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Advancing the assessment of sustainability risk in the equity investment fund industry

Laura Fabregat-Aibar[1*], Elena Escrig-Olmedo[2], Maria-Glòria Barberà-Mariné[1] and María Ángeles Fernández-Izquierdo[2]

Abstract

It is imperative for the fund management industry to integrate the current relevant global risks into its evaluation processes. This necessitates clarifying how sustainability ratings providers—the principal source of extra-financial information for fund managers—assess sustainability risks, as required by the Sustainable Finance Action Plan. To this end, this study aims to analyse how the Morningstar Sustainability Rating—one of the most widely used sustainability ratings by practitioners and researchers worldwide—evaluates sustainability risks and advances this assessment with a new proposal for a sustainability risk rating based on a strong sustainability approach. This measure minimises the offset of fund's environmental, social, and governance (ESG) risks, in addition to considering the managed risk in relation to the ESG risk exposure.

Keywords Sustainability risks, Strong sustainability, Environmental, social, and governance (ESG) managed risk, Sustainability investment fund, Equity small/cap funds, Investment decision-making

JEL Classification G11, G23, G24

Introduction

In the transition to a more sustainable world, the global financial market must ascertain and assume its fundamental role amid a dynamic regulatory and risk environment [1]. The investment fund industry is a key component of the financial market [2–4]. In recent years, environmental, social, and governance (ESG) factors have been integrated into the financial investment process [5–7]. Investors demand this information from asset managers before making their sustainability investment decisions [8] because ESG factors are essential to address significant global challenges such as climate change [9].

In this process of incorporating sustainability, it is essential to consider the preferences of investors [5]. A few investors may understand sustainability from a 'weak perspective', and others may understand it from a 'strong perspective'. The main gap between 'weak sustainability' and 'strong sustainability' is characterised by the level of compensation allowed among the ESG variables [10].

The new European regulations, which support the transition to a sustainable economy [11]—especially after the Sustainable Finance Disclosure Regulation (SFDR)—are crucial for the affordable governance, environmental, and societal transitions from a strong sustainability perspective [12]. As part of this transition, investors are seeking to identify new sustainability-related risks in order to make sound investment decisions and better manage their portfolios more effectively [13].

The SFDR establishes the harmonised rules on transparency that market actors should consider in relation to the inclusion of sustainability risks and the analysis of adverse sustainability events. As noted by Zioło et al. [14]—and as prevalent in the financial market—the

*Correspondence:
Laura Fabregat-Aibar
laura.fabregat@urv.cat
[1] Department of Business Management, Rovira i Virgili University, Tarragona, Spain
[2] Department of Finance and Accounting, Jaume I University, Castelló de la Plana, Spain

concepts of sustainability risk and ESG risk are used interchangeably in academic literature. Sustainability risk or ESG risk is defined as '*an environmental, social or governance event or condition which, if it occurs, could cause an actual or potential material negative impact on the value of the investment arising from an adverse sustainability impact*' [15]. Advancing on this definition, Boiral et al. [16] highlight that sustainability risk focuses on the estimation of the probability of the occurrence of environmental and/or social events and their potential impact on sustainable development. This requires determining the current and past ESG performance of companies, particularly demonstrating effective ESG risk management.

Investors and professionals in the mutual fund management industry have become increasingly aware of the need to manage sustainability risks [1, 17]. The failure to manage these risks itself constitutes a risk and can lead to significant challenges.

Numerous institutional and retail investors rely on sustainability rating agencies (SRAs)[1] to assess and manage sustainability risks [1]. However, they experience challenges arising from the paucity of data on sustainability concerns, which hinders a comparative analysis [18], or the presence of metrics that consider the investment choices of different investors with manifold sensitivities regarding sustainability concerns [19].

The Regulation [20] 2024/3005 on the transparency and integrity of ESG rating activities introduces additional measures to enhance the reliability and comparability of SRAs. This regulation requires ESG rating providers to obtain authorisation from the European Securities and Markets Authority (ESMA) and mandates full disclosure of methods, models, and key assumptions employed in sustainability assessments. By requiring separate scores for environmental, social, and governance factors, and ensuring that combined ratings explicitly state their respective weightings, the regulation aims to improve the accuracy and transparency of ESG evaluations, ultimately enabling investors to make more informed decisions.

In addition, other key European regulations are fundamental in the transition towards a sustainable financial system. The Corporate Sustainability Reporting Directive (CSRD) (Directive [21] 2022/2464) requires large and listed companies to disclose detailed information on sustainability matters, thereby enhancing the transparency and comparability of ESG data and indirectly affecting the investment fund industry. Moreover, the EU Taxonomy Regulation (Regulation [22] 2020/852) complements the SFDR by establishing a classification system for environmentally sustainable economic activities, providing investors with a framework to assess the degree of environmental alignment of their portfolios. Recently, the Corporate Sustainability Due Diligence Directive (CSDDD) (Directive [23] 2024/1760) has further strengthens the European sustainability framework by imposing obligations on companies to identify, prevent, mitigate, and report on adverse human rights and environmental impacts in their operations and value chains. Together, these regulations promote greater accountability, transparency, and sustainability due diligence within the European financial market.

The Morningstar database is a significant source of sustainability data in the investment fund industry [3, 24, 25]. This database provides information on the Morningstar Sustainability Rating, which adopts a weak sustainability approach focused on risk.

Integrating both current or historical ESG performance and effective ESG risk management into the sustainability risk assessment process is a significant challenge, as highlighted by Boiral et al. [16]. This study aims to propose an alternative sustainability risk rating that adopts a strong sustainability approach in line with the SFDR, the Regulation (EU) 2024/3005 on the transparency and integrity of ESG rating activities, and the sustainability risk definition by Boiral et al. [16]. Particularly, this study introduces an alternative to Morningstar's Portfolio Corporate Sustainability Rating (PCSR), using information provided by Morningstar itself.

To test this methodological proposal, the 724 mutual funds included in the 'Europe Equity Mid/Small Cap' category are analysed. The results indicate divergences between the two alternatives in the evaluation of investment funds. Previous studies have provided several suggestions to address the limitations of the Morningstar Rating [3, 25–27]. However, to the best of the authors' knowledge, this is the first study to provide a rating proposal for the measurement of sustainability risks based on a strong sustainability approach. This proposal integrates the preferences of a socially aware investor, does not allow low scores to be offset by high scores, and includes both impact assessment and their management in the evaluation process.

Specifically, this study contributes to the literature on the investment fund industry in two ways. First, it advances the research on the evaluation of sustainability risks by analysing how the fund industry assesses sustainability risks and proposing alternatives to address associated challenges. This contribution is particularly relevant to the Global Sustainability Agenda [1]. Second, it introduces a comparable and reliable rating proposal

[1] Several studies have employed heterogeneous vocabulary when referring to sustainability rating agencies (SRAs). This article uses the term SRAs, ESG rating agencies, and ESG information providers interchangeably.

for measuring sustainability risks, emphasising the importance of risk management while integrating the preferences of investors who seek to integrate a strong sustainability perspective in their investment processes. Given the challenges associated with diversifying ESG risks, it is crucial that investors comprehend the sustainability profile of their portfolio [18]. Consequently, the purpose of this study is to propose an alternative framework to Morningstar's method of assessing the sustainability risks of equity funds. This approach will take into account specific investor preferences and new regulatory requirements in financial markets.

