (Venturelli et al., 2020) and when companies provide external assurance to their reports (Ballou et al., 2018; Pinnuck et al., 2021). However, most of the literature has concentrated on the determinants of sustainability restatements and how companies may rely on them to improve their legitimacy in the eye of stakeholders (Michelon et al., 2019). The effect of this practice on a sustainability report's external users has been little explored.

Therefore, adopting the perspective of the signaling theory, this study aims to investigate the contribution of restatements to the risk relevance of sustainability reporting. While most of the studies on the value relevance of sustainability reporting use variables that do not

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take risk into account, the present research analyses the correlation between sustainability restatements and firm risk. Specifically, rather than relying on the most common models that use stock prices to measure value relevance (Ohlson, 1995), a conceptualisation of firm risk is employed that measures the volatility of stock returns (Jo & Na, 2012). In doing so, specific attention is paid to controversial industries, such as sinful industries and those operating in environmentally-sensitive sectors, since they usually face greater scepticism by stakeholders (Oh et al., 2017), that particularly affects sustainability reporting (García-Meca & Martínez-Ferrero, 2021).

To address this matter, regression models are developed with 1580 European firm-year observations of sustainability reports. The results of this research show that sustainability restatements are generally correlated with lower firm risk when they are issued due to methodology updates. This supports the view that, under normal conditions, update restatements are perceived as risk-reducing signals by investors. However, the results also highlight an increase in firm risk for firms belonging to controversial industries when they issue sustainability restatements, regardless of whether they are related to methodological updates or errors. These findings contribute to the previous literature by providing additional insights into the risk relevance of sustainability reporting. By examining controversial industries separately, it is confirmed that the sector factor can change perceptions of the same sustainability reporting practices. Since the regulatory initiatives occurring worldwide (e.g. the revision of Directive 2014/95/EU in Europe) will soon alter the sustainability reporting environment, an increase in sustainability restatement issuance should be expected. Companies and investors could benefit from the understanding the effects these restatements will have on financial markets in terms of firm risk.

The paper has the following structure. Section two contains the theoretical framework and development of the study's hypotheses. Section three explains the methodology. The results are presented and discussed in section four. The fifth and final section contains concluding remarks.

2 | THEORETICAL FRAMEWORK AND HYPOTHESES DEVELOPMENT

2.1 | Sustainability reporting, restatement and firm risk

Sustainability reporting is experiencing increasing relevance and adoption worldwide (KPMG, 2020). However, it also generates perplexity, especially regarding some of its characteristics and methodologies (Cho et al., 2012; Michelon et al., 2016). One example of this is the issuance of sustainability restatements. In financial reporting, restatements revise previously disclosed financial statements to correct errors (FASB, 2005). In sustainability reporting, a disclosure is considered restated not only when it is revised in a later disclosure due to errors but also when there are methodological updates, such as improvements in definitions, scope or calculation methodologies

(Michelon et al., 2019). While restating financial information is usually negatively perceived by investors (Bardos et al., 2013; Kravet & Shevlin, 2010), this practice may be positively evaluated in sustainability reporting because of its connection with improvements in data credibility, accuracy and disclosing techniques (Ballou et al., 2018). In addition, as suggested by Michelon et al. (2019), sustainability assurance providers might use frequent restatements to co-build legitimacy with their clients. Sustainability restatements generally occur more frequently in firms that have reported a high level of social performance, have environmental targets and reside in strong-law countries (Pinnuck et al., 2021). Adopting new standards and reporting legislative initiatives are matters strictly related to the issuance of sustainability restatements. For instance, Venturelli et al. (2020) found that adopting Directive 2014/95/EU led to an increase in this practice, with a consequent decrease in overall data comparability.

The research mentioned so far has dealt with sustainability restatements by studying their determinants rather than their value relevance and, in general, their effects on report users. In the literature, it is possible to find a few studies that investigate how investors perceive this practice. Wans (2017) study the value relevance of CSR disclosures when financial (not sustainability) restatements are issued. Martínez-Ferrero et al. (2021) investigate the market reaction to sustainability restatements, considering them a mediator in the relationship between sustainability assurance quality and cost of capital. In light of this limited evidence, the relationship between issuing restatements, as sustainability reporting practice, and value relevance seems worthy of further investigation.

Accounting studies on value relevance, once exclusively focused on financial reporting, have addressed investors' reactions to sustainability information for more than two decades (Barth & McNichols, 1994; Cormier & Magnan, 2007; Dowell et al., 2000; Hughes, 2000). Financial information alone seems unable to explain value relevance, leading to the need for sustainability disclosures (Paolone et al., 2021). This is corroborated by the growing number of regulatory initiatives, established in many countries, to mandate sustainability reporting and define its methodologies (Haji et al., 2022). While in the past the value relevance of this practice was questioned due to inconsistent and sometimes contradictory results (Berthelot et al., 2012; Cardamone et al., 2012; Carnevale et al., 2012), nowadays investors are more interested in carefully reviewing business reports for sustainability issues, and they expect companies to communicate their sustainability practices transparently and consistently (IOSCO, 2020).

