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Article

Comparative assessment of ESG ratings methodology and results based on XBRL

Bence Lukács[1,*], Péter Molnár[1], Robert C. Rickards[2]

[1] Doctoral School of Regional and Economic Sciences, Széchenyi István University, 9026 Győr, Hungary
[2] Department of Business Administration–Public Management, German Police University, 48165 Muenster, Germany
*** Corresponding author:** Bence Lukács, bencelukacs1222@gmail.com

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Abstract: This study provides a comparative analysis of Environmental, Social, and Governance (ESG) ratings methodologies and explores the potential of eXtensible Business Reporting Language (XBRL) to enhance transparency and comparability in ESG reporting. Evaluating ratings from different agencies, the research identifies significant methodological inconsistencies that lead to conflicting information for investors and stakeholders. Statistical tests and adjusted rating scales confirm substantial divergence in ESG scores, primarily due to differing data categories and indicators used by rating firms. Using a sample of 265 European companies, the study demonstrates that individual ESG agencies report markedly different ratings for the same firms, which can mislead stakeholders. It proposes that XBRL based reporting can mitigate these inconsistencies by providing a standardized framework for data collection and reporting. XBRL enables accurate and efficient data collection, reducing human error and enhancing the transparency of ESG reports. The findings advocate for integrating XBRL in ESG reporting to achieve higher levels of comparability and reliability. The study calls for greater regulatory oversight and the adoption of standardized taxonomies in ESG reporting to ensure consistent and comparable data across sectors and jurisdictions. Despite challenges like the lack of a standardized taxonomy and inconsistent adoption, the research contends that XBRL can significantly improve the reliability of ESG ratings. In conclusion, this study suggests that standardizing ESG data through XBRL could provide a viable solution to the unreliability of current ESG rating scales, supporting sustainable business practices and informed decision making by investors.

Keywords: ESG ratings; ESG reporting; XBRL; sustainability reporting

1. Introduction

Environmental, social, and governance (ESG) ratings have become increasingly prominent in the financial sector as a field of business in general due to their capacity for evaluating business sustainability and ethical conduct. These multidimensional ratings have gained importance by going beyond conventional measures of financial performance. So, ESG ratings serve as indispensable tools for sophisticated investors and stakeholders alike, providing a nuanced framework for assessing a company's long term sustainability and its ability to withstand a range of risks. Additionally, they facilitate companies, effective engagement with a wide range of stakeholders.

This research addresses such challenges through a comparative study of ESG ratings from different agencies, pointing out sources of methodological inconsistencies that might originate with conflicting ratings of the same company. This research discusses the use of eXtensible Business Reporting Language (XBRL) as one of the ways to increase transparency and comparability of such ESG reports. XBRL

standardizes the financial reporting data collection and reporting processes, minimizing human errors and allowing for more reliable data analysis. It enables more transparent and comparable ESG reporting, because it standardizes the format and structure of the data. Standardization makes it easier for investors and other stakeholders to compare ESG performance across different companies and sectors. This research applies that framework to a sample of 265 European firms through the use of statistical tests of dispersion in ESG ratings and demonstrates ways in which XBRL can promote efficiency and harmonization in ESG data.

The key takeaways from this study show significant divergence in the ESG scores, mainly due to the differences in the data categories and indicators applied by the rating firms. Application of XBRL based reporting is promising, as that may overcome the challenges of common structure for ESG reporting. This would enhance the credibility and comparability of ratings issued by different agencies. It therefore contributes to the growing literature on sustainable finance and corporate governance with a new perspective on ESG data standardization, as well as practical ways forward for investors, companies, and regulators.

However, the use of XBRL also presents several public policy and regulatory challenges. One of the main challenges is the lack of a standardized taxonomy for ESG reporting. While XBRL provides a standard format for data, the content of the data (i.e., the specific ESG metrics reported) can vary widely between companies and sectors. The different formats makes it difficult to compare ESG performance on a like for like basis. Another challenge is the lack of regulatory oversight and enforcement. Even though some jurisdictions have mandatory XBRL reporting requirements, others do not, leading to inconsistent adoption and use of the technology. Although there are challenges, this research contends that XBRL could meaningfully enhance ESG reporting and promote more sustainable business practices. It calls for greater regulatory oversight and standardization of ESG reporting as well as increased adoption and use of XBRL.

