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What do we know about ESG and risk? A systematic and bibliometric review

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Abstract

Environmental, Social and Governance (ESG) issues have become particularly relevant in the agendas of policymakers, investment decisions by companies and asset allocation process of investors. However, the transition to a greener and more sustainable economic system is not without risks. The literature has investigated the relationship between ESG and risk in different ways, through multiple perspectives and approaches. We select all documents with "ESG" and "Risk" in the title, abstracts and keywords available in Scopus and, after removing non-relevant papers, we are left with a sample of 589 documents published in the period 1983–2022. To provide a view of the most important studies, we also focus on the most cited documents to discuss the methodological approaches and main results. The results show that over time, ESG has gained increasing attention from the literature, but researchers work in isolation and there is no single approach or leading core topic driving academic productivity; a clear taxonomy of ESG risks appears to be missing. To the best of our knowledge, this paper is the first to discuss research on ESG and risk from a financial perspective. The results highlight some existing gaps in the literature that can provide a hint for the development of the topic by researchers. These include a clearer taxonomy of ESG risks that can affect investors' and companies' decisions, a greater effort to evaluate how ESG risks distribute and spill from one sector to another and the inclusion of emerging economies and small and medium-sized enterprises in the samples.

KEYWORDS
bibliometric review, ESG, risk, sustainability

1 | INTRODUCTION

In recent years, much attention has been given to the sustainability of businesses and investment activities. Policymakers, investors, and institutions are making efforts to achieve a more sustainable way of doing business and to promote greener growth.

From a broad perspective, policy decisions, companies' activities, urban development (Anelli & Tajani, 2023; Morano et al., 2020), consumers' choices in goods, food, and services (Jackson, 2005) can all contribute to more sustainable development. Within this framework, finance has been identified as the enabler for the transition to a greener economy, and the trend of sustainable finance and

sustainable investing emerged (Arvidsson & Dumay, 2022). The growth of this trend is fueled by the fund supply and demand side of the funds. On the one hand, investment managers have developed portfolios that target only the best-performing companies in terms of sustainability behaviour and disclosure by employing corporate sustainability measures (Agosto et al., 2022) to adapt investment portfolios to the new preferences of investors (Carlsson Hauff & Nilsson, 2022) or via the issuance of "green" financial products (Taghizadeh-Hesary et al., 2021). On the other, companies have started disclosing more information about their sustainable behaviour and have gradually begun the transition to a greener economy.

The transition to greener and more inclusive economic processes is not without risks. Despite being a necessary condition to ensure sustainable growth, it puts pressure on the current economic systems and requires changes to financing and investment models that can entail financial and non-financial risks that are less known or can increase exposure to well-known risks in the financial markets.

Karagozoglu (2021, 2022) defines non-financial risks "any novel risks other than the financial risks of market, credit and liquidity" driven by environmental, social, governance (ESG), climate change, and geopolitical risks.[1]

ESG risks can stem precisely from the transition to a more sustainable economic system or from physical risks due to the changing environmental conditions of the globe (i.e., climate risk) (Lee et al., 2016) and can be measured by the financial losses caused by a firm's lack of adherence to Environmental, Social and Governance pillars. In the financial sector, the inclusion of ESG metrics in the investment process modifies the asset allocation, by limiting the selectable investment opportunities. On the company side, the cost of financing for "brown" projects can be higher, thereby changing the profitability profile of investments (MacAskill et al., 2021).

However, while changes associated with a transition to a lower-carbon economy presents significant risks, they also create significant opportunities for organisations which vary depending on the region, market and industry in which an organisation operates (see e.g., Pizzutilo (2017), Eriandani and Wijaya (2021), Mohanty et al. (2021), Reber et al. (2022), among others). We quote the definition of Corporate Social Responsibility given by the European Commission (2011) as "the responsibility of enterprises for their impacts on society (…) to integrate social, environmental, ethical, human rights (…) in close collaboration with their stakeholders". CSR is a pillar for sustainability, competitiveness, and innovation of enterprises and the economy.

Many studies specifically investigate the impact of ESG metrics on CSP (Corporate Social Performance) linked to the firm (total) risk, systemic (idiosyncratic or unsystematic) risk and firm specific (or idiosyncratic) risk (see e.g., Embrechts et al. (2011) and McNeil et al. (2015)). Idiosyncratic risk is caused by specific firm's characteristics and it can be estimated by the realised idiosyncratic volatility and expected idiosyncratic volatility (Mefteh-Wali et al., 2022), whereas the systemic risk depends on a firm's sensitivity to changes in average market, which is explained by how a stock's return reflects the general market movements (the universe of securities) and it is measured by a firm's Beta, based on the standard CAPM model and its improvements (Sassen et al., 2016). Through CSR, firms can manage their idiosyncratic risk. At the aggregate CSP level, many studies highlight a negative association between CSP and the company's total risk, showing that the environmental performance decreases the idiosyncratic risk, whereas it has a negative effect on systematic risk only in sensitive industries. (see e.g., Eriandani and Wijaya (2021), Sassen et al. (2016), Izcan and Bektas (2022)).

High ESG-rated companies are more transparent with respect to risk exposure, risk management and governance having a lower exposure to systematic risk. Firms invest in CRS projects to control their risk using CRS as an insurance mechanism against risk. Mefteh-Wali et al. (2022) and Clemente et al. (2022) propose innovative methodologies to manage idiosyncratic risk. Based on various copula functions, Mefteh-Wali et al. (2022) depicts the complex dependence structures between the firm specific risk and idiosyncratic risk levels, showing a directional causality between CSR and the idiosyncratic risk. Clemente et al. (2022) provides a stochastic model to quantify the capital requirement and risk (focusing on demographic risk) in different time horizons. The results of these research shed new light on how CSR can be integrated in any risk management strategy to speed up the transition to a more sustainable, low-carbon economy. Additionally, ESG risks, such as environmental risks (including climate change and natural disaster), social risks (including health risks) together with safety risks (including cybercrimes, wars fraud and terrorist acts, trade policy), are found to be interrelated with geopolitical risks that can affect the overall market conditions and, consequently, portfolio risks and performance (Caldara and Iacoviello, 2022).