Studies such as that by Thompson et al. (2022) demonstrate a positive relationship between sustainability reporting and firm value. According to Aureli et al. (2020), the impact of sustainability reports on firm value has increased in the last few years. Sustainability reports and their characteristics have been analysed: some of these characteristics are the standards adopted (Schadewitz & Niskala, 2010), the incremental information contained in disclosures (Cahan et al., 2016) and the readability and tone of the reports (Du & Yu, 2020). While there is no specific definition, Aboody et al. (2002, p. 969) explain the value relevance of accounting information 'in terms of the extent to which they explain intrinsic value, i.e., the present value of expected

future dividends conditional on all information to the market'. Models to study value relevance are often based on stock returns, employing earnings to explain the variation in returns (Easton & Harris, 1991) or share prices and using earnings to explain the variation in share prices (Ohlson, 1995).

Many studies on sustainability reporting and value relevance rely on Ohlson's model (Jadoon et al., 2020; Miralles-Quiros et al., 2017; Schadewitz & Niskala, 2010). However, some argue that return models can be preferred to price models since they have less severe econometric problems (Kothari & Zimmerman, 1995). In addition, returns models are easily linked to firm risk in terms of a firm's stock volatility. As a matter of fact, a conceptualisation of firm risk that measures a firm's stock volatility is the standard deviation of daily stock returns over the previous year (Sila et al., 2016). This approach allows total risk to be considered, combining both market and idiosyncratic risk (Jo & Na, 2012), measuring firm risk as stock volatility and defining securities with less predictable returns as riskier. Many studies that examine sustainability reporting use value relevance measures that are not risk-adjusted, overlooking a significant component of investment decisions. For instance, two firms with identical stock prices at a given moment can present different levels of volatility, resulting in less predictable stock returns.

A study on sustainability reporting consistent with this approach has been developed by Arayssi et al. (2016). Their study measures firm risk as the volatility of a firm's returns and firm beta, demonstrating that sustainability reporting, along with investment in effectual social engagement, creates a favourable effect on firms' risk and performance when they adopt an effective gender-diverse board structure. Benlemlih et al. (2018) use stock return volatility to measure the correlation between firms' environmental and total risk, obtaining negative and significant associations. Aside from these studies, the impact that sustainability reporting characteristics and practices have on firm risk has received little attention to date. Sustainability restatements are a widespread practice in sustainability reporting, yet few studies have been produced about their signaling power in financial markets. The imminent launch of new reporting standards by internationally recognised institutions (such as EFRAG and ISSB) will probably cause a significant increase in methodological update restatement issuance, as occurred when Directive 2014/95/EU (Venturelli et al., 2020) was adopted. Studying the signaling power of sustainability restatements on firms' stock volatility could help clarify how financial markets evaluate firm risk in terms of this reporting practice, providing additional insights for companies, investors and regulators.

Several studies concerning sustainability reporting and value relevance refer to signals managers convey to investors through sustainability disclosures (Cahan et al., 2016; Du & Yu, 2020; Romito & Vurro, 2021). These signals can be conceptualised through the signaling theory (Spence, 1973). The signaling theory focuses on a sender's signals and on receiver's interpretation and feedback to these signals (Connelly et al., 2011). It is often used to analyse financial market reactions to corporate actions (Yu et al., 2017). Therefore, this theoretical perspective seems well suited to explain how sustainability reporting influences market reaction (Paolone et al., 2021). Since most

of the literature on sustainability restatements developed so far has focused on the company perspective, this study analyses how investors (receivers) interpret and respond to sustainability restatements (signals), influencing the volatility of stock returns (firm risk).

If investors perceive sustainability restatements as signals of company commitment to sustainability reporting, through the correction of previous years' disclosures or updates in methodology, they are expected to reduce firm risk. This could happen because the increased accuracy of the information and the use of more up-to-date reporting techniques could reduce uncertainty in valuing a company's stock, resulting in more predictable returns and lower levels of volatility and total risk. The first hypothesis is formulated accordingly.

Hypothesis 1. *The issuance of sustainability restatements is associated with lower firm risk.*

2.2 | Sustainability restatements and controversial industries

The issuance of sustainability restatements in controversial industries is even more interesting to investigate since these companies are under greater pressure and scrutiny by stakeholders (García-Meca & Martínez-Ferrero, 2021). In controversial industries, stakeholders might be particularly sceptical about the level of sustainability that is truly achievable by these firms (Cai et al., 2012; Kilian & Hennigs, 2014). Companies in controversial industries are intensively involved in CSR reporting, however, they seem less active in adopting CSR policies (Sardanelli et al., 2021). Studies on sustainability reporting in controversial industries are scarce and show inconsistent results: Kilian and Hennigs (2014) claim that companies in controversial industries are more active in CSR communication than companies in non-controversial industries. According to Byrd et al. (2017), environmental concerns receive far more attention in non-controversial firms' reports than in controversial ones; however, the latter devote a greater proportion of their reporting to social and community initiatives than environmental operations.

Even fewer studies have been developed on the effects of controversial companies' sustainability efforts on financial markets and, more specifically, on value relevance and firm risk. Some contributions treat CSR engagement, for instance, Cai et al. (2012) found that in firms in controversial industries, CSR positively affects firm value. Jo and Na (2012) found that CSR engagement reduces risk in a more economically and statistically significant way in controversial industry firms than in non-controversial industry firms. According to Oh et al. (2017), when sinful firms advertise their CSR engagement, they make the firms' performance vulnerable (high idiosyncratic risk) by causing stakeholder scepticism.

In terms of sustainability reporting, García-Meca and Martínez-Ferrero (2021) evidenced a positive effect of sustainability reporting on performance in controversial sectors, implying that value-enhancement only occurs in companies under intense social scrutiny and with stakeholders concerned about ethical and environmental issues.