The novelty of this paper lies in its application of XBRL to ESG reporting, a method traditionally reserved for financial data. By adapting XBRL to the realm of non financial information, this study opens new avenues for enhancing the integrity and consistency of ESG data. Furthermore, this research underscores the urgency for regulatory bodies to adopt standardized taxonomies for ESG reporting to ensure consistency across sectors and jurisdictions.

The paper is structured as follows: Section 2 reviews the relevant literature and the development of research hypotheses. Section 3 describes the materials and methods used in the analysis, including the adaptation of XBRL for ESG reporting. Section 4 presents the results, focusing on the divergence in ESG ratings and the potential of XBRL to resolve these issues. Finally, Section 5 concludes with the broader implications of the findings for stakeholders, alongside limitations of the study and directions for future research.

2. Literature review and hypothesis development

The literature summary was conducted by searching in Scopus using the search term “(xbrl) AND (esg OR non financial OR sustainability) AND (disclosure OR

reporting OR rating)" (Tóth et al., 2023). This search resulted in a total of 37 hits. After filtering for journal articles, after excluding conference papers and abstracts, 20 results remained that were Q rated journals. After manual examination of these 20 results, the final sample was reduced to 15 articles from Q1–Q3 rated journals. These articles are reviewed in this section.

2.1. Articles considering the global scope of sustainability reporting

The implementation of the XBRL (eXtensible Business Reporting Language) as a global standard for business reporting marks a significant shift in data management, particularly through the use of electronic tags to mark individual data elements (Suta et al., 2022). XBRL's effectiveness hinges heavily on stakeholder support, especially from employees who are often resistant to adopting new technologies (Chang et al., 2015). Therefore, establishing a strong foundation of support is vital for companies' long term sustainability. In terms of promoting XBRL's broader adoption, the existence of taxonomies and regulatory frameworks plays a crucial role (Mousa and Ozili, 2022). Molnár et al. (2023) highlighted the application of XBRL in sustainability accounting, particularly for tagging digital accounting elements, showing how it facilitates the tracking of sustainability data in alignment with the Global Reporting Initiative (GRI) guidelines (Tóth et al., 2021).

A key benefit of XBRL is its adaptability, allowing it to be used across various industries while enabling companies to meet mandatory ESG reporting requirements (Faccia et al., 2021). Initially, XBRL was used primarily for structured data, such as annual accounts, but its application has since expanded to include unstructured textual data. Despite these advancements, no efforts have yet been made to create an XBRL based income statement specifically tailored to ESG purposes (Faccia et al., 2021). XBRL has the potential to overcome the limitations of existing ESG methodologies by offering a new taxonomy for data convergence, though adoption can be slow as many users have not yet embraced this technology (Aksoy et al., 2021).

2.2. Articles considering the EU scope of sustainability reporting

Transitioning to the European context, the adoption of XBRL is gaining momentum, particularly in light of the European Union's Corporate Sustainability Reporting Directive (CSRD). The directive emphasizes the importance of aligning XBRL with non financial data, which is already in use for ESEF financial reporting and is being integrated into sustainability reporting frameworks (Miścikowska, 2022). However, Miścikowska's study found that only two companies had prior experience with XBRL, reflecting a broader reluctance among companies to expand its use, especially for non financial reporting. This resistance is often due to the difficulty in interpreting XBRL outputs, despite its potential to improve sustainability management through enhanced data administration and standardized reporting.

The research of Liu et al. (2017) demonstrates that XBRL adoption in Belgium has significantly improved market liquidity and reduced information asymmetry. The impact of XBRL appears to be particularly pronounced in non technology sectors, where it fosters transparency and accountability in financial reporting (Liu et al., 2017).