From a professional standpoint, this study enhances the transparency and accessibility of the fund industry's sustainability risk assessment process. Furthermore, it provides fund managers with the necessary skills to assess and manage ESG risks from a strong sustainability perspective. This is significant because managing sustainability risks may yield potential benefits for investors [18].

The rest of this article is structured as follows. Sect. "Literature review" discusses the theoretical framework, and Sect. "Method" outlines the main characteristics in the construction of the Morningstar Sustainability Rating and the proposal of an alternative rating, as well as the sample used in this paper. Sect. "Application to European equity investment funds" presents the empirical study of the funds evaluated. Sect. "Validation analysis" presents the results that validate the proposed method, and finally, Sect. "Conclusions and limitations" Descriptive statistics presents the main conclusions.

Literature review

Incorporation of investor preferences with a strong sustainability approach

The sustainability theory suggests a harmonious integration of its three fundamental pillars to achieve balance [28]. It is important to highlight that governance (G) is sometimes treated in the literature not only as a stand-alone pillar but also as a lever to enhance environmental and social outcomes. Studies [29, 30] show that governance mechanisms—such as board diversity, independence, and transparency—facilitate effective ESG implementation and value creation. However, under conditions of high managerial slack, governance may instead constrain these practices [31].

There are two main approaches to understand the impact of sustainability: the 'weak sustainability' approach and the 'strong sustainability' approach [32]. The latter emphasises the preservation of the natural environment, with a strong focus on justice for the environment as well as social considerations [33]. However, strong sustainability does not consist merely of limiting trade-offs between pillars, rather, it requires meeting certain minimum sustainability thresholds. From a theoretical perspective, strong sustainability incorporates absolute sustainability thresholds, critical natural capital, and safe operating spaces [34, 35], ensuring that certain environmental and social conditions are never compromised, regardless of improvements in other areas. Hediger [36] defines strong sustainability as maintaining constant environmental quality, while ensuring ecosystem resilience and fulfilling basic human needs as fundamental requirements. This contrasts with weak sustainability, which allows substitutability among natural, social, and economic capitals [35, 37].

In the business context, the line between these two approaches is marked by the level of compensation allowed between environmental and socioeconomic variables during the aggregation process [10]. According to the 'strong sustainability' approach, the favourable results of defining policies and implementing processes in certain areas cannot conceal adverse results elsewhere [38]. Thus, an organisation's contribution to sustainable development is meaningful only when there exists a balance between long-term commitments reflected in policies and management structures and the actual results achieved with all stakeholders [19]. Nikolaou et al. [39] provide a practical framework for operationalizing strong corporate sustainability by designing a composite sustainability index. Their approach integrates the triple-bottom-line dimensions with explicit environmental and social thresholds, reflecting critical natural capital and safe operating spaces. This methodology shows how absolute thresholds can be embedded in performance measurement to ensure that positive outcomes in one dimension do not compensate for failures in others, addressing a key limitation of simpler compensation-based approaches. Therefore, the lower the degree of tolerance allowed when compensating among the economic, social, and environmental pillars, the closer one will be to strong sustainability, and, thus, to true sustainability (van den [40]).

Recently, the concept of sustainable development has acquired significant attention. Agheli and Taghvaee [41] argue that, within the strong sustainability framework, the environmental pillar is the most crucial, whereas weak sustainability treats all three pillars equally. Contemporary sustainability theories further suggest that adherence to planetary boundaries is a key criterion for strong sustainability, ensuring that economic activity remains within the Earth's ecological limits [34, 42].

Currently, an increasing number of investors are considering sustainability when making their investment decisions [43]. According to Escrig-Olmedo et al. [19], there exist different types of investors in the financial market—those that adopt the 'strong sustainability'

approach and those who favour the 'weak sustainability' perspective. In this context, an investor who invests according to the 'weak sustainability' approach would be a 'conventional investor'—someone who executes investment decisions to maximise financial returns. For these investors, economic and governance aspects override social and environmental concerns. Meanwhile, the investor who adopts the 'strong sustainability' approach would be a 'strong socially responsible investor'. This investor perceives ESG aspects as integral to the investment decision-making process, without sacrificing the financial criteria. These findings coincide with those evidenced by Nilsson [44] and Dam and Scholtens [45].

The integration of ESG concerns in the financial market is meaningful for investors as a necessary means to manage risks [46]. Przychodzen et al. [47] highlight that mutual fund managers consider ESG factors while making investment decisions because of the positive relationship between ESG factors and risk aversion. Other reasons to integrate ESG aspects include pressure from different investors and other stakeholders, the fiduciary responsibility of fund managers, and the regulatory framework. In the context of Morningstar's ESG risk indicators, Ferriani and Natoli [48] explore investors' consideration of ESG risks when making investment decisions. The results show that investors prefer funds with low ESG risk and that they are most concerned about environmental risks.

Therefore, for better management of sustainability risks by the financial market, the investment preferences of sustainable investors that have a 'strong sustainability' perspective must be integrated into the evaluation models of asset managers. As this approach requires meeting minimum thresholds for environmental quality, ecosystem resilience, and basic human needs [36], these fundamental criteria must be incorporated into risk assessments. The fund sustainability risk rating proposal presented in this study is aligned with this viewpoint.

Sustainability risk assessment

Availability of appropriate information is crucial for evaluating the sustainability of a company—just as it is when evaluating company risk [49]. To integrate sustainability risks into the assessment process, fund managers, investors, and professionals in general, employ the assessments provided by SRAs [50]. SRAs have become highly influential financial market institutions [51] because they evaluate the environmental, social, and economic performance of organisations [52]. The Rate the Raters report (2020) highlights that SRAs are regularly utilised by investors as a tool to obtain information on the ESG performance of the assets being considered for invested [53].

In recent years, the restructuring of the financial market has led to the integration of sustainability risk assessment into the evaluation processes of traditional rating agencies; nonetheless, sustainability principles are yet to be fully integrated into their assessment processes [52]. This integration is indispensable because, as Younas and Zafar [54] indicate, investors and companies require these evaluations to manage sustainability risks because their mismanagement can adversely impact financial performance [55, 56].

However, research on the application of ESG scores as a measure of sustainability risk remains scarce. Clément et al. [57] revealed in their review that merely 14 articles have considered that ESG scores represent an analysis of the risk of a future event that can adversely impact investments. Recent studies have begun to address this gap by empirically examining the relationship between ESG ratings, sustainability risk, and fund performance. For instance, Papathanasiou and Koutsokostas [58] analyse European ESG equity mutual funds, showing that ESG ratings influence performance persistence and investor preferences, particularly during periods of market stress such as the COVID-19 pandemic. Similarly, Hasnaoui [59] explores the link between ESG ratings and investment performance in tech-heavy mutual funds, finding that ESG alignment may improve risk-adjusted returns and market timing abilities.