**TABLE 1** Sample selection

	Obs.
<i>Initial sample of firm-year observations</i>	
Thomson Reuters Eikon & GRI database (2012–2016)	1805
<i>Less</i>	
Sustainability reports not available	185
Databases mismatch	40
Total firm-year observations available (reports analysed)	1580
Unique firm observed	353

Given the scarcity and inconsistency of the results in the literature on sustainability reporting in controversial industries, it seems appropriate to study the relationship between sustainability restatements and firm risk for companies operating in these sectors. Sustainability restatements increase disclosure transparency, signaling error correction or methodological updates to previous reports. Intuitively, this could improve firms' public image and enhance their market positioning. However, it could also expose adverse sustainability impacts and risks that financial markets could perceive negatively. It seems reasonable to hypothesise that this second case could frequently occur when companies operating in controversial industries issue a restatement. In addition, in the eyes of investors, a company adopting new reporting standards could do so to improve its reporting techniques and provide a more accurate representation of its sustainability or to disguise the negative impacts of its actions with more favourable methodologies, misleading stakeholders about the evaluation and predictability of the company's performance, thereby increasing investors' perception of risk. This line of reasoning has led to the formulation of the second hypothesis, as follows.

Hypothesis 2. *Sustainability restatements in controversial industries are associated with higher firm risk.*

2.3 | Different signals based on restatement type

As already mentioned, there may be different reasons behind sustainability restatements. The revision may be to correct an error or omission or connected to methodological updates, such as calculation techniques, definitions applied and scope (Ballou et al., 2018). To further explore the relationship between sustainability restatements and firm risk, it seems appropriate not only to consider this practice in general but also according to the type of revision involved. Methodological update restatements (update restatements) are positively perceived because they can be associated with a company's commitment to improving its sustainability reporting practices (Martínez-Ferrero et al., 2021). This practice is tolerated by investors in light of the heterogeneous and fast-changing standards environment. On the other hand, revision of previously disclosed information due to a company's omissions or mistakes (error restatement) may be perceived by investors as increasing risk, leading to more stock volatility.

TABLE 2 Sample characteristics from 2012 to 2016

	Obs.	Freq.
Panel A. Sample by year		
2012	307	19.43
2013	328	20.76
2014	323	20.44
2015	305	19.3
2016	317	20.06
Panel B. Sample by country		
Austria	31	1.96
Belgium	43	2.72
Czech Republic	5	0.32
Denmark	81	5.13
Finland	147	9.3
France	144	9.11
Germany	127	8.04
Greece	39	2.47
Hungary	9	0.57
Ireland	18	1.14
Italy	103	6.52
Luxembourg	8	0.51
Netherlands	81	5.13
Norway	15	0.95
Poland	29	1.84
Portugal	26	1.65
Spain	112	7.09
Sweden	202	12.78
Switzerland	107	6.77
United Kingdom	253	16.01
Panel C. Sample by industry		
Communication Services	118	7.49
Consumer Discretionary	162	10.29
Consumer Staples	127	8.06
Energy	88	5.59
Financials	214	13.59
Health Care	72	4.57
Industrials	355	22.54
Information Technology	73	4.63
Materials	151	9.59
Real Estate	90	5.71
Utilities	125	7.94
Other	5	0.32
Total	1580	100

Consequently, it is expected that investors perceive different signals according to the type of revision. In addition, based on these considerations, and assuming that restatements issued by controversial industries are associated with higher firm risk, this association is expected to be stronger when revisions are due to errors rather than

TABLE 3 Distribution and characteristics of sustainability restatements from 2012 to 2016

	Obs.	Freq.
Panel A. Distribution		
Sustainability reports with restatements	1158	73.29
Sustainability reports without restatements	422	26.71
Total	1580	100
Panel B. Type of restatement		
Error	149	35.31
Update (methodology, scope, definition)	258	61.14
Error and update	14	3.32
Unspecified	1	0.23
Total	422	100
Panel C. Number of restatements by sustainability report		
1 restatement	377	89.34
2 restatements	44	10.43
3 restatements	1	0.23
Total	422	100
Panel D. Type of data restated		
Environmental	287	68.01
Social	95	22.51
Governance	2	0.47
Combination	38	9.00
Total	422	100

methodological updates. From the above, the following hypotheses are proposed:

Hypothesis 3. *Sustainability restatements reduce firm risk only when they are related to methodological updates.*

Hypothesis 4. *In controversial industries, the association between sustainability restatements and firm risk is stronger for error-based revisions than for methodological updates.*

3 | METHOD

3.1 | Sample and data

The initial sample originates from the economic and financial information collected from Thomson Reuters Eikon for the period 2012–2018, restricting the sample to publicly held companies in Europe. After removing duplicate observations (companies listed on more than one stock index), the sample is made up of 12,061 firm-year observations (1723 different firms for the 8-year period). The research is focused on European companies because the continent is generally committed to sustainability reporting (KPMG, 2020; Sassen et al., 2016). In addition, European regulators have been paying more attention to sustainability reporting, for instance with Directive 2014/95/EU and its imminent revision.

TABLE 4 Descriptive statistics

	Mean	Std. dev.
Risk_Return	−0.096	2.606
Size	22.987	2.155
Debt	1.387	6.059
Financial_Res	0.296	0.517
No_Restatements	0.166	0.744
Tangibility	0.373	0.209
Sales_Growth	0.242	6.352
	Obs.	Freq.
Sustainability_Restatement	422	26.71
Controversial	110	6.96
GRI	1153	72.97

Note: Sample: 1580 firm-year observations (353 unique firms) from 2012 to 2016.