2.3. Articles considering the US scope of sustainability reporting

In the United States, XBRL has been mandatory for all exchange listed companies reporting to the Securities and Exchange Commission (SEC) since 15 June 2021. This shift included aligning XBRL with the Sustainability Accounting Standards Board's (SASB) standards to improve transparency in ESG reporting (Mousa and Ozili, 2022). Despite the standardization of XBRL data and reduced human intervention, the data are still primarily machine-readable, requiring specialized software to be converted into a more accessible format for human interpretation.

The potential of XBRL goes beyond financial data, extending to non financial disclosures such as those in the Global Reporting Initiative (GRI) and CDP reports (Muñoz et al., 2018). Moreover, the development of Digitally Uniform Reporting (DUR) in XBRL provides a real time, transparent platform for ESG data, which could enable regulatory bodies like the SEC to monitor sustainability performance (Seele, 2017). XBRL not only enhances sustainability but also strengthens the reliability of financial reporting by mitigating information risk and reducing asymmetry in uncertain information environments (Chou et al., 2016). The role of company specific characteristics in voluntary XBRL disclosure was confirmed by Kaya (2014), who found that larger firms are more likely to engage in extensive disclosure practices.

2.4. Research questions and hypotheses development

After the examination of the included articles, research questions were developed, to explore the improvement possibilities of ESG reporting if XBRL was applied as a standard for reporting practices. To further strengthen the research, the examination of the current state of sustainability reporting is also considered an important factor in the hypothesis development, by examining different ESG ratings worldwide, since the studied articles also handle ESG reporting and sustainability as a global issue.

Considering these factors, the following research questions were developed:

- RQ 1: How do ESG rating divergences manifest across different agencies (S&P Global, Sustainalytics, Refinitiv, MSCI), and what statistical methods can be used to quantify these divergences?
- RQ 2: How can XBRL based reporting frameworks address the ESG rating inconsistencies identified in previous research?
- RQ 3: What future steps could regulators, policymakers, and rating agencies take to ensure consistent and transparent ESG reporting through XBRL?

In the following section, the exact selected methodology is presented step by step, followed by the results and conclusions sections, where these research questions are answered separately.

3. Materials and methods

3.1. ESG divergence

The analysis in this study, involves two steps. First, it examines the ESG ratings of companies from varios sectors which are available in S&P Global's "The Sustainability Yearbook 2023". The 265 companies analysed were rated by four ESG

rating agencies (S&P Global, Sustainalytics, Refinitiv and MSCI). However, ratings were not available for all companies from all raters. To this end, it employs statistical tests. Second, based on the results of those tests and findings previously reported in the literature (Berg et al., 2022; XBRL 2022), the study proposes a novel approach to the methodology for ESG ratings. That approach utilizes XBRL reporting logic and the financial reporting framework.

A total of 265 companies were selected for study based on their ranking in the top 1%, 5%, and 10% on ESG indicators (S&P Global, 2023). Primary data included each company's name, industrial sector, and the country in which its headquarters are located. Next, firm scores computed by four ESG rating agencies (MSCI 2023a; Refinitiv 2023; S&P Global 2023; Sustainalytics 2023) were collected. Although potentially there were 4 ratings × 265 companies = 1060 enterprise ratings, after data cleaning, 995 company ratings remained for analysis.

S&P Global and Refinitiv score companies on rating scales ranging from 0 to 100. Sustainalytics and MSCI, however, use different scales. To make all four scales roughly comparable, Sustainalytics and MSCI's ratings had to be adjusted as follows. As shown in **Table 1**, on Sustainalytics's scale 0 is the best score, while higher numbers indicate worst scores. Consequently, the modified Sustainalytics scale now ranges from 0 to100 with 100 being the best possible score. Furthermore, five steps of ten points each were replaced with five steps of 20 points apiece.

Table 1. ESG agencies' rating scales.