ESG is the acronym that stands for Environmental, Social and Governance. ESG behaviour is becoming an increasingly important aspect of businesses and institutions, as they are being held accountable for their impact on the environment and society (see among others the recent contributions by Agarwal et al. (2023), Jin and Kim (2022)). ESG metrics have been developed to measure and evaluate a company's performance in these areas, with the aim of improving sustainability practices and reducing risk arising from ESG transition, climate change and sustainability issues. The Environmental pillar (E) includes measures such as Greenhouse Gas (GHG) emissions, wastewater disposal, pollution, and renewable energy, among others. The Social pillar (S) looks at practices towards employees, human rights and equal opportunities to the workforce. Finally, the Governance pillar focuses on the corporate governance structure of the company, which can affect the long-term strategy and value of the company (Mihail et al., 2021). These three pillars should be able to convey information on the "sustainability" of the business (see e.g., Bocken & Short, 2021; Chopra et al., 2021; Jørgensen et al., 2022; Pieroni et al., 2019; Torres, 2021; Wang et al., 2021, among others) and asset allocation process (see e.g., Giese et al., 2019, Gougler and Utz. 2020, Gallucci et al., 2022, Giese et al., 2019, Lueg et al., 2019).

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[1]A part of the literature also investigates another source of risks that derives from the cybersecurity issues. Cybersecurity commonly refers to any risk of financial loss, disruption or damage to the reputation of an organisation resulting from the failure of its information technology systems (Jiang et al., 2022).

ESG metrics are generally calculated using a combination of qualitative and quantitative data, obtained from company disclosure, news, and financial and non-financial indicators. These metrics are provided by information providers (e.g., rating agencies, commercial databases, google and twitter trends) on the basis of balance sheet indicators and annual report content, but might also include events and scandals that affect the ESG profile of companies (Passas et al., 2022). ESG metrics have become more widespread and accurate, but gaps remain. While academics, practitioners and policymakers have investigated ESG metrics and risks stemming from a greener transition, the literature appears still scant, and little is known about the risks embedded in ESG investments.[2]

The literature on ESG risk estimation and evaluation is becoming wide and dispersed, with numerous approaches (e.g., empirical, theoretical, etc.) and different perspectives (e.g., company managers, investors, asset managers, etc.). Despite the number of studies published on ESG behaviour and its effects on companies' evaluation (D'Amato et al., 2022) and on the dynamics of ESG risk spillovers in financial markets (Dutta et al., 2021; Gao et al., 2022; Mzoughi et al., 2022; Tsagkanos et al., 2022; Zhang et al., 2022), there is no clear answer to the effects of ESG risks on financial markets and investment decisions.

This creates the need to provide a state-of-the-art review of the academic literature on ESG and risk published until July 2022. The aim is to understand how the literature has evolved over time, what the main topics covered are, and what aspects of ESG risk have received more attention.

Therefore, the paper aims to answer the following research questions:

- What is the current trend of research that analyses ESG and risk?
- What are the most active countries and research groups?
- Which authors and institutions are leading the discussion on this topic?
- What research questions have been addressed in the most relevant documents investigating ESG and risk?

Answering these questions will help to pinpoint the areas that still need to be addressed to better understand ESG risks and how the ESG transition affects risks in financial markets. The discussion of the most cited papers can also help in understanding the direction of future research.

To the best of our knowledge this is the first updated and systematic review of the academic literature on ESG and risks. The paper is organised as follows: Section 2 summarises the methodology employed; Section 3 presents the results of the bibliometric review; Section 4 describes the most relevant papers in terms of research questions, methodology and sample employed. Section 5 presents the

discussion of our results, Section 6 illustrates future streams of studies and Section 7 draws the main conclusions.

2 | MATERIALS AND METHODS

This study aims to survey and analyse previous studies on the relationship between ESG and risk. To achieve our goal, we employ a bibliometric and systematic review.

Bibliometric reviews have become more common recently in the literature and consist of the analysis of publications' data, including information on authorship, affiliations, countries, citations, and keywords, as well as the use of graphs and network relations. For some relevant examples of bibliometric reviews see Geissdoerfer et al. (2017), Kim and McMillan (2008). We select Scopus as the source database. It includes over 18.8 million cited references published since 1970 (Scopus n.d.).

There is a huge debate in the literature about the comparison of Scopus and Web of Science (WoS). As maintained by Martín-Martín et al. (2018), Abbay and Amit (2019), Pranckute (2021), and Pham et al. (2021), Scopus has several advantages over Web of Science that may lead authors to prefer it. One of the major advantages is that Scopus covers a wider range of sources than Web of Science, including more international and interdisciplinary sources and Scopus provides more up-to-date information, with new content being added more frequently than in Web of Science. Overall, while WoS is a respected citation database, Scopus may be a better choice for bibliometric reviews due to its wider coverage of sources, advanced search and filtering options, up-to-date information, and comprehensive citation analysis. With respect to Google Scholar, Scopus provides peer-reviewed documents, increasing the reliability of the content. For these reasons, we decided to use Scopus due to data availability, and its greater compatibility in combination with the use of the Package Bibliometrix of R Studio and VosViewer (Dervis, 2019).

To perform the bibliometric and systematic review we followed the process summarised in Figure 1:

- Selection of relevant papers: we perform a search on the Scopus database using the keywords «"ESG" and "risk"» in the title, abstract and author's keywords. We limit our choice to these two keywords to allow the inclusion of all the possible documents citing these two terms, that are to object of our analysis. By doing so, we allow the inclusion of non-relevant papers, but we then work manually to exclude this possibility in the next step.
- Cleaning the sample: we start from the initial list of 710 documents available as at end July 2022. We exclude the documents not written in English and the documents that are not related to the core topic of our research. After this process, we are left with 589 documents to analyse. these documents. Considering these documents, we collect authorship, source, citations, year, and references.
- Bibliometric analysis: we perform a bibliometric analysis on the final sample of documents and select the most cited ones for an additional systematic review.

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[2]The evaluation of risks in financial markets has always been important due to the nature of the financial activity, but it became especially relevant after the 2007–2008 financial crisis. The crisis highlighted the negative effects of underestimated risks and risk contagion, even in highly regulated and supervised industries, such as banking (Hałaj & Kok, 2013).