In the second stage, the data on sustainability reports are obtained from the General Reporting Initiative (GRI) Report List, one of the sources most frequently used in the literature. At this stage, the data collected from Thomson Reuters Eikon and the GRI are merged, obtaining a sample of 1805 firm-year observations from 2012 to 2016, after excluding the observations lacking the variables required for the empirical tests. The sample does not include observations after 2016 because it is the last year covered by the GRI Report List. To avoid mixing different sources for the same kind of information and due to difficulties identifying an alternative source with the same reliability and amount of data, the sample ranges from 2012 to 2016.

Each observation belongs to a sustainability report published by firms in the 5-year period of 2012 to 2016. In the third stage, the data are hand-collected from the 1805 firm-year observations, determining whether the sustainability report contains restatements of information from previously issued reports. According to Ballou et al. (2018) and Michelon et al. (2019), the possible reasons for these changes are: error or omissions (i), updated/improved estimation/calculation methodology (ii), new definitions applied (iii), different scope (iv) and lastly, non-specified changes (v). In this stage, information about restatements is obtained by hand-revising each sustainability report. Following the above-referenced papers, the following search words are employed: 'restat', 're-stat', 'error', 'correct', 'update', 'revis', 'adjust', 'amend', 'figure', 'previous'. Consistent with Ballou et al. (2018) and Michelon et al. (2019), restatements for M&A, divestiture and similar reasons are not considered. The same restatement in multiple years is considered only once (i.e. the same restated 2014 numbers present in 2015 and 2016 disclosures).

After the conclusion of the described hand-collection process, firm-year observations with unavailable disclosure (185 out of 1805) and database mismatch (40 out of 1805) were excluded. Finally, the sample was made up of 1580 out of the initial 1805 firm-year observations for the period 2012–2016 from 353 different firms. Table 1 summarises the sample creation process.



TABLE 5 Bivariate correlations

	1	2	3	4	5	6	7	8	9	10
1. Risk_Return	1									
2. Sustainability_Restatement	0.011	1								
3. Controversial	-0.045*	0.043	1							
4. Size	-0.095***	0.057**	0.089***	1						
5. Debt	-0.070***	-0.019	-0.007	0.129***	1					
6. Financial_Res	0.019	-0.032	-0.045	-0.177***	0.074**	1				
7. GRI	-0.032	0.052**	0.038	0.101***	-0.007	0.028	1			
8. No_Restatements	0.012	0.948***	0.040	0.054**	-0.021	-0.033	0.062**	1		
9. Tangibility	0.046*	-0.049*	-0.038	-0.298***	-0.041	0.115***	-0.072***	-0.044	1	
10. Sales_Growth	0.019	-0.012	-0.017	-0.029	-0.005	0.002	-0.044	-0.013	0.037	1

Note: Sample: 1580 firm-year observations (353 unique firms) from 2012 to 2016.

*, **, and ***: 95%, 99% and 99.9%, respectively.

Table 2 reports the sample distribution by year, country and industry. The sample appears to be consistently distributed over time (Panel A). However, from the 20 countries analysed, it must be noted that the United Kingdom (253 observations out of 1580; 16.01%), followed by Sweden (202 observations out of 1580; 12.78%), are the most represented countries in the sample. Finally, the three industries with the largest numbers of companies are industrial (355 observations out of 1580; 22.54%), financial (214 observations out of 1580; 13.59%) and consumer discretionary (162 observations out of 1580; 10.29%).

3.2 | Regression models

The objectives of this study are explored through several regression models developed using dependence techniques for panel data. Panel data ensure consistency and the explanatory power of regressions and provide more informative data and greater variability. In terms of the analysis technique, the proposed models suffer from heteroscedasticity, autocorrelation and endogeneity, tested through the Hausman, Wald and Durbin-Wu-Hausman tests, respectively. In general, instrumental variables are required to control endogeneity. However, the conventional IV estimator (although consistent) is inefficient in the presence of heteroscedasticity and autocorrelation. For this reason, and due to the three econometric issues (heteroscedasticity, autocorrelation and endogeneity), it is necessary to use an estimator that guarantees these problems are controlled. Due to the presence of endogeneity and heteroscedasticity problems, it is necessary to use the generalised method of moments (GMM; Arellano & Bond, 1991) and, specifically, the two-step estimator proposed by Roodman (2009). GMM not only solves the possible endogeneity problem but it also controls heteroscedasticity and serial autocorrelation, employing two lagged values as suitable instruments.

To test the first two hypotheses, it is attempted to find a correlation between sustainability restatement issuance and volatility, as a measure of firm risk (Model I). To do this, firm risk is regressed on the indicator sustainability restatement and the control variables. This association is then examined specifically in controversial industries (Model II). Firm risk is regressed on sustainability restatement and on the indicator of controversial industries to examine the interaction between the main variables and control variables, as follows:

$$\text{Risk_Return}_{it} = \delta_1 \text{Sustainability_Restatement}_{it} + \delta_2 \text{Size}_{it} + \delta_3 \text{Debt}_{it} + \delta_4 \text{Financial_Res}_{it} + \delta_5 \text{GRI}_{it} + \delta_6 \text{No_Restatements}_{it} + \delta_7 \text{Tangibility}_{it} + \delta_8 \text{Sales_Growth}_{it} + \delta_9 \text{Year}_t + \delta_{10} \text{Country}_i + \eta_i + \mu_{it} \text{ [Model I]}$$

$$\text{Risk_Return}_{it} = \delta_1 \text{Sustainability_Restatement}_{it} + \delta_2 \text{Controversial}_{it} + \delta_3 \text{Sustainability_Restatement} * \text{Controversial}_{it} + \delta_4 \text{Size}_{it} + \delta_5 \text{Debt}_{it} + \delta_6 \text{Financial_Res}_{it} + \delta_7 \text{GRI}_{it} + \delta_8 \text{No_Restatements}_{it} + \delta_9 \text{Tangibility}_{it} + \delta_{10} \text{Sales_Growth}_{it} + \delta_{11} \text{Year}_t + \delta_{12} \text{Country}_i + \eta_i + \mu_{it} \text{ [Model II]}$$