	S&P Global	**Sustainalytics**	**Refinitiv**	**MSCI**
Rating scale	0–100	0–40+	0–100	CCC–AAA
Rating scale transformed	0–100	0–10 = 100–80 10–20 = 80–60 20–30 = 60–40 30–40 = 40–20 40+ = 20–0	0–100	CCC = 0–14 B = 14–28 BB = 28–42 BBB7 = 42–57 A = 57–71 AA = 71–85 AAA = 85–100 (average)

For MSCI, CCC is the worst score, and AAA is the best one. Because this scale consists of seven steps MSCI's ratings were modified by dividing the range from 0 to 100 into seven steps. Whereas there is no additional information on MSCI's ratings, the mean value of each step was used as the basis for scaling in the subsequent statistical analysis.

3.2. ESG rating development based on XBRL

Berg et al. (2022) find the differences in ESG raters' results derive mainly from differing measurement methodologies, while weighting is not much of a problem. Standardised data reporting would facilitate rating agencies' selection of the same information for use in computing a given firm's ESG scores. With the XBRL database and reporting format, homogeneous data communication can be implemented easily. **Figure 1** shows how financial and non financial reporting can be merged in XBRL

(XBRL, 2022). The presented approach facilitates the tagging of information. It also helps readers to interpret ESG agencies' reports.

To avoid "greenwashing," the XBRL based reporting approach provides additional tools, which simplify the production of transparent reports for auditing bodies. Furthermore, the ability to verify a given non-financial item with an accounting line item, hinders attempts by companies to engage in unsubstantiated reporting and other forms of greenwashing.

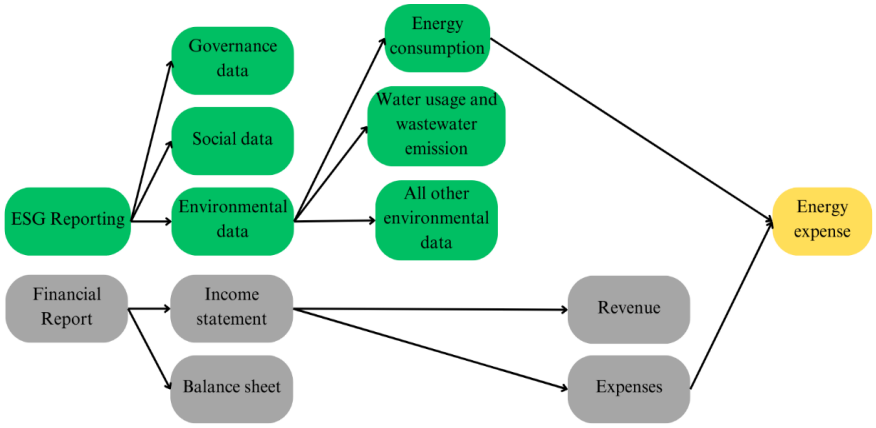

Figure 1. XBRL data that can be tagged in ESG and financial reporting (XBRL, 2022).

For ESG rating agencies, the logic illustrated in **Figure 1** also provides a more accurate score. Raters could weight data they extract as they wish to maintain their autonomy. By weighting differently, key characteristics can be preserved, when different methods take different elements into account.

4. Results

4.1. Results of ESG divergence tests

The descriptive statistics of ESG ratings for the 265 sampled companies are summarized in **Table 2**. Among the four ESG raters studied, MSCI's, methodology was the least comprehensible. Hence, adjusted MSCI ratings were available for only 215 companies.

Although the mean values for three agencies' ratings are similar, MSCI's mean rating is markedly lower than the others. The standard deviations are similar for S&P Global and Sustainalytics, but somewhat larger for Refinitiv and much larger for MSCI. In the case of MSCI, the larger standard deviation may be partly an artifact of the technique used to adjust its rating scale. However, the greater dispersion evident in Refinitiv's and MSCI's standard deviations underscores the fact that ratings are not comparable across all four performance methodologies. The Shapiro Wilk normality test yielded $p < 0.001$, indicating that the sample under study resulted in a non normal distribution of businesses' scores reported by all rating agencies.

Table 2. Descriptive statistics.