3 | BIBLIOMETRIC LITERATURE REVIEW

We analyse the 589 relevant papers resulting from our search, using the Bibliometrix package in R Studio and the VosViewer software (Dervis, 2019; Mohanty et al., 2023). First, we focus on the keywords included in the studies by the authors. Looking at the trend over time, we can observe a change in the wording used to study ESG over time. Figure 2 shows that in the early studies, the keywords employed were "social responsibility", "socially responsible investments", and its acronym "sri"; later on these terms are substituted gradually with "ESG" that is a broader definition of corporate social responsibility and also includes the environmental and governance profile of companies.

Recently, also the keyword "Covid-19" has been employed frequently, due to the disruption of the pandemic on the markets and risks. The same evidence is provided by Figure 3: the keyword ESG sees a surge, especially after 2020. A useful analysis relates to the keywords co-occurrences. Three clusters emerge (Figure 4). The first cluster (A) relates mainly to the topics of ESG and sustainability together with finance and investments. The green cluster (B) relates more to the social and governance dimension of ESG and can be interpreted as a specialised stream of studies. The other clusters (C and D) are relatively less important than A and B and can be considered very specialised and focused research streams with few contributions. When analysing the keywords employed by the authors to describe risk in
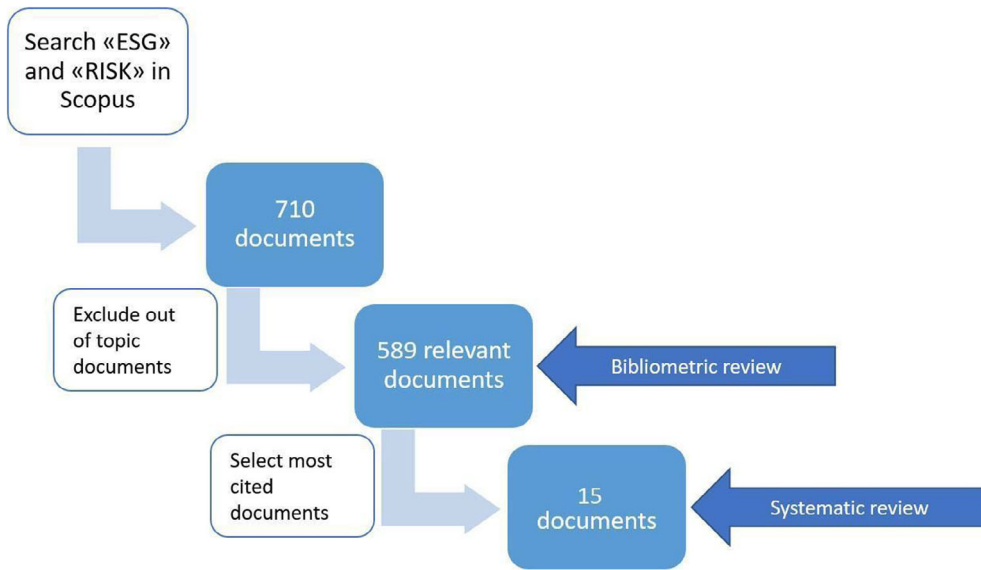