In the second step, to address hypotheses 3 and 4, differences based on restatement type are examined. Two variables are employed in the regression models instead of **Sustainability_Restatement**. By



TABLE 6 The effect of the issuance of sustainability restatements on the level of firm risk

	Model I		Model II	
	Coef.	Std. error	Coef.	Std. error
<i>Main variables: independent and moderating</i>				
Sustainability_Restatement	-0.540**	0.251	-0.602*	0.332
Controversial			-0.659	0.131
Sustainability_Restatement*Controversial			0.879***	0.257
<i>Control variables</i>				
Size	-0.059	0.298	-0.086***	0.019
Debt	-0.017***	0.002	-0.014***	0.001
Financial_Res	0.067***	0.008	0.010	0.015
GRI	0.428***	0.141	-0.119*	0.062
No_Restatements	0.381*	0.200	0.452	0.291
Tangibility	-1.257	0.983	-0.867***	0.176
Sales_Growth	-0.008	0.007	-0.013***	0.002
Year and country effects	Controlled		Controlled	
	Wald chi ²		Wald chi ²	
	Prob > chi ² = 0.0000		Prob > chi ² = 0.0000	

Note: Sample: 1580 firm-year observations (353 unique firms) from 2012 to 2016. *, ** and ***: 95%, 99% and 99.9%, respectively.

doing so, firm risk is alternatively regressed on restatements connected to errors and on restatements connected to methodological updates. In both cases, the relation with the controversial industries indicator is also considered: Model I and Model II are again regressed by replacing the **Sustainability_Restatement** indicator with **Error_Restatement** (Model IA) and **Update_Restatement** (Model IB) and including the interaction with **Error_Restatement*Controversial** (Model IIA) and **Update_Restatement*Controversial** (Model IIB).

In the literature, several measures have been proposed to reflect firm risk. As already mentioned in the second section of the study, and following Sila et al. (2016) and Jo and Na (2012), the total risk of an investment is measured as the standard deviation of daily stock returns over the previous year. This measure allows to evaluate firms' stock volatility and represents total firm risk, combining both market and idiosyncratic risk (Jo & Na, 2012).

The issuance of sustainability restatements is measured through a dichotomous variable that represents the disclosure of restatements/rectifications in the sustainability report (Ballou et al., 2018; Michelon et al., 2019). '**Sustainability_Restatement**' codes as 1 if the sustainability report contains changes to information previously disclosed for one of the following reasons: (i) error or omission (error); (ii) updated/improved estimation/calculation methodology (without error); (iii) updates of the applied definitions (without error); (iv) scope update (without error); and (v) some unspecified reason (without error). It codes as 0 for sustainability reports without restatements.

To classify restatement types, this research follows the classification of Ballou et al. (2018) and Michelon et al. (2019) and proposes the following two indicators: **Error_Restatement** codes as 1 when restatements respond to changes due to error or omission and 0 otherwise (i); and **Update_Restatement** codes as 1 when restatements respond to changes due to updated/improved estimation/calculation methodology, definitions applied, or scope (ii) and 0 otherwise. In line with the above-

mentioned studies, if the type of restatement is not specified, it is considered an error/omission.

As a moderating factor, following Hong and Kacperczyk (2009), Cai et al. (2012), and Jo and Park (2021), the variable **Controversial** is a dichotomous indicator that codes as 1 for two categories of firms: those operating in sinful industries, which include the alcohol, tobacco and gambling industries (i), and those operating in industries involved in emerging environmental, social and ethical issues such as defence-related weapons, oil and gas and hazardous waste (ii) (Jo & Park, 2021). In every other case, the indicator codes as 0.¹

Control variables have also been included to avoid biased results, in line with previous literature (Faccio et al., 2016; Jo & Na, 2012; Sila et al., 2016). '**Size**' is the natural logarithm of total sales; '**Debt**' is the ratio of total debt to total equity; '**Financial_Res**' is the ratio of cash flow to revenues; '**GRI**' is a dummy variable that codes as 1 when firms disclose sustainability reports following the GRI guidelines and 0 otherwise; '**No_Restatements**' is the number of restatements in each sustainability report; '**Tangibility**' is the ratio of fixed to total assets; and '**Sales_Growth**' is the annual rate of sales growth. Finally, year and country are controlled by dummy variables representing each year and country analysed.

4 | RESULTS AND DISCUSSION

4.1 | Descriptive results

Table 3 reports the distribution and characteristics of the sustainability restatements. As Panel A illustrates, out of 1580 firm-year observations,

¹Despite examining the two categories of controversial firms (sinful industries and industries involved in emerging environmental, social or ethical issues) separately, no significant differences have emerged between them.