	S&P Global	Sustainalytics	Refinitiv	MSCI
Firms	265	265	265	265
Firms cleaned	265	259	256	215
Mean	81.9	79.9	78.2	71.7
Standard deviation	6.01	6.61	9.98	17.0
Minimum	62	60	32	21
Median	83	81	79	78
Maximum	94	93	96	93
Shapiro-Wilk *W*	0.969	0.970	0.955	0.886
Shaprio-Wilk *p*	<0.001	<0.001	<0.001	<0.001

Figure 2 shows the scores of the analysed firms with the largest ESG rating deviation. The largest deviation in the analysed sample was 34.15 points, while the smallest was 3.5.

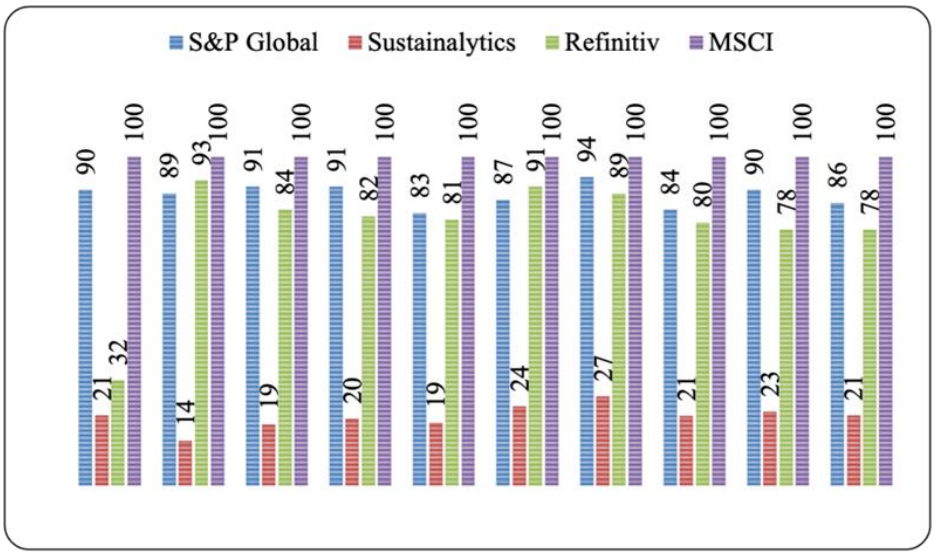

Figure 2. Biggest average discrepancies across the analyzed sample.

Table 3. Chi squared test of independence.

		Value	df	*p* value	*N*
S&P Global	Sustainalytics	848	900	0.892	259
S&P Global	Refinitiv	1270	1290	0.651	256
S&P Global	MSCI	140	150	0.705	215
Sustainalytics	Refinitiv	1461	1290	<0.001	253
Sustainalytics	MSCI	171	150	0.101	215
Refinitiv	MSCI	NaN	215	NaN	211

The chi squared test indicates that, for the sample under study, there are no statistically significant relationships among the company scores computed by the four ESG rating agencies, with one exception. That exception is the highly significant relationship ($p < 0.001$) between the scores of Sustainalytics and Refinitiv.

To examine differences in ESG ratings, Spearman's correlation was calculated. The results appear in **Table 4**. They suggest that the scores of the four ESG rating agencies are weakly correlated at best. The weak correlations nevertheless are statistically significant due to the large sample size. Previous literature likewise has uncovered differences in scores across ESG rating agencies when examining larger samples (Berg et al., 2022; Gibson Brandon et al., 2021). In **Table 4**, results are significant at the following levels: $p < 0.10$*, $p < 0.05$**, $p < 0.01$***.

Table 4. Spearman correlation co efficient.