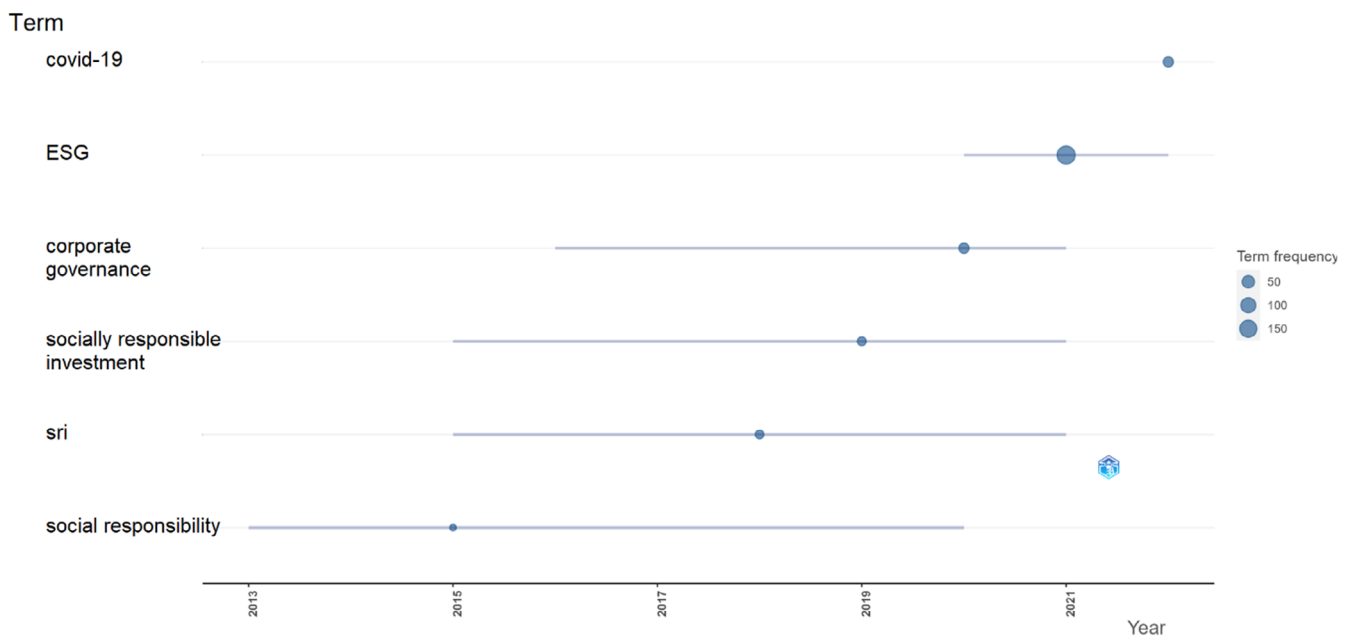FIGURE 1 Document selection process and analysis.
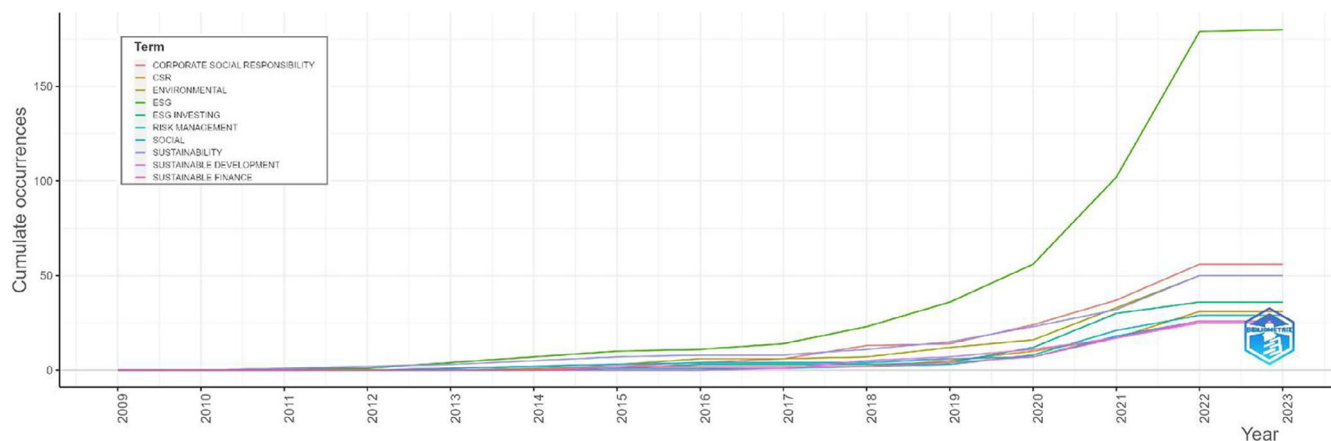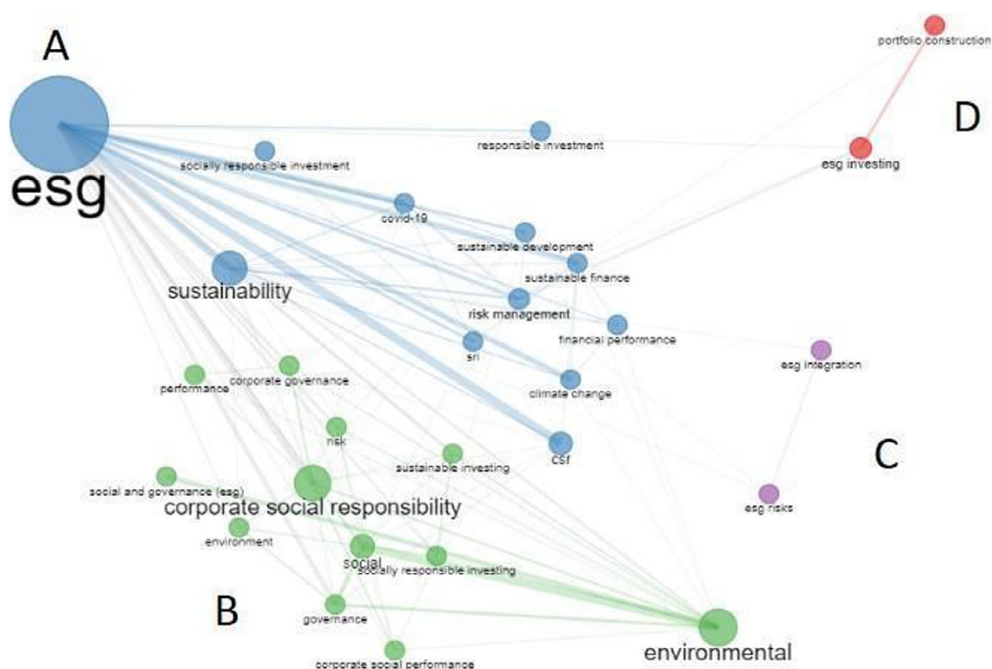

FIGURE 2 Trend topics.

FIGURE 3 Word growth.

FIGURE 4 Keyword co-occurrence network.

this field of study, we note that most of the "risk" keywords are related to portfolio risks, for example, "diversification risk", "downside protection", "equity risk", "portfolio risk exposure". ESG risks are described in terms of: "Climate" and "climate-related risks" that include the physical risk and carbon transition risk indicators; "ESG risk factors", "ESG risk premium", and "Sustainability risks" that encompass all the dimensions of ESG, namely Environmental, Social and Governance risks. The latter can also have applications not only in corporate finance themes, but also in the portfolio construction processes. A second set of keywords related to ESG risks specifically describes the management of risk. These keywords include, among others, "risk assessment", "risk aversion", "risk avoidance", "risk management theory", "risk mitigation", "risk tolerances", and "risk reduction". Finally, some keywords on "risk" address the measurement of risk or the risk-adjusted performance, where risk is always interpreted

as ESG risk. These include "risk-adjusted performance", "risk-adjusted return", "risk–return analysis", "risk–return performance".