TABLE 7 Analysis of the types of sustainability restatement

	Model I		Model II	
	Coef.	Std. error	Coef.	Std. error
Panel A. Error restatement				
<i>Main variables: independent and moderating</i>				
Error_Restatement	0.282*	0.161	0.443**	0.192
Controversial			0.676**	0.272
Error_Restatement*Controversial			1.499**	0.676
<i>Control variables</i>				
Size	0.112**	0.047	0.088	0.061
Debt	-0.018***	0.003	-0.014***	0.002
Financial_Res	0.676***	0.185	0.760***	0.257
GRI	-0.248**	0.126	-0.058	0.183
No_Restatements	-0.424**	0.165	-0.373**	0.161
Tangibility	-0.126	0.523	-0.597	0.594
Sales_Growth	0.012*	0.007	0.011	0.008
Year and country effects	Controlled		Controlled	
	Wald chi ²		Wald chi ²	
	Prob > chi ² = 0.0000		Prob > chi ² = 0.0000	
	Model I		Model II	
Panel B. Updated restatement				
<i>Main variables: independent and moderating</i>				
Update_Restatement	-0.535*	0.319	-0.209**	0.087
Controversial			0.129	0.099
Update_Restatement*Controversial			0.461***	0.141
<i>Control variables</i>				
Size	0.093	0.056	-0.124***	0.029
Debt	-0.017***	0.003	-0.013***	0.001
Financial_Res	0.522**	0.218	-0.028**	0.014
GRI	-0.175	0.146	0.022	0.100
No_Restatements	0.064	0.272	0.191***	0.069
Tangibility	-0.061	0.610	-0.454*	0.243
Sales_Growth	0.010	0.008	-0.029***	0.004
Year and country effects	Controlled		Controlled	
	Wald chi ²		Wald chi ²	
	Prob > chi ² = 0.0000		Prob > chi ² = 0.0000	

Note: Sample: 1580 firm-year observations (353 unique firms) from 2012 to 2016.

422 sustainability reports contain a sustainability restatement, that is, 26.71%. Panel B reports that out of the 422 sustainability restatements: 149 correspond to error corrections (35.31%); 258 involve updated/improved estimation/calculation methodology, definitions applied or scope (61.14%); 14 are both error and update restatements (3.32%); and a single sustainability restatement out of the 422 is linked to unspecified reasons (0.23%). These values are similar to the distribution reported by Ballou et al. (2018), who document the clear dominance of sustainability restatements linked to methodological updates. According to Panel C, out of the 422 reports containing restatements, the dominance of those with a single restatement (377 out of 422; 89.34%) is clear. Fewer reports contain two restatements (44 out of

422; 10.43%) or three restatements (1 out of 422; 0.23%). Finally, Panel D reports the distribution of the sustainability restatements according to the type of data. 287 out of 422 firm-year observations involve restatements of environmental information (68.01%), 95 of them involve restatements of data related to social issues (22.51%), 2 of them restate governance information (0.47%) and 38 of them involve a combination of the above (environmental, social and governance), representing 9.00%. This initial evidence shows that the issuance of restatements for the period considered is a widespread practice in sustainability reporting. In fact, more than a quarter of the reports analysed contain at least one restatement. Companies of the sample rely on restatements more often to make methodological updates than to

TABLE 8 Further analysis I. Alternative risk measures based on firm risk leverage

	Model I		Model II	
	Coef.	Std. error	Coef.	Std. error
<i>Main variables: independent and moderating</i>				
Sustainability_Restatement	−0.044*	0.024	−0.035*	0.019
Controversial			0.108**	0.051
Sustainability_Restatement*Controversial			0.175***	0.032
<i>Control variables</i>				
Size	−0.168***	0.044	0.043***	0.009
Debt	−0.012***	0.001	0.003***	0.000
Financial_Res	0.002	0.003	−0.014***	0.003
GRI	−0.051***	0.018	0.001	0.018
No_Restatements	0.029**	0.013	−0.009	0.014
Tangibility	1.502***	0.244	0.176	0.114
Sales_Growth	0.010***	0.001	−0.005***	0.001
Year and country effects	Controlled		Controlled	
	Wald chi ²		Wald chi ²	
	Prob > chi ² = 0.0000		Prob > chi ² = 0.0000	

Note: Sample: 1580 firm-year observations (353 unique firms) from 2012 to 2016.

correct errors and omissions. This confirms that deepening the study of this phenomenon could provide significant insights.

Table 4 reports the descriptive statistics of the main variables proposed in this paper. As previously highlighted, out of 1580 firm-year observations, 422 sustainability reports contain a sustainability restatement, that is, 26.71%. 6.96% of the firm-year observations are from firms operating in controversial industries. Regarding the other control variables, out of 1580 firm-year observations, 1153 sustainability reports have been prepared following the GRI guidelines (72.97%). The financial resources ratio is around 0.296. Table 5 reports the bivariate correlations showing low values that do not lead to multicollinearity problems.

4.2 | Multivariate analyses

Table 6 presents the results of estimating the two models that test the effect of sustainability restatement issuance on firm risk (Model I) and whether this relationship changes in controversial industries (Model II). The results of Table 6, Model I clearly confirm that sustainability restatements are associated with lower firm risk (coef. −0.540; $p < 0.10$), thereby confirming Hypothesis 1. Results show that generally speaking, sustainability restatements are perceived as risk-reduction signals by investors. More specifically, this practice is associated with better predictability of a company's returns, thereby reducing firms' stock volatility and consequently, total risk.