Further evidence on sustainable investment behaviour is provided by López Vázquez et al. [60], who empirically assess Morningstar's best-in-class mutual funds, demonstrating how sectoral diversification and strong ESG performance contribute to profitability and investor attraction. Complementary results are reported by Ottem and Romanets [61] in the Scandinavian market, where sustainable funds under SFDR Articles 8 and 9 exhibit performance and risk patterns comparable to or superior to conventional funds. In addition, Kammoun and Mrissa Bouden [62] analyse initial public offerings (IPO)-focused mutual funds, concluding that ESG commitment influences both systematic risk exposure and fund performance, especially during crisis periods. Moreover, Sorrosal-Forradellas et al. [63] evaluated equity investment funds within the energy sector, taking into account ESG risks and investors' short- and long-term approaches. Their findings highlighted the need for rating systems that are adaptable to the preferences of investors, given the current methods do not take these possibilities into account. Together, these studies confirm that sustainability assessments are becoming increasingly central to evaluating both financial performance and risk.

Rating agencies are rapidly evolving regarding the development of ESG scores assessing firms' exposure to sustainability risks [48]. A few studies have questioned

the validity of the ESG risk scores and the rigour of the risk assessment process developed by these agencies [16]. Saadaoui and Soobaroyen [64] indicate the difference between ESG performance measurement and ESG risk assessment and suggest the absence of any definite and homogeneous measure to assess sustainability risks. Meanwhile, Boiral et al. [16] highlight the challenges of measuring sustainability risks because of their unpredictability and the lack of reliable information. Recently, to clarify how to evaluate sustainability risks, Champagne et al. [65] analysed whether the extra-financial ratings provided by SRAs are related to the probability of occurrence of adverse ESG events and, therefore, can be considered as indicators of ESG risk. The results show that a 'firm's global extra-financial performance is negatively related to its likelihood of dealing with adverse ESG-related events'. The reviewed studies suggest that while rating agencies actively evaluate sustainability risks, their methods may not consistently align with strong sustainability principles. The studies identified persisting differences in ratings between agencies and gaps in how sustainability concepts are integrated into evaluations.

Morningstar is a significant provider of data to the investment fund industry because of its international prestige and reliability [2, 27, 66, 67], and it is widely used by the sustainability rating agencies for information on ESG risks to make investment decisions [68]. Ferriani and Natoli [48] provide the most direct examination of rating agencies' methods and processes, comparing the Morningstar Sustainability Rating with the SFDR ESG disclosure requirements. This study determined that investors strongly rely on Morningstar's ESG risk indicators in order to inform their portfolio decisions, with more sustainable funds attracting larger net inflows. However, Sorrosal-Forradellas et al. [27] highlight a few limitations of this assessment, such as assigning a risk rating to the fund without discriminating the proportion of assets with ESG information. Therefore, considering the importance for both the financial market and the academic community, this study aims to propose an alternative fund sustainability risk rating aligned with the demands of investors most committed to sustainability, the new European regulations and the academic literature on ESG risk measurement.

Method

Morningstar Sustainability Rating

Morningstar provides ratings that enable investors to assess the performance, risk, and quality of investment funds. In particular, the Morningstar Sustainability Rating, which evaluates how well a fund's holdings address ESG risks, has become increasingly relevant [24, 69]. This is due to the growing trend of integrating sustainability factors into investment decisions. This rating is based on data from Sustainalytics—a leading provider of ESG research and ratings.

Morningstar uses Sustainalytics's ESG risk ratings of companies to calculate its own sustainability rating. These ratings are calculated for each fund based on the total number of funds in the same category and provided there are at least 30 funds in that category. To determine this rating, Morningstar considers the asset composition within the fund, specifically the percentage of the portfolio invested in corporate and sovereign assets. Both types of assets have an associated ESG risk score. Figure 1 illustrates the method employed by Morningstar to calculate the sustainability rating for each fund.

The process is detailed step by step below:

1. Calculation of the Portfolio Corporate Sustainability Score: Morningstar calculates this score, if the weight of corporate assets within the fund is at least 5%. It is calculated by weighting each company's ESG risk if at least 67% of the companies in the fund have an ESG risk score. The Portfolio Corporate Sustainability Score is calculated monthly and usually ranges from 0 to 50, where 0 indicates the lowest level of ESG risk
2. Calculation of the Historical Corporate Sustainability Score: This historical score is determined based on the Portfolio Corporate Sustainability Scores for the preceding 12 months. The monthly values are weighted by (12-n), where n is the number of months elapsed between the calculation of the score and the calculation of the historical score.
3. Calculation of the PCSR: Based on the Historical Corporate Sustainability Score, Morningstar assigns a PCSR in the following way:
   All funds within the same global category are ordered from highest to lowest based on their historical scores. These funds are then distributed into five groups: from 1 (the worst) to 5 (the best). The percentage of funds in each group is as follows: The top 10% funds are classified as high rating, the next 22.5% as above average, half of the 35% as average, the next 22.5% as below average, and the final 10% as low.
   The rating may be adjusted depending on the Portfolio Corporate Sustainability Score. This is adjusted based on the following criteria: (i) If the risk is between 30 and 35, the fund receives a maximum score of 3; (ii) if the risk is between 35 and 40, the fund receives a maximum score of 2; and (iii) if the risk exceeds 40, the fund receives a maximum score of 1.
4. Calculation of the Portfolio Sovereign Sustainability Rating: The same procedure is applied to the sover-