We analyse the researchers investigating ESG and risk. Authors are ranked according to their impact, measured in this setting by Total citations (Figure 5). The most cited author is Starks, followed by Nofsinger and Varma. The co-authorship network shows a high number of authors with very few weak relationships and limited relevance in terms of normalised citations (size of circles). This can suggest that there are few authors and co-authors working together on risk and ESG and that authors investigate ESG and risk according to their specific field of research, but mainly in isolation. Apparently, there is still no consistent leading group of researchers in this area of study which is well connected to the rest of the scientific community, according to the statistics on studies on ESG and risk included in the analysis (Figure 6).
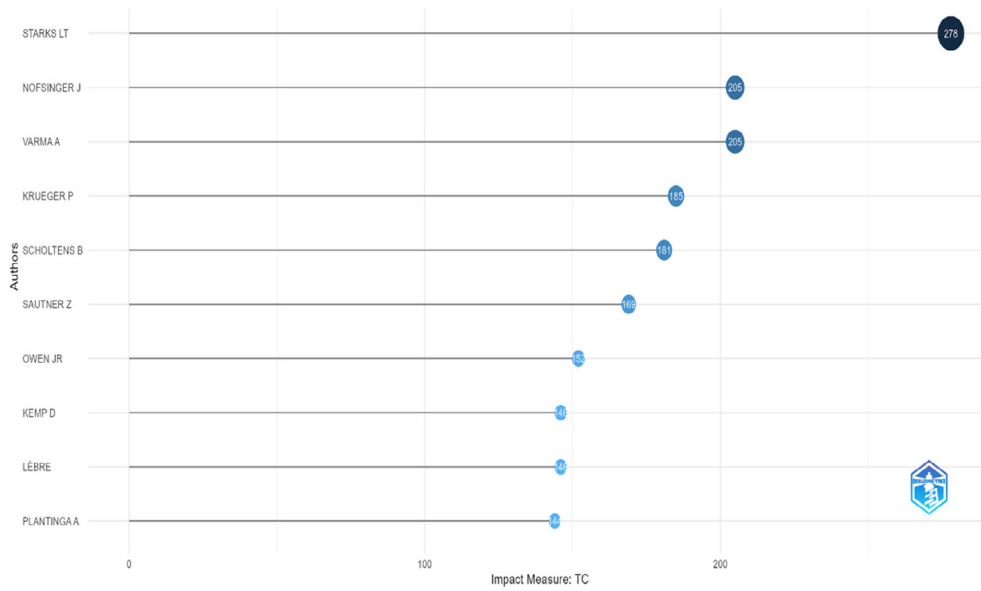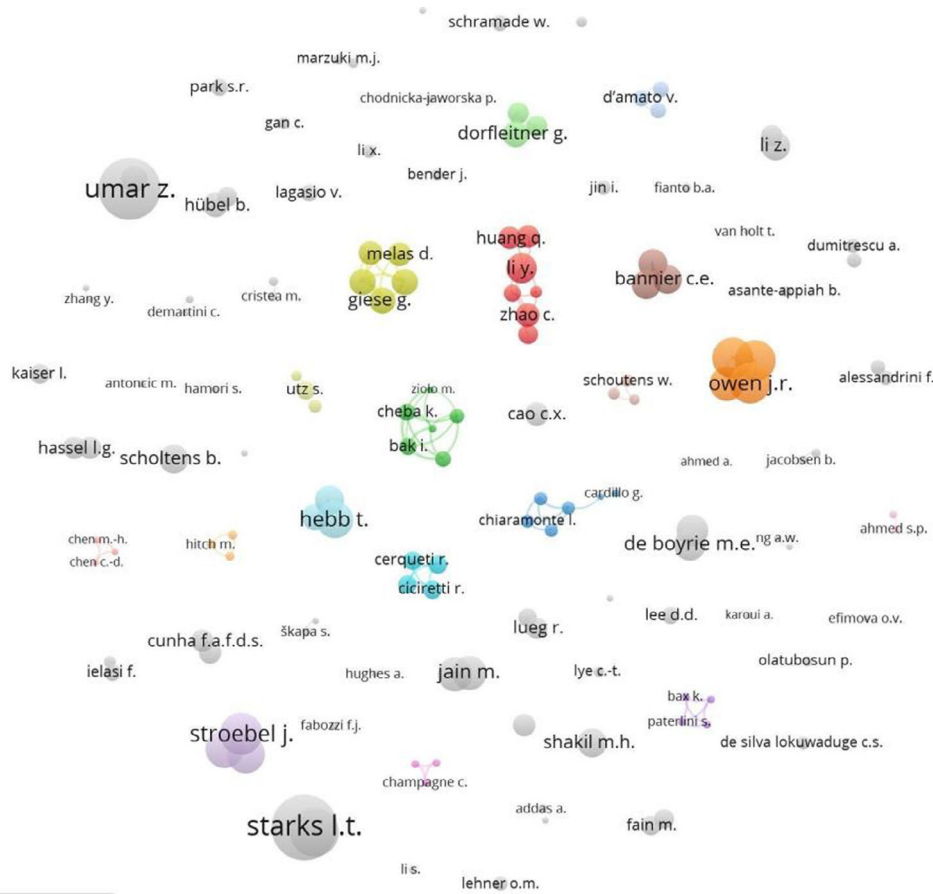
FIGURE 5   Author impact by TC index.

FIGURE 6   Author networks by normalised citations.
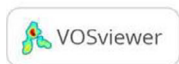
Researchers are located in different countries, and collaboration occurs also internationally. Figure 7 shows the collaboration network between countries. The main cluster (A) is reported in red and includes authors affiliated with US, UK and Canadian institutions, among others. The US represents the country with the highest number of papers in the sample (179 documents), followed by the UK, Italy and China with 85, 84 and 77 papers respectively. Cluster A is weakly linked to two relevant clusters (B and C), while the other

clusters appear less linked and isolated. The same evidence can be seen in Figure 8 where countries are shown. The US appears as the most linked and central country in the network. When looking at the most relevant sources, we can rank the journals according to the number of publications. Table 1 shows the following top journals: Sustainability, Journal of sustainable finance and investments and Journal of Portfolio Management. Most of the journals pertain to Q1 and Q2 journals according to both the Impact factor rank and the Journal Citation Indicator rank.