Table 6, Model II highlights a different effect of sustainability restatements on firm risk in controversial industries. The results again confirm a decrease in firm risk from issuing sustainability restatements (coef. −0.602; $p < 0.10$). However, the opposite effect is registered when the companies belong to controversial industries. Operating

with coefficients to examine the moderating effect, the issuance of sustainability restatements in controversial industries is associated with higher firm risk (coef. 0.879; $p < 0.10$). Hypothesis 2 is confirmed: when companies operating in controversial industries issue a sustainability restatement, it is perceived by investors as a risk-increasing signal. In this case, the reporting practice is associated with lower predictability of company returns, thereby increasing firms' stock volatility and consequently, total risk.

In light of these results, it seems that investors generally perceive sustainability restatements as signals of companies' commitment to increasing the accuracy of their information, amending errors and omissions of posterior disclosures and adopting updated reporting methodologies. These signals reduce uncertainty in evaluating firms' stock returns, leading to a decrease in firm risk. This is coherent with previous studies that demonstrated how sustainability reporting can be value-enhancing (Aureli et al., 2020; Cahan et al., 2016; Thompson et al., 2022) and risk-reducing (Arayssi et al., 2016). Restatements can be seen as demonstration of commitment to and improvement of sustainability reporting and, due to this, reduce firm risk. In contrast, when companies belong to controversial industries, the issuance of restatement is associated with an increase in firm risk. While other studies highlighted that, for these corporations, CSR engagement may reduce firm risk (Jo & Na, 2012), and sustainability reporting can increase firm value (García-Meca & Martínez-Ferrero, 2021), the issuance of restatement is a sustainability reporting practice that investors perceive as a risk-increasing signal. Two possible explanations can be provided for this phenomenon. First, correcting errors and improving methodologies could lead to greater transparency and informative value in sustainability reporting, exposing negative impacts on environmental and social dimensions that could be more frequent when a company operates in a controversial industry. Second, in controversial

**TABLE 9** Further analysis II. Alternative risk measures based on firm risk leverage of different types of restatement

	Model I		Model II	
	Coef.	Std. error	Coef.	Std. error
Panel A. Error restatement				
<i>Main variables: independent and moderating</i>				
Error_Restatement	0.029***	0.008	0.019***	0.006
Controversial			0.19***	0.024
Error_Restatement*Controversial			0.077***	0.007
<i>Control variables</i>				
Size	-0.389***	0.016	0.038***	0.003
Debt	-0.012***	0.000	0.003***	0.000
Financial_Res	-0.016***	0.001	-0.022***	0.001
GRI	-0.023*	0.012	0.007*	0.004
No_Restatements	-0.019**	0.009	-0.058***	0.004
Tangibility	0.187	0.115	0.304***	0.033
Sales_Growth	0.007***	0.000	-0.009***	0.000
Year and country effects	Controlled Wald chi ² Prob > chi ² = 0.0000		Controlled Wald chi ² Prob > chi ² = 0.0000	
	Model I		Model II	
Panel B. Update restatement				
<i>Main variables: independent and moderating</i>				
Update_Restatement	-0.055***	0.009	-0.068***	0.008
Controversial			0.102***	0.014
Update_Restatement*Controversial			0.105***	0.009
<i>Control variables</i>				
Size	-0.397***	0.015	-0.018***	0.003
Debt	-0.012***	0.000	0.004***	0.000
Financial_Res	-0.017***	0.001	-0.046***	0.002
GRI	-0.018	0.012	0.019**	0.008
No_Restatements	0.016**	0.007	-0.016***	0.005
Tangibility	0.213**	0.102	0.216***	0.032
Sales_Growth	0.008***	0.000	-0.019***	0.001
Year and country effects	Controlled Wald chi ² Prob > chi ² = 0.0000		Controlled Wald chi ² Prob > chi ² = 0.0000	

Note: Sample: 1580 firm-year observations (353 unique firms) from 2012 to 2016.

industries, investors may be more sceptical of companies' actions (Oh et al., 2017), causing methodological updates and corrections of errors/omissions in previously disclosed information to be perceived not as a sign of commitment but as an effort to camouflage negative impacts on sustainability dimensions, thereby increasing the uncertainty in evaluating firms' stock returns. Despite companies' real intentions, the distrust and greater scrutiny that characterise controversial sectors may be the causes of this reaction by investors.

The regression models presented so far have examined the relationship between sustainability restatements and firm risk without considering the restatement type. This second part of the analysis investigates possible differences if the revision is related to correcting

errors and omissions rather than updates and improvements in estimation/calculation methodology, definitions applied or scope. The results are reported in Table 7, which provides clear differences in the types of restatement reported. Model I shows that the issuance of sustainability restatements is associated with higher firm risk when the restatements correspond to error (coef. 0.282, $p < 0.01$) (Panel A). In contrast, methodological update restatements are associated with lower firm risk (coef. -0.535, $p < 0.01$) (Panel B). Hypothesis 3 is confirmed; only sustainability restatements related to methodological updates reduce volatility and, consequently, firm risk. However, investors perceive error restatements as risk-increasing signals, leading to an increase in firms' stock volatility.

Examining Model II, in controversial industries, both error (coef. 1.499, $p < 0.01$) (Panel A) and update restatements (coef. 0.461, $p < 0.01$) (Panel B) are associated with higher firm risk. However, there is a stronger correlation with firm risk when restatements are issued due to errors than methodological updates (1.499 vs. 0.461). This confirms Hypothesis 4, demonstrating that although sustainability restatements increase risk in controversial industries, investors perceive different signals from error and methodological updates. They are both associated with higher volatility, but this association is stronger for errors and omissions.