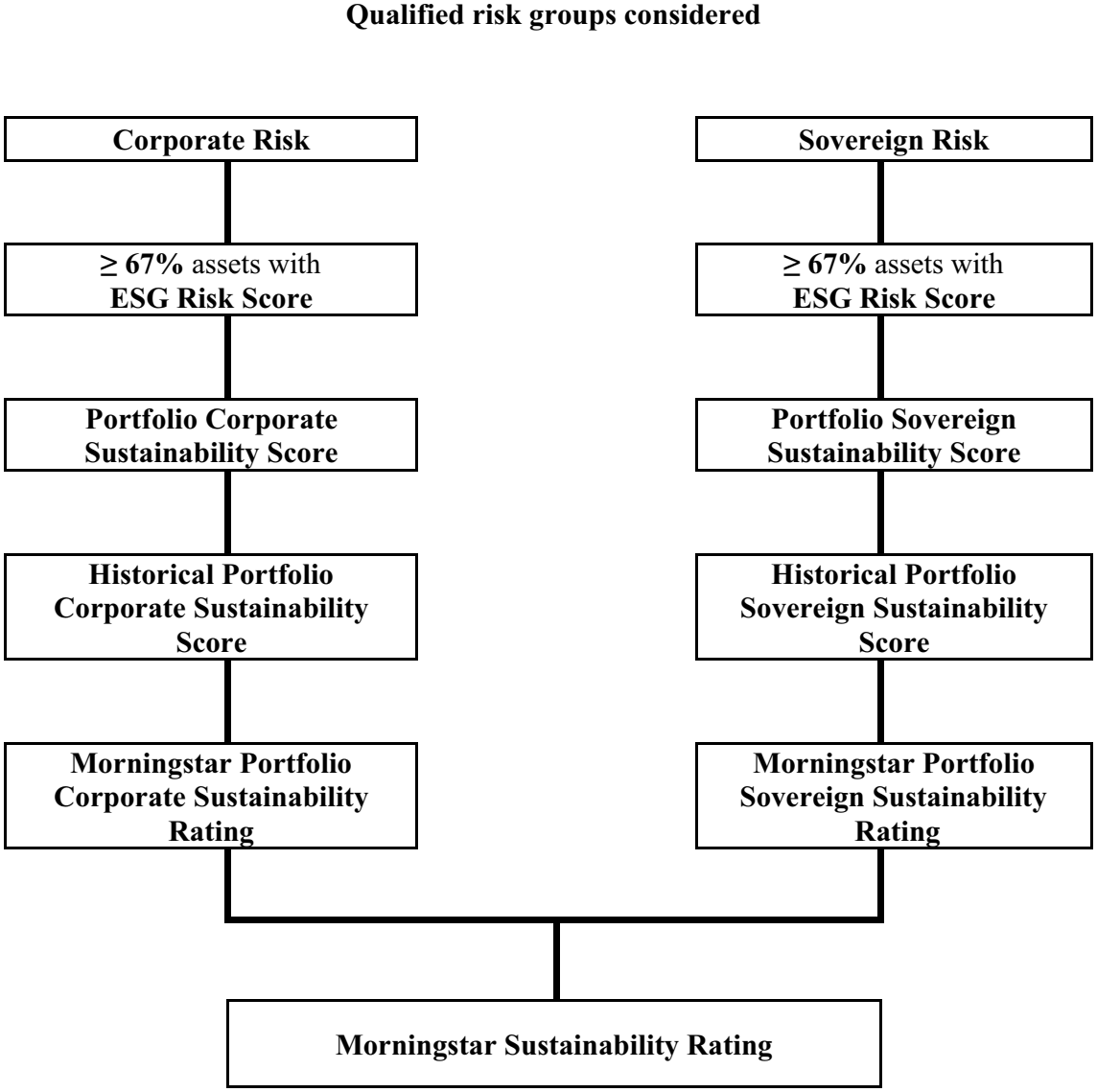

Fig. 1 Morningstar's procedure for obtaining the morningstar sustainability rating

eign assets within the fund, under the same conditions and steps.

Finally, the Morningstar Sustainability Rating is calculated by weighting the PCSR and the Portfolio Sovereign Sustainability Rating based on their proportion within the portfolio. The value is then rounded to the nearest integer. If the value is equidistant, it is rounded up to the higher integer number. Morningstar publishes the rating of each fund by assigning a number of globes equal to its rating.

A Proposal of a strong corporate sustainability rating

This study proposes an alternative approach that considers investors' sensitivity to sustainability issues. This approach, the 'Corporate Sustainability Managed Risk Rating' (CSMRR), is presented as an alternative to Morningstar's Corporate Portfolio Sustainability Rating for the evaluation of a fund's corporate risk. The method builds upon the data sourced from Morningstar's database, although our approach is designed for investors who prioritise strong sustainability.

The main difference between the current proposal and Morningstar's proposal relates to the assessment of ESG risks. While Morningstar uses an aggregate ESG

score, the proposed method evaluates each of the three ESG pillars (environmental, social, and governance). This distinction is based on the idea that investors with a strong preference for sustainability do not wish a single score that offsets the risks across multiple dimensions. Instead, they require investment funds to manage each risk individually (environmental, social, and governance). According to Escrig-Olmedo et al. [19], socially responsible investors demand high scores in all three dimensions. Such investors would not accept a fund that performs well in one area of ESG while performing poorly in another. To address this perspective, the following variables are introduced: Portfolio Environmental Risk Score, Portfolio Social Risk Score, and Portfolio Governance Risk Score—all of which are provided by Morningstar, as mentioned above.

Another important aspect of this method is the integration of ESG risk exposure and management as key components of sustainability assessment. The following variables are employed to incorporate these concepts: Portfolio Corporate ESG Risk Exposure Score and Portfolio Corporate ESG Managed Risk Score. According to the Morningstar Sustainability Rating method (2021), ESG exposure is defined as 'a measure of the extent to which a company is exposed to material ESG risks. Exposure can be considered as a sensitivity or vulnerability to ESG risks'. Meanwhile, ESG management is defined as 'a measure of a company's handling of material ESG issues through policies, programmes, quantitative performance, and involvement in controversies, as well as its management of corporate governance'. Boiral et al. [16] highlighted the importance of integrating risk management into risk assessment processes. To reflect both perspectives in a single measure, the ratio of managed risk to exposed risk is calculated. This ratio plays a key role in our proposal, as it is used to assess not only the fund's ability to mitigate ESG risks but also to penalise those that fail to manage their risk exposure effectively. Therefore, this approach enables investors with strong ESG preferences to make better-informed investment decisions based not only on a fund's current level of risk, but also on how well it actively manages and mitigates its ESG risks. Figure 2 summarises the procedure for obtaining the CSMRR.

The first step is to calculate the historical risk score for each ESG pillar (environmental, social, and governance) using the same method as applied by Morningstar. These historical scores are derived from the data of the preceding 12 months, with each month's score weighted accordingly. Historical scores are also calculated for ESG risk management and risk exposure.

Second, each fund is assigned a risk rating for each ESG pillar based on the historical scores calculated in the previous step, applying the same criteria as utilised for Morningstar's PCSR. The resulting ESG risk ratings are: Portfolio Environmental Risk Rating (ER), Portfolio Social Risk Rating (SR), and Portfolio Governance Risk Rating (GR).

Next, these ratings are aggregated. Unlike conventional methods, which allow risk scores to offset each other, this approach ensures that a fund cannot receive a high sustainability rating if it performs poorly in any of the three ESG pillars. Objective, reliable, transparent, and accurate decision rules are defined based on the literature and expert knowledge. To reach a consensus on these rules, two researchers acted as the primary coders, while the other two identified the inconsistencies in the rules and results [70].

The following procedure is therefore proposed to add the ratings of the three pillars of each fund:

$$\mathrm{ARR}_{\mathrm{ESG}} = \begin{cases} \min(\mathrm{ER}, \mathrm{SR}, \mathrm{GR}) & \text{if Average } (\mathrm{ER}, \mathrm{SR}, \mathrm{GR}) \\ & \leq \min(\mathrm{ER}, \mathrm{SR}, \mathrm{GR}) + 1 \\ \min(\mathrm{ER}, \mathrm{SR}, \mathrm{GR}) + 1 & \text{in other case} \end{cases} \quad (1)$$

This criterion ensures that the aggregation never assigns a rating to the fund higher than the average of the three pillar's ratings. For example, if the ratings of the three pillars of a fund are ER = 5 (high), SR = 2 (below average), and GR = 2 (below average), it would be assigned an $\mathrm{ARR}_{\mathrm{ESG}}$ of 2. If ER = 2 (below average), SR = 5 (high) and GR = 4 (above average), it would be assigned an $\mathrm{ARR}_{\mathrm{ESG}}$ of 3.