4 | SYSTEMATIC LITERATURE REVIEW OF TOP CITED PAPERS

To provide an overview of the most relevant papers in the area of ESG and risk, we present a systematic literature review of the top 15 cited papers. We define the most relevant papers as those papers that received around at least 100 citations. The documents selected are listed in Table 2. This analysis allows us to understand which studies are identified as most relevant by peer researchers.
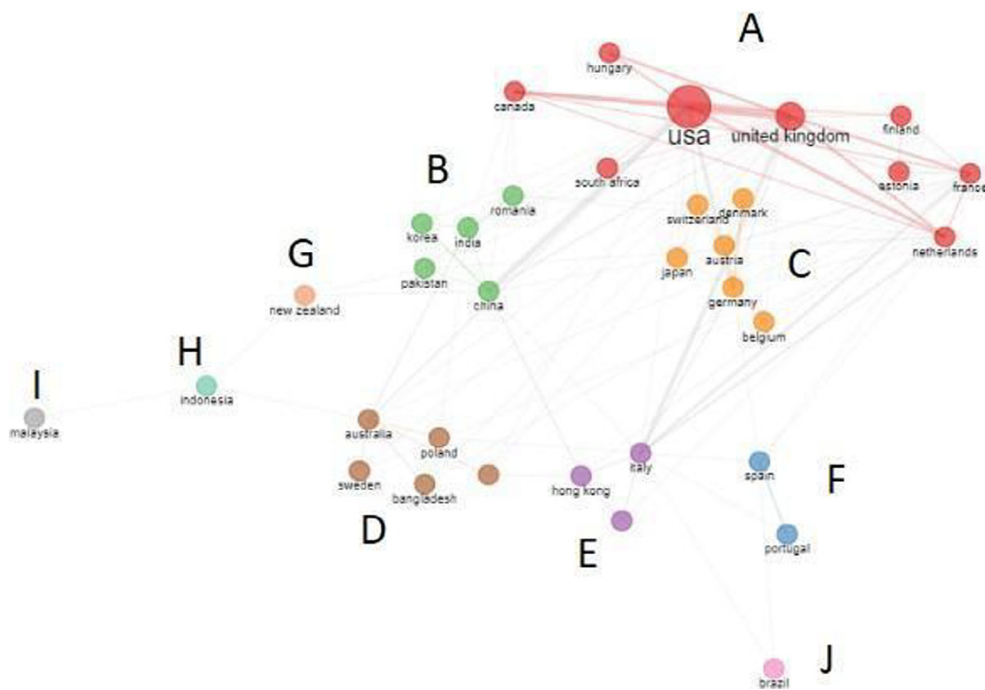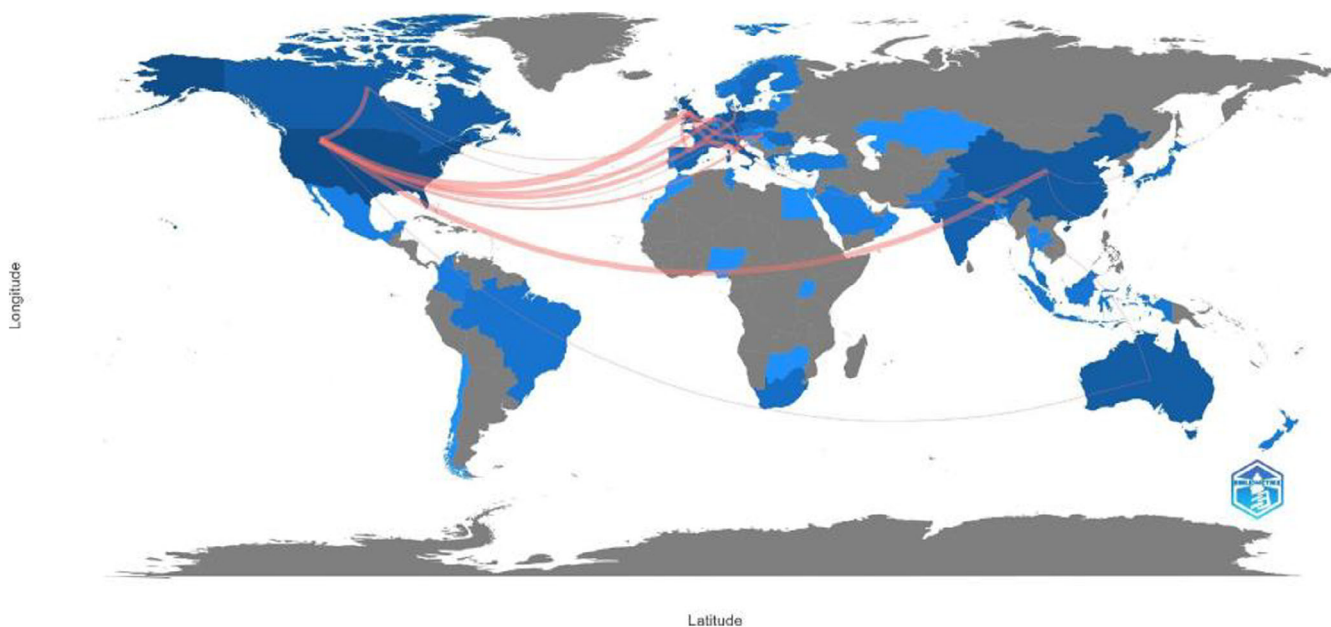

FIGURE 7   Country collaboration network.

FIGURE 8   Country collaboration map.

TABLE 1 Source relevance: top-5 journals.

n	Source	Number of documents	Impact factor rank	JCI rank
1	Sustainability	45	Q2	Q2
2	Journal of Sustainable Finance and Investments	35	n.a.	Q2
3	Journal of Portfolio Management	23	Q4	Q4
4	Finance Research Letters	16	Q1	Q1
5	Corporate Social Responsibility and Environmental Management	13	Q1	Q1
5	Journal of Business Ethics	13	Q1	Q1

TABLE 2 Overview of top-cited studies included in the analysis, by total citations.

Purpose	Data	Methods	Reference
Evaluate asymmetry of returns in ESG mutual funds	240 US domestic SRI equity mutual funds (2000–2011)	Fama–French Factor model	Nofsinger and Varma (2014)
Surveys reaction by investors to Climate risk	Survey	Descriptive statistics, logit and probit regressions	Krueger et al. (2020)
Investigate how asset managers account for ESG factors in investment process	Survey	Survey	van Duuren et al. (2016)
Studies the relationship between corporate social irresponsibility and financial risk	539 firms (2008–2013)	Linear regression	Kölbel et al. (2017)
Find ESG portfolio outperforms non-ESG stocks during Covid19 shock	China CSI300 Index (2015–2019)	Event study and regressions	Broadstock et al. (2021)
Study effectiveness of corporate governance in addressing the climate change by firms	256 non-financial UK firms (2002–2014)	Panel regression	Haque (2017)
Investigate country- and firm-level determinants of ESG	Cross-country sample of 14,174 firm-year observations (2005–2012)	Linear regression	Baldini et al. (2018)
Study how CSR and institutional ownership affect firm value	261 CSR and 261 matched firms (2006–2009)	Triple difference regression models	Buchanan et al. (2018)
Study the behaviour of firms with respect to ESG factors	Australian listed firms (2002–2009)	Descriptive statistics and ANOVA	Galbreath (2013)
Examine if superior CSR performance results in lower credit risk	872 bonds issued by EMU companies (2006–2012)	Linear and ordered logistic regressions	Stellner et al. (2015)
Review previous research on ESG in corporate finance	n.a.	Review	Gillan et al. (2021)
Evaluate the role of gender diversity in creating firm value	Listed firms (2007–2012)	Regression; BHR	Arayssi et al. (2016)
Study pricing differentials between green bonds and other bonds	617 bonds (Aug 2016)	Panel regression	Dorfleitner et al. (2015)
Compare ESG ratings and risk by different providers	More than 8500 companies worldwide	Correlation	Hachenberg and Schiereck (2018)
Evaluates ESG drivers of value creation	16 companies listed in Johannesburg Stock Exchange (JSE) and the Australian Stock Exchange (ASX)	Interview	Adams (2017)