Considering the significant difference between these two types of restatements, their distinct signaling value is consistent with the fact that investors have become interested in sustainability issues and more critically evaluate the information provided (IOSCO, 2020). The need for transparent and consistent reports could be undermined by errors and omissions announced through restatements. On the other hand, updating reporting methodologies is positively perceived by investors, even if this leads to revising previously disclosed information. This may be related to the fact that sustainability reporting standards are rapidly evolving. In such an environment, investors are likely to consider companies that strive to improve their reporting practices as less risky. Consistent with what has been demonstrated above, this phenomenon is similar in controversial industries, but firm risk is increased with both types of restatement, albeit with a stronger association between firm risk and error restatements than update restatements. It might be reasonable to assume, however, that once sustainability reporting will be more homogeneous and strongly regulated, investors may be also concerned by restatements related to methodological updates, thereby reducing the difference with error restatements.

To ensure the robustness of the findings, the results are confirmed by examining leverage risk as an alternative measure of firm risk. This variable, as suggested by Faccio et al. (2016), is a measure of the risk involved in corporate financing choices. This indicator is measured as the ratio of financial debt—the sum of long-term debt and short-term loans—divided by the sum of financial debt plus equity. Faccio et al. (2016) argue that when there is a negative shock to a firm's business conditions, a higher leverage ratio leads to the greater negative impact of this shock on net profitability and to a higher probability of default. The results provided in Tables 8 and 9 support the already presented evidence. Further analysis confirms that sustainability restatements are risk relevant. However, investors perceive different signals based on revision types (error vs. methodological update) and whether the firm belongs to a controversial industry or not.

5 | CONCLUSIONS

To contribute to the debate about the effects of sustainability reporting on financial markets, this study demonstrates how sustainability restatements affect firm risk, measured through the volatility of stock returns. Recent literature tends to associate sustainability reporting with value-enhancing (Aureli et al., 2020; Thompson et al., 2022) and

risk-reducing (Arayssi et al., 2016; Benlemlih et al., 2018) effects. However, the issuance of sustainability restatements requires further analysis, as it is a frequent practice with significant differences from financial reporting. Different types of revision, as well as belonging to a controversial industry, provoke different reactions in financial markets. This evidence contributes to the signaling theory, demonstrating that investors perceive different signals reacting to the volatility of stock returns. Issuing error restatements and operating in a controversial industry are perceived as risk-increasing signals when a restatement is issued, regardless of the message the sender wants to convey. This limits camouflaging and the symbolic use of restatements. On the other hand, this reaction risks penalising companies committed to sustainability reporting. These companies could face increased firm risk by improving their reporting methodologies and verification processes.

The study has implications for companies, investors, sustainability reporting regulators and standard setters. Having demonstrated the relationship between sustainability reporting and firm risk, companies should be aware of the signals that investors perceive from the revision type and sector. Given the scarcity of information available on the effects of restatement issuance, the evidence provided by this research allows to better understand the effects of restatements on financial markets, hopefully leading to a more informed use of this practice. According to Venturelli et al. (2020), Directive 2014/95/EU led to an increase in sustainability restatements in the first year it was in effect. The present study demonstrates that the issuance of sustainability restatements in controversial industries is correlated with an increase in firm risk, regardless of whether they are caused by errors or methodological updates. Keeping in mind that a revision of the Directive is underway, controversial companies could be penalised with increased firm risk by adhering to new regulations. Additionally, many studies have demonstrated that companies that engage external assurance are more likely to issue sustainability restatements (Ballou et al., 2018; Pinnuck et al., 2021), especially related to errors and omissions (Michelon et al., 2019). Sustainability reporting assurance, which is still voluntary in many jurisdictions, will soon be mandatory with imminent regulatory initiatives. This change could lead to a further increase in sustainability restatements, which could have undesirable effects on firm risk, especially for companies belonging to controversial industries. To limit this effect, companies could consider the ways restatements are communicated. For example, in the sample analysed, most of the restatements are indicated with footnotes, which could provoke scepticism about the company's intentions. In the year of transition to new standards or external assurance, companies could communicate why these lead to an initial increase in restatements and how to reduce them as quickly as possible.

The present research also presents limitations and further avenues for research. Firm risk conceptualisation is based on stock return volatility, with an approach that only considers financial market reactions. Nowadays, companies must deal with other important types of risks (e.g. compliance, climate change-related and so on) that are also relevant when investigating sustainability reporting. Future research could develop these notions of risk. The most recent year observed by the empirical analysis is 2016. Therefore, the sample refers to a



period when sustainability reporting and assurance were still voluntary in Europe, since Directive 2014/95/EU on non-financial information had not yet been adopted in most countries. Future studies could examine the relationship proposed here, expanding the period of analysis, also considering the Directive and its revision. In addition, only the European environment is considered in this research. Similar analyses in other geographic regions could lead to different results, bringing new perspectives to the dialogue. Future studies could examine the specific nature and differences of each set of industries and how other industry and institutional factors impact the relationship between sustainability restatements and firm risk. In the same line, further research could examine how firms can reconcile relative controversies within an industry, focusing special attention on the firm's reputation by examining, for instance, Forbes' reputation ranking or additional reputation sources. Lastly, this study analyses the effects of restatement issuance in single years, without considering how often the company has resorted to this practice over time. The frequency of sustainability restatements could alter the effects highlighted by the evidence presented, leading to the need for a more in-depth analysis.

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