In the fourth step, the Corporate Sustainability Risk Rating (CSRR) is determined by taking the minimum value between the aggregate value of the three pillars and the PCSR of Morningstar:

$$\mathrm{CSRR} = \min\left\{\mathrm{ARR}_{\mathrm{ESG}},\ \text{Morningstar PCSR}\right\}$$

This ensures that the original rating is not disregarded, but rather acts as a constraining factor in the final evaluation.

Finally, in the fifth step, the CSMRR will consider the available ESG risk management information based on the risk management ratio (RMR) to ensure a strong sustainability assessment.

The RMR is calculated as the ratio between the Historical Portfolio Corporate ESG Managed Risk Score and the Historical Portfolio Corporate ESG Risk Exposure Score, both obtained with the same method as applied to calculate the historical ESG pillar scores. The ratio of these historical scores highlights the fund's efficiency in managing its exposure to inherent ESG risk:

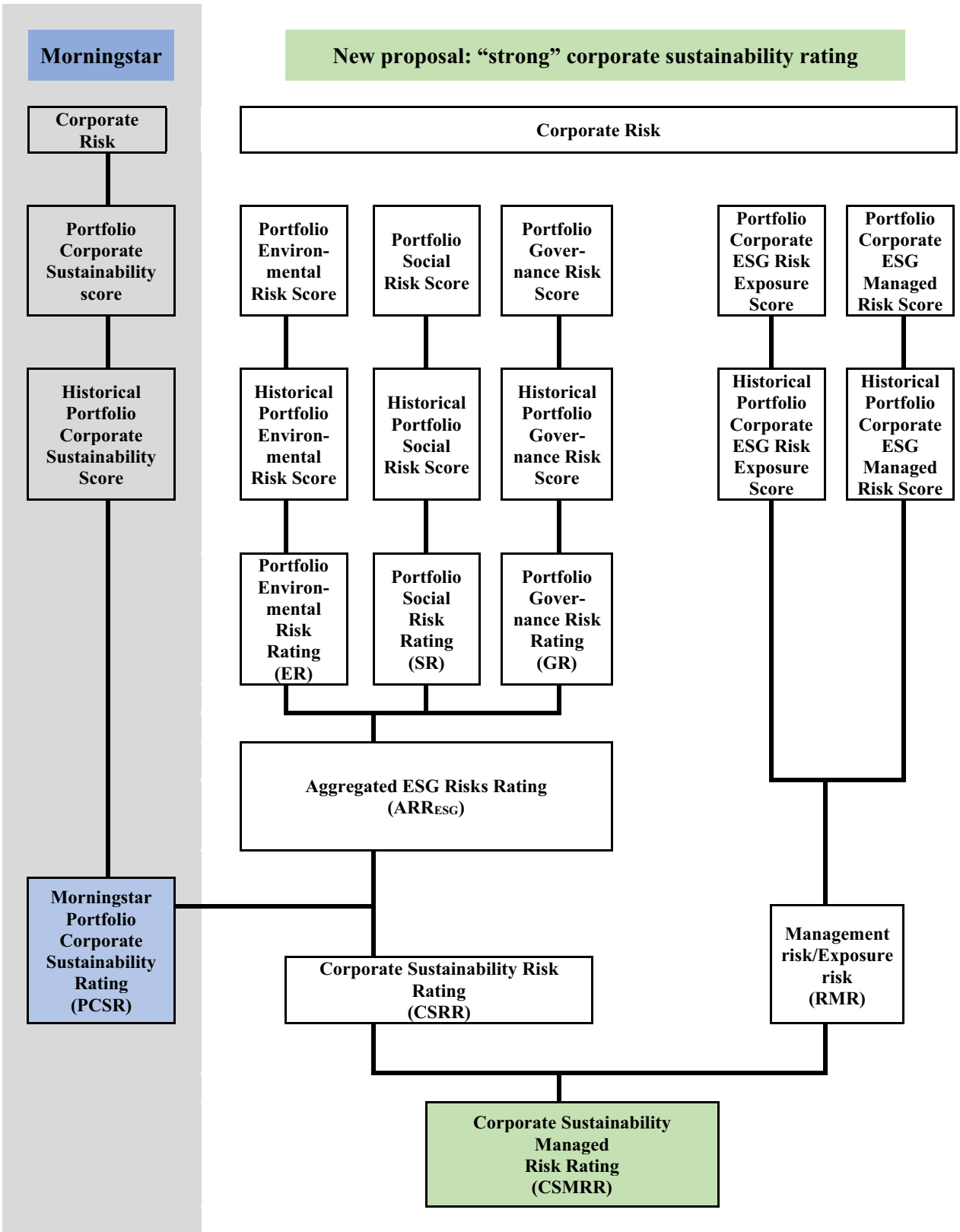

Fig. 2 Corporate sustainability managed risk rating proposal

$$\text{RMR} = \frac{\text{historical Portfolio ESG managed risk score}}{\text{historical Portfolio ESG risk exposure score}} \quad (2)$$

The rating for funds that do not effectively manage at least 40% of their ESG risk exposure is reduced by one:

$$\text{CSMRR} = \begin{cases} \text{CSRR} & \text{if RMR} \geq 0.4 \\ \max\{1,\ \text{CSRR} - 1\} & \text{if RMR} < 0.4 \end{cases} \quad (3)$$

This threshold of 40% was established based on professional practice in the European insurance and risk management sectors, where this coverage ratio is often used as a minimum standard. Similarly, García-Gómez et al. [71] also use 40% as the lower limit for acceptable control effectiveness.

In summary, the CSMRR calculation process requires the following for each fund:

1. Calculation of historical scores: Portfolio Environmental Risk, Portfolio Social Risk, Portfolio Governance Risk, Portfolio ESG Managed Risk, Portfolio ESG Risk Exposure.
2. Assignment of a risk rating for each pillar (environmental, social, and governance).
3. Calculation of the Risk Management Ratio.

Using the aforementioned data, the three previously discussed ratings are sequentially obtained: Aggregated ESG Risk Rating, Corporate Sustainability ESG Risk Rating, and Corporate Sustainability ESG Managed Risk Rating.

This procedure allows specific investor preferences to be taken into account by varying the criteria defined in (1) and (3). This can be done either by setting a maximum rating for a fund based on the minimum value of one of its pillars or by requiring a higher percentage of managed risk.