Note: Top cited papers are ordered according to the total number of citations as reported in Scopus.

Additionally, these represent the papers that generally are consulted by researchers investigating the topic and therefore are likely to shape the future related literature. To curb the potential effect of the age of the document (in terms of date of publication) on the number of citations, we also report the top 15 cited papers according to the citation per year (Paltrinieri et al., 2019).[3] Some of these papers overlap with the first set of top-cited papers (see papers marked with an asterisk in Table 3) and are discussed only once. The top-cited papers, with few exceptions, are published in top-ranked journals and all after 2013, therefore representing a very recent set of contributions. With one exception, they are all authored by different authors and/or groups of authors, highlighting once again how research groups on the topic are fragmented and isolated. The top influential papers present the topics that drive possible future streams of research in the area of ESG and risk.

The three-top papers according to total citations are Nofsinger and Varma (2014), Krueger et al. (2020) and van Duuren et al. (2016). The first paper (Nofsinger & Varma, 2014) presents an analysis of potential asymmetries of return in ESG mutual funds for US Social responsible funds over the period 2000–2011. The authors apply a Fama–French Factor model, integrating the ESG factor in the determinants of the distribution of returns. The second paper, by Krueger et al. (2020), deals with ESG in relation to climate change and evaluates the reaction of investors to climate risks. The third top-cited paper is by van Duuren et al. (2016). The authors employ a survey through interviews and study how asset managers incorporate ESG factors in their investment decisions. When looking at total citations per year, the three top papers are Broadstock et al. (2021), Gillan et al. (2021) and Krueger et al. (2020). The latter corresponds to the paper just cited. Broadstock et al. (2021) study the comparative performance of ESG and non-ESG stocks during the period around the Covid-19 outbreak and find that the ESG portfolio outperforms the non-ESG stock portfolio for a sample of Chinese listed companies. Gillan et al. (2021) present a review of previous research focusing on ESG from a corporate finance perspective. The other top-cited papers deal with different perspectives on ESG and risk. A number of studies investigate ESG from the investment manager's perspective; others investigate the effects of ESG behaviour on companies' evaluation and riskiness; another set of papers evaluates the policy implications of ESG. The methodology employed by most of the papers is the panel or cross-section linear regression; a few papers employ interviews and surveys or present only descriptive statistics.

5 | DISCUSSION

The analysis of the trends in publications related to ESG and risks allows us to understand what the main streams of studies are and how knowledge develops over time and across themes, geographies

and authors. First of all, the use of keywords related to sustainability has changed over time from "social responsibility" to a more comprehensive term, such as "ESG". This reflects the need to study sustainability from many perspectives, not only related to "social responsibility" but also to Environmental, Social and Governance aspects. Most studies investigating ESG and risk relate to ESG measurement in asset allocation, as observed in the most relevant papers, or on the company side (e.g., the effects of ESG behaviour on corporate value). The identifies several key challenges that companies face when attempting to integrate ESG factors into their decision-making processes. These include a lack of standardised ESG data and metrics, difficulties in identifying material ESG issues, and the need for greater transparency and accountability in ESG reporting. Second, the findings provided by empirical papers are geographically focused on the sample employed. Many of these papers, which are likely to drive the development of future research streams, are focused on listed companies and developed markets. The literature addressing non-listed companies and SMEs is still underdeveloped and the same holds for studies that focus on developing or emerging economies. The majority of studies employ ESG metrics provided by external data providers (e.g., Bloomberg, Refinitiv, S&P, etc.) and this influences the sample composition of empirical investigation, with a prevalence of large listed companies and multinational companies. This result is generally common in the finance literature, however in this specific case, we must underline how integrating evidence on SMEs and developing countries is crucial to reach truly sustainable growth. Both the United Nations in the declaratory of the Sustainable development goals and the international policymakers specifically address the issue of including all the countries in the process of "greening" the economy and promoting more inclusive growth (Growth & Countries, 2011). Additionally, the core stream of research investigates the problems of asset managers and companies on how to improve economic or financial metrics through ESG investing. Less studies investigate how to decrease ESG risk, for companies and markets. Moreover, very few tackle the physical risk of ESG and transition risk explicitly.

6 | FUTURE RESEARCH DIRECTIONS

The growth in the literature stream on ESG and risk has been accompanied by a plurality of views and approaches to understand and measure the risks for investors and companies of a transition to a greener and sustainable economy. A key issue in the research on ESG and risk is the definition of risk employed. Studies use different types of risks, and this limits the possibility of understanding ESG risk in its entirety. Efforts should be devoted to developing and adopting a more comparable and extensive taxonomy of ESG risks in the academic literature. Future research streams can stem from the current literature to improve the understanding of the phenomenon and to better manage risks deriving from the transition to a greener society and to the physical risks emerging from climate change. One possible research stream relates to the need for investors to understand and include the different facets of ESG risks in their evaluations (see, e.g., Krueger et al. (2020)) and

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[3]We still allow the visualisation of the top papers according to total citations as when researchers search for studies in Scopus, they are allowed to order them by year or citations, and these are not adjusted to the time, but they are total citations. Hence researchers might find it interesting to have a view of the total citations.

TABLE 3 Overview of top-cited studies included in the analysis, by citations per year.

Purpose	Data	Methods	Reference
Find ESG portfolio outperforms non-ESG stocks during Covid19 shock[a]	China CSI300 Index (2015–2019)	Event study and regressions	Broadstock et al. (2021)
Review previous research on ESG in corporate finance[a]	n.a.	Review	Gillan et al. (2021)
Surveys reaction by investors to Climate risk[a]	Survey	Descriptive statistics, logit and probit regressions	Krueger et al. (2020)
Analyses ESG factor in investment decisions	n.a.	Theoretical model	Pástor et al. (2021)
Employs ESG to predict catastrophic risks	328 mining projects	Case study	Owen et al. (2020)
Examines the dynamic connectedness between COVID-19 media coverage index MCI and ESG leader indices	Indexes (2020–2021)	TVP–VAR	Akhtaruzzaman et al. (2022)
Proposes a method to hedge climate risk	WSJ Climate Change News Index (1984–2017)	Fama-MacBeth estimator	Engle et al. (2020)
Evaluates ESG companies resilience during Covid-19	1642 firms during Covid (2020)	Regression, BHR	Demers et al. (2021)
Investigate country- and firm-level determinants of ESG[a]	Cross-country sample of 14,174 firm-year observations (2005–2012)	Linear regression	Baldini et al. (2018)
Study how CSR and institutional ownership affect firm value[a]	261 CSR and 261 matched firms (2006–2009)	Triple difference regression models	Buchanan et al. (2018)
Investigate investors preferences for green bonds	2896 green bonds and matched non-green bonds	Fixed-effect regression	Larcker and Watts (2020)
Studies the relationship between corporate social irresponsibility and financial risk[a]	539 firms (2008–2013)	Linear regression	Kölbel et al. (2017)
Study effectiveness of corporate governance in addressing the climate change by firms[a]	256 non-financial UK firms (2002–2014)	Panel regression	Haque (2017)
Evaluate asymmetry of returns in ESG mutual funds[a]	240 US domestic SRI equity mutual funds (2000–2011)	Fama–French Factor model	Nofsinger and Varma (2014)
Compare ESG ratings and risk by different providers[a]	More than 8500 companies worldwide	Correlation	Hachenberg and Schiereck (2018)

Note: Top-cited papers are ordered according to the total number of citations per year.
[a]Also included in Table 2.

in the light of potential shocks that can affect the riskiness of ESG investments or increase or decrease the ESG risks Broadstock et al. (2021). Another strand of literature identifies the effects of ESG risks on performance and the opportunity to choose ESG investments over traditional ones. As the market evolves and new products are included by asset managers, it is important to understand also how ESG risks evolve in portfolios and what determines the attractiveness of ESG investments over traditional ones Nofsinger and Varma (2014). Directing funds to ESG investments is a prerequisite for the sustainable transition. And, on the company side, understanding if and how ESG practices and disclosure affects company risk and company evaluation remains a pivotal topic with still unclear response (Gillan et al., 2021). Within this area of research, future studies should also address the impact of ESG information delivered by the company on the market or retrieved via social networks and news. Greenwashing is one of the main topics in ESG disclosure and the risk of greenwashing should also be of concern for investors (Kölbel et al., 2017). To better understand the risks related to ESG transition it is also very relevant to increase the understanding of ESG and risk in emerging markets and for non-listed companies. These are generally less investigated in all the areas of finance, nevertheless, they represent a large majority of companies and have high relevance in terms of employment and value-added. Understanding ESG risks in this set of companies is necessary to have a clear-cut idea of how the transition will also affect SMEs and unlisted companies. The relationship between ESG and risks is also likely to be affected by the way ESG risks evolve in developing economies and understanding the nexus between different markets could be of particular interest. All these

streams of research appear worthy of being investigated to increase knowledge on the relationship between ESG and risk and to provide policymakers and practitioners with the evidence needed to issue correct policies that reach the final objective of a more sustainable economic system in all different economies. Policymakers and practitioners stand to gain invaluable insights from the empirical evidence generated by such research, enabling them to make data-driven decisions and formulate policies that proactively advance sustainability objectives. In light of the aforementioned considerations, it is prudent to strategize for a forthcoming comparative study, employing the same keywords, within a defined time frame. This methodological continuity underscores our commitment to rigorous research, ensuring that our findings contribute substantially to the development of evidence-based policies in the realm of sustainability.

7 | CONCLUSIONS

Despite the importance of ESG issues in the latest years, in many aspects of business and investments, the knowledge on the evaluation of the risk of ESG and of the risks of a transition to a more sustainable economic model is scant and scattered. The number of studies on ESG and risk has grown impressively over the years and will grow more, most likely. This paper has provided an overview of the literature on ESG and risk, identifying the most relevant countries, keywords, papers, and sources. We selected all the documents with "ESG" and "risk" in the title, abstract and keywords available in Scopus available until July 2022 and analysed the resulting sample of 589 documents through a bibliometric review. Studies are varied and present different approaches, but the most cited relate to ESG risk in asset allocation and ESG companies' practices and the effects on their evaluation. There is no clear dominant topic leading the research in this area, nor a single well-connected group of authors. Research is currently fragmented, and this might prevent scholars from elaborating valuable implications for companies and policymakers. The study presents some limitations. Firstly, the study is limited to English documents available in Scopus, which may have excluded valuable research published in other languages or in other databases. Moreover, and more importantly, the review is limited to a specific time period, and therefore, may not reflect the most recent developments (in 2023) in the analysed field. A new bibliometric and systematic review performed in the future could help clarify some of our findings further or might find a shift in the interest of the academic studies to another specific topic or methodology (e.g., clean or renewable energies or mobility). Second, the analysis of top-cited documents depends on the citations that rely on the decisions of the authors to cite other papers. This practice can be driven by legitimate and less legitimate rationale and might be subject to distortion or misrepresentation depending also on the subfield of study (Suominen et al., 2019). Additionally, we might have missed some relevant studies with no citations or recently published that received so far, no citations. Finally, the keywords have surely influenced our results, and to the best of our knowledge we have selected the most relevant keywords

(in comparison with the actual literature) but some articles may not be considered in this work.

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