Sample description

The analysis is based on 724 equity funds that are classified within the 'Europe Equity Mid/Small' category according to Morningstar. The sample includes all funds in this category with a Morningstar Sustainability Rating as of December 2022. Europe was selected because it is a pioneer in sustainable finance, as demonstrated by initiatives such as the Action Plan on Sustainable Finance and the SFDR. Moreover, the focus on equity funds is justified by their dominance within the European sustainable fund market, where they represent about 61% of total sustainable assets under management [72]. This makes Europe an ideal context in which to analyse sustainability risks, particularly within the investment fund industry. As mentioned above, the data were obtained from the Morningstar Direct database.

Application to European equity investment funds

Descriptive statistics

Table 1 presents the descriptive statistics of the historical scores. It is noteworthy that a lower value of each ESG pillar indicates better sustainability risk behaviour.

The Historical Portfolio Corporate Sustainability Score averages 21.89, with scores ranging from 16.83 to 31.31. Meanwhile, the average risk scores for each of the three pillars ranges from 3.22 to 5.26. The values indicate a low level of risk in the evaluated funds.

The Portfolio Corporate ESG Risk Exposure Score indicates that, on average, funds within the Europe Mid/Small Cap category hold a moderately elevated risk exposure (38.80), especially compared to other categories or geographical regions [68]. In contrast, the Portfolio Corporate ESG Managed Risk Score highlights the ESG risk management efforts across these portfolios, with an average score of 17.13.

When the maximum and minimum observations across all metrics are assessed, it is evident that funds manage ESG risks in different ways. This indicates a potential scope for enhanced risk management.

Table 1 Descriptive statistics of the sample

	Mean	Standard deviation	Min	Max
Historical Portfolio Corporate Sustainability Score[a]	21.89	2.31	16.83	31.31
Historical Portfolio Environmental Risk Score[b]	3.22	1.65	0.01	9.25
Historical Portfolio Social Risk Score[b]	5.26	2.11	0.02	8.96
Historical Portfolio Governance Risk Score[b]	4.36	1.75	0.03	7.38
Historical Portfolio Corporate ESG Managed Risk Score[b]	17.13	4.41	3.06	30.38
Historical Portfolio Corporate ESG Risk Exposure Score[b]	38.80	4.95	10.27	53.62
Risk Management Ratio[b]	0.44	0.07	0.24	0.60

[a] Value obtained from Morningstar

[b] Own elaboration

To better understand the relationships among the ESG pillars, a correlation matrix was computed (Table 2). The results reveal strong and positive correlations between the ESG scores, suggesting that funds with high exposure to risk in one pillar tend to exhibit similar patterns in the others.

To assess whether the difference in mean values across the three ESG pillar scores are statistically significant, a contrast of means was conducted (Table 3). The results show that the differences in mean values are statistically significant at the 1% level ($p < 0.01$). These results justify the need for a rating system that evaluates each pillar separately, as done in the proposed method.

Finally, Fig. 3 shows how the RMR is distributed among the 724 equity funds analysed. The majority of funds have RMR values concentrated between 0.40 and 0.50, with a median of around 0.44. This confirms that 40% is a realistic and conservative threshold. Therefore, setting the limit at this level penalises funds whose ESG risk management is clearly below standard market practice while avoiding excessive restrictions.

Results

Table 4 presents the distribution of funds across each step of the classification proposal in relation to the Morningstar PCSR.

The distribution of funds according to ARR_{ESG} shows a similar pattern to that of the Morningstar PCSR. The percentage of funds concentrated in rating categories 4 and 5 decreases by 7.1% (from 32.5 to 25.4%), while in the lower rating levels (categories 1 and 2), the percentage of funds increases by 12.5%.

Examining the distribution of funds according to the CSRR, a significantly higher concentration is noted in rating categories 1 and 2, which together represent 66.3% of the total funds. This contrasts with the respective results of 32.5% and 45.0% observed with the Morningstar PCSR and ARR_{ESG}. Thus, only 3.0% of the total have a rating of 4, and no fund reaches rating 5.

Furthermore, applying the restriction that requires a minimum RMR of 40%, an even greater change in fund distribution is observed. In this scenario, the percentage of funds in ratings 1 and 2 rises to 73.2%, which further reinforces the impact of this requirement.

However, the percentage distribution of the funds in Table 4 could lead to erroneous conclusions about the impact of the pillar aggregation criterion on the fund ratings. Tables 5 and 6 justify this statement. Despite the similarity in distribution between the Morningstar PCSR and ARR_{ESG}, the funds classified within each rating differ significantly. Only 19.8% of the funds maintain the same position in relation to Morningstar's rating (Table 6), that is, 80.2% change their rating. These changes are not immediately evident in the overall distribution, as they are balanced by 30.2% of the funds improving and 50.0% deteriorating in their rankings (Table 6). The 100% with

Table 2 Correlation matrix of environmental, social, and governance risk scores

	Environmental risk score	Social risk score	Governance risk score
Environmental risk score	1.00	0.74	0.79
Social risk score	0.74	1.00	0.89
Governance risk score	0.79	0.89	1.00

Table 3 Contrast of means: ESG scores

Comparison	*t*-stat	*p*-value	Significance
Environmental risk vs social risk	−43,855	0.000	***
Environmental risk vs governance risk	−31,511	0.000	***
Social risk vs governance risk	38,834	0.000	***

Paired *t*-test was conducted to compare the mean scores of the ESG risk pillars across for the same set of equity funds

*** Significance level at 0.01

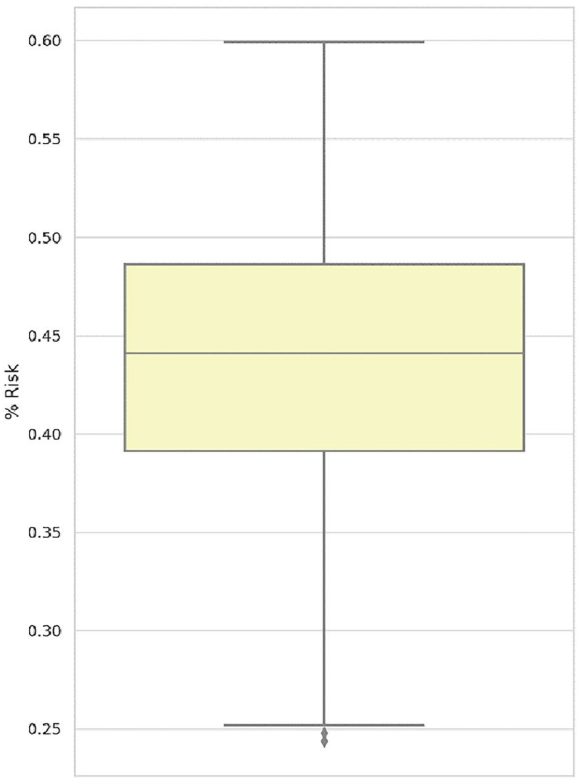

Fig. 3 Boxplot of the risk management ratio (RMR)

Table 4 Distribution of funds at each rating level

	Morningstar		**New proposal**					
	Portfolio Corporate Sustainability Rating		Aggregated ESG risk rating (**ARR_{ESG}**)		Corporate Sustainability Risk Rating (**CSRR**)		Corporate Sustainability Managed Risk Rating (**CSMRR**)	
Rating Category	Num		Num.		Num.		Num.	
1	72	10	113	15.6	178	24.6	268	37.0
2	163	22.5	213	29.4	302	41.7	262	36.2
3	254	35	214	29.6	222	30.7	178	24.6
4	163	22.5	134	18.5	22	3.0	16	2.2
5	72	10	50	6.9	0	0.0	0	0.0
Total	**724**	**100**	**724**	**100**	**724**	**100**	**724**	**100**

Table 5 Change of position in the ARR_{ESG} regarding the Morningstar PCSR

	Portfolio Corporate Sustainability Rating	Aggregate ESG Risk Rating									
Rating	**Num. Funds**	**Up 4**	**Up 3**	**Up 2**	**Up 1**	**Remain**	**Drop 1**	**Drop 2**	**Drop 3**	**Drop 4**	**Total Funds**
1	72	19	18	18	10	7					113
2	163		17	55	27	26	38				213
3	254			12	41	93	73	35			214
4	163				2	17	58	56	30		134
5	72					0	3	18	48	3	50
	724	**19**	**35**	**85**	**80**	**143**	**172**	**109**	**78**	**3**	**724**

Table 6 Description of the funds by at each level of ARR_{ESG} in relation to the Morningstar PCSR

	Aggregate ESG Risk Rating	Funds with the worst rating regarding the Morningstar PCSR		Funds with the same rating regarding the Morningstar PCSR.		Funds with the best rating regarding the Morningstar PCSR.	
Rating Category	Num. Funds	Num. Funds		Num. Fund		Num. Funds	
1	113	106	93.8	7	6.2	0	0.0
2	213	177	83.1	26	12.2	10	4.7
3	214	76	35.5	93	43.5	45	21.0
4	134	3	2.2	17	12.7	114	85.1
5	50	0	0.0	0	0.0	50	100.0
	724	362	50.0	143	19.8	176	30.2

the highest ARR_{ESG} correspond to funds that increased their rating with respect to the Morningstar PCSR. Conversely, 93.8% of the funds with the lowest ARR_{ESG} have higher ratings in the Morningstar system. Furthermore, 83.2% of the funds that maintain their rating (143 in total) are concentrated in ratings 2 and 3 (Table 5).

Table 7 presents how funds are distributed according to the CSRR and how this varies from the original Morningstar rating. By definition, the CSRR of each fund will always be equal to or lower than the PCSR, as it is the lower of the ARR_{ESG} and the Morningstar rating. As the rating increases, it is evident that the percentage of funds retaining their rating decreases, which reinforces our strong sustainability approach. Specifically, 77%, 57%, and 12% of funds with a rating of 2, 3, or 4, respectively, retain the same rating under the CSRR proposal. None of the funds is rated 5. Moreover, seven out of ten funds rated 5 according to Morningstar's PCSR have a rating that decreases by 3 or 4 positions under the CSRR proposal.

Table 8 displays the same data as Table 7 but focuses on the CSMRR. A comparison of the two tables shows that 143 funds (19.8%) experience a downgrade in their rating because of poor ESG risk management. This percentage would increase to 26.7% if the 50 funds classified at rating 1 were included, as these also do not reach the 40% managed risk threshold.

Investors with strong sustainability criteria are expected to consider only funds with a rating of 4 or 5 when making investment decisions. In the analysed group of funds, for example, the eligible set would decrease from 235 to 16 funds. Therefore, the results show that Morningstar's PCSR does not accurately reflect to the preferences of investors with a strong sustainability perspective.

Validation analysis

As the proposed method is based, at an initial stage, on the minimum values of the ESG pillar ratings, it is important to establish whether a dominant pillar exists in determining the aggregate value of the three pillars. To this end, a correlation analysis was conducted between the ESG Risk Ratings and the ARR (Table 9). The results demonstrate a strong positive correlation between the

Table 7 Change of positions in the CSRR regarding the Morningstar PCSR

	Portfolio Corporate Sustainability Rating	Corporate Sustainability Risk Rating					
Rating Category	Num. Funds	Num. Funds	Remain	Drops 1	Drops 2	Drops 3	Drops 4
1	72	178	72				
2	163	302	125	38			
3	254	222	146	73	35		
4	163	22	19	58	56	30	
5	72	0	0	3	18	48	3
	724	**724**	**362**	**172**	**109**	**78**	**3**

Table 8 Change of position in the CSMRR regarding the Morningstar PCSR

	Portfolio Corporate Sustainability Rating	Corporate Sustainability Managed Risk Rating					
Rating Category	Num. Funds	Num. Funds	Remain	Drops 1	Drops 2	Drops 3	Drops 4
1	72	268	72				
2	163	262	38	125			
3	254	178	96	121	37		
4	163	16	13	64	55	31	
5	72	0	0	3	18	48	3
	724	**724**	**219**	**313**	**110**	**79**	**3**

Table 9 Correlation matrix of Environmental, Social, and Governance Risk Ratings and ARR

	Environmental risk rating	Social risk rating	Governance risk rating	ARR
Environmental risk rating	1.00	0.74	0.79	0.89
Social risk rating	0.74	1.00	0.89	0.91
Governance risk rating	0.79	0.89	1.00	0.92
ARR	0.89	0.91	0.92	1.00

* *Note*: in this case, the correlations refer to the pillar ratings, rather than underlying raw scores

rating value of each pillar and the proposed aggregation method. This confirms that the ARR accurately reflects the combined pattern of the individual ESG pillars.

To assess whether a specific pillar has a predominant role, Table 10 shows the proportion of funds for which the minimum rating was uniquely determined by a single ESG pillar. A total of 202 funds had a minimum value for a single pillar that defined their aggregate rating. Of these, the environmental pillar was the most influential factor, being the unique minimum for 116 funds (21.9% of the total). The social and governance pillars contributed to rating adjustments in approximately 10% and 6% of cases, respectively. This suggests that environmental risk was the dominant factor driving downward adjustments.

To examine the consistency of the proposed rating system, correlation analyses were conducted between the Morningstar Corporate Sustainability Rating and the ratings obtained in this study (Table 11).

The correlation matrix indicates, first, that the CSMRR exhibits a strong correlation with the measure CSRR ($r=0.88$); second, a weaker, yet still positive, correlation between CSRR and ARR ($r=0.47$), and, third, that the CSMRR is moderately correlated with Morningstar's rating ($r=0.55$). The divergence in the assessment between the Morningstar Corporate Sustainability Rating and the non-compensatory aggregation of the three ESG pillar ratings is further supported by the negative correlation

Table 10 The proportion of funds for which one ESG pillar uniquely determined the ARR

Pillar	Number of funds with unique minimum rating in the pillar	% of total funds ($N=724$)
Environmental	116	21.9%
Social	53	10.1%
Governance	33	6.3%

Table 11 Correlation matrix between Morningstar Corporate Sustainability Rating and ARR, CSRR, and CSMRR

	MS corporate sustainability rating	ARR	CSRR	CSMRR
MS corporate sustainability rating	1.00	−0.27	0.44	0.55
ARR	−0.27	1.00	0.47	0.20
CSRR	0.44	0.47	1.00	0.88
CSMRR	0.55	0.20	0.88	1.00

between Morningstar's Sustainability Rating and the ARR ($r=-0.27$).

The robustness and relevance of the proposed CSMRR can also be observed when analysing the relationship between each rating level and the presence of ESG controversies. The Morningstar Direct database reports the percentage of assets under management (AUM) for each fund that are associated with holdings involved in ESG controversies. For this study, it is obtained the percentage of AUM with controversies (severe, high, significant, moderate, or low) and without controversies for each rating level, for both Morningstar Sustainability Rating and the proposed rating (Table 12).

The comparison reveals a significant difference between the two approaches. According to Morningstar's methodology, the highest-rated funds (ratings 4 and 5) concentrate the largest proportions of AUM exposed to ESG controversies. For example, 63.5% of the AUM of funds rated 5 and 52.5% of those rated 4 are invested in firms with reported controversies. By contrast, the proportion of AUM that is free from controversies is considerably higher in the lowest-rated funds (64.3% for rating 1 and 54.7% for rating 2). This suggests that Morningstar's sustainability rating does not fully capture actual exposure to ESG-related risks and may even rank highly some funds that are involved in a substantial number of controversies. In contrast, the results derived from the CSMRR demonstrate a much more coherent risk pattern. The highest-rated funds (rating 4) show the lowest exposure to ESG controversies (32.0%) and the highest proportion of AUM that is free from controversies (68.0%). The opposite occurs among lower-rated funds (ratings 1 and 2), where close to 50% of AUM is associated with controversies.

These results confirm that the proposed rating is aligned with the conceptual definition of sustainability risk, whereby higher ratings correspond to lower controversy exposure. Therefore, these findings support the validity of the CSMRR as a measure of sustainability risk based on a strong sustainability perspective.

Table 12 Distribution of AUM by ESG controversy and Morningstar Corporate Sustainability Rating

	With ESG Controversies *	No ESG Controversies
MS Corporate Sustainability Rating		
1	35.690	64.31
2	45.262	54.739
3	47.446	52.554
4	52.539	47.46
5	63.520	36.48
CSMRR		
1	48.333	51.667
2	50.985	49.015
3	47.201	52.799
4	32.048	67.953

Conclusions and limitations

Sustainability risks are becoming increasingly relevant, as emphasised by regulators, investors, internal and external auditors, and other stakeholders. Through the Sustainable Finance Action Plan, the EU is emphasising the importance of assessing and managing sustainability risks within the financial market. Indeed, the SFDR requires asset managers to report on the sustainability risks inherent to their investments. Many fund managers rely on the ratings provided by sustainability rating agencies to obtain this information. However, these methods are currently under scrutiny by the EU following the recent proposal to regulate ESG rating providers.

Considering the current regulations, global risks and uncertainties that the financial market must address, it is necessary to adopt a strong sustainability perspective in the risk management process [73]. In this context, this study aims to determine whether the financial market is evaluating sustainability risks using this approach. For this reason, Morningstar, one of the main providers of ESG information for the fund industry, is analysed. Following this analysis, an alternative method to assess the fund sustainability is proposed, aligned with a definition of 'strong sustainability' and considers the relationship between the fund's ESG managed risk and its exposure.

The approach focuses on analysing the ESG pillars individually and then, proposing a composite value, that considers all three pillars and Morningstar's PCSR. Additionally, it also examines how ESG risks are managed, in line with the academic literature. This proposal provides the information necessary to meet the needs of a sustainability-focused investor.

Comparing the original Morningstar PCSR with the new rating proposal, it can be observed that a significant number of funds that were previously highly rated by Morningstar have seen their ratings drop significantly.

It is noted that any funds achieved the top ranking in the new rating proposal, emphasising the challenges and demands of strong sustainability. This could prompt funds to move beyond basic sustainability practices and adopt more comprehensive strategies and initiatives.

From an academic and theoretical perspective, this study makes several contributions. First, it increases our understanding of Morningstar's method of assessing the ESG risks of investment funds. This will provide significant support to researchers examining the Morningstar Sustainability Rating. Second, it provides clear and comprehensive guidance on constructing a rating to evaluate the strong sustainability of mutual funds. Third, it introduces the managed risk as an additional variable in the ESG risk assessment process. This offers a risk assessment rating that considers the management of identified risks as well their impact.

From a professional and practical standpoint, the study is significant for the fund industry. In the current environment of global economic uncertainty, ESG rating methods must be rigorous, systematic, objective, and subject to validation and periodic review, as set out in the European Commission's proposal. In this context, this work will facilitate progress in measuring and improving the transparency of data, providing greater robustness for investor who are strongly committed to sustainability. The fund industry must regularly review and recalibrate its sustainability risk integration processes.

Although this research has provided valuable insights, it is important to acknowledge its limitations. The proposed model integrates a typology of investors with specific preferences into the sustainability risk assessment. To incorporate multiple dimensions of investor preferences, multi-criteria decision-making methods could be employed. Additionally, further refinements could improve model's adaptability to various investment strategies and regulatory developments. Furthermore, although governance (G) is treated as a separate pillar for clarity and comparability with existing ESG frameworks, this approach may oversimplify the complex interdependencies among ESG dimensions. In practice, G often functions as an enabler of social (S) and environmental (E) outcomes, which can amplify or mitigate their real-world performance and associated risks. Future research should investigate these interactions in order to more accurately capture the facilitating role of governance within ESG systems.

Another challenge stems from the current focus on a single fund category and geographical area. Extending the analysis to regions such as North America or Asia could establish whether the proposed strong sustainability model remains relevant and predictive globally. Furthermore, expanding the analysis to other fund categories or asset classes (e.g. fixed income, large cap, or global funds) would help assess the robustness and transferability of the model across different investment universes.

Temporal dynamics also represent an important frontier. The study considers a single point in time, which does not capture potential volatility or the evolution of ESG risk management practices across market cycles. Incorporating a time-series approach would offer valuable insights into how sustainability risk ratings perform in terms of stability, resilience and adaptability under varying economic and regulatory conditions.

Finally, the model's reliance on a single ESG data provider (Morningstar) presents a clear opportunity for methodological development. Future research could incorporate multiple ESG data sources in order to evaluate consistency, mitigate potential biases, and explore the influence of methodological differences on sustainability risk outcomes.

In summary, these challenges highlight significant opportunities for advancing the field. Addressing them could contribute to the development of a more comprehensive and globally applicable framework for sustainability risk assessment that captures cross-regional differences, temporal dynamics, and diverse investment contexts.

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Data availability
The data that support the findings of this study are available from the Morningstar Database. However, restrictions apply to the availability of these data, which were used under license for the current study and are not publicly available. Data are available from the authors upon reasonable request and with permission from Morningstar.

Declarations

Ethics approval and consent to participate
Not applicable.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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