	S&P Global	**Sustainalytics**	**Refinitiv**	**MSCI**
S&P Global	-			
Sustainalytics	0.255** N = 259	-		
Refinitiv	0.167** N = 256	0.159* N=253	-	
MSCI	0.184** N = 215	0.253*** N = 215	0.224** N = 211	-

Significant result $p < 0.05$ *, $p < 0.01$ **, $p < 0.001$ ***

4.2. Results of ESG rating development based on XBRL

Table 5 illustrates one example of how ESG rating agencies use different data categories for the same pillar. (Sustainalytics methodology was not accessible.) Examination of the methodologies also revealed differences in the labels used for the same indicator. The facciafa Parliament's regulation requires ESG rating agencies to ensure transparent, comparable disclosures by using common category and indicator labels for the same data (EU, 2023). Consequently, the forthcoming EU regulation could prove exemplary for the rest of the world.

Table 5. Examples of ESG rating providers' methodologies

ESG rating provider	**Pillar**	**Category**	**Indicator**
Refinitiv (2022)	Environmental	Resource use	Energy
MSCI (2023b)	Environmental	Environmental opportunities	Energy
S&P Global (2022)	Environmental	Operational eco efficiency	Energy use
Sustainalytics	-	-	-

From common starting points and items reported in a uniform way, rating companies easily could develop weighting schemes for scores in keeping with their own criteria. In addition, rating agencies could provide a clearer picture of what additional factors they consider. They could differentiate their ratings by relying on unique weighting methodologies.

Figure 3 depicts how harmonization based on XBRL (2022) methodology could work. Costs shown in the financial report, for example, could be linked to consumption values shown in the non financial report. In the present case, electricity consumption expressed in kWh in the non financial report could be corroborated with the firm's electricity expense in the financial report. XBRL would identify the two values with a

common tag. Such use of transparent data would result in smaller differences among ESG ratings (Berg et al., 2022).

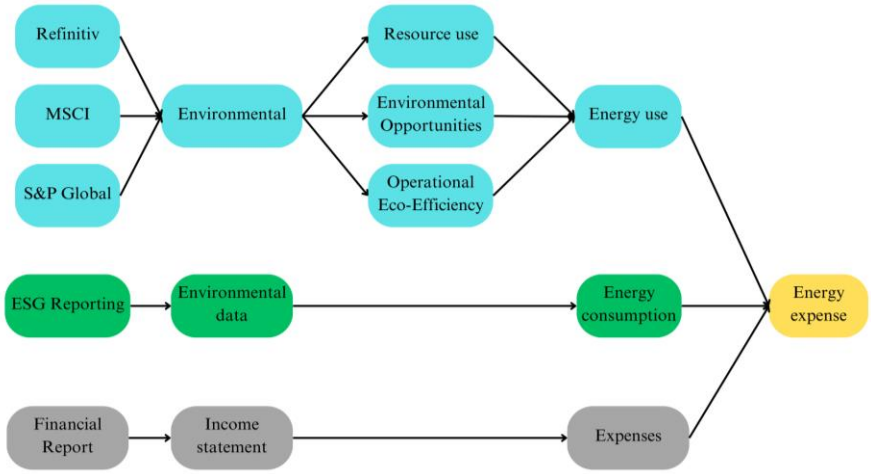

Figure 3. Harmonisation ESG reporting, financial reporting, ESG rating methodologies via XBRL (XBRL, 2022).

The present investigation's results agree with some findings of two earlier studies (Berg et al., 2022; Gibson Brandon et al., 2021). The first investigation found similar results for a larger sample. It encompassed seven ESG agencies' ratings of S&P 500 companies from 2010–2017. Its conclusion was that the differences among those ratings were so large as to preclude the need for statistical testing of their significance. Whereas no rescaling was undertaken, it is unclear whether the observed large differences resulted from incompatible scales, the use of different data or both causes. Moreover, the study proposed no solution to the problem of rival evaluation methodologies.

The second inquiry was based on six ESG agencies and their ratings for 924 companies. In contrast to the first investigation, it calculated Krippendorff's alpha, which indicates the reliability of the rating assessments across those agencies. The statistical test results showed those ratings to be unreliable. That research, however, also did not consider scaling differences as a potential source for the evident unreliability in ratings, nor did it suggest a plausible way to overcome the obstacle of the agencies' incompatible methodologies.

5. Conclusions

Answers to the research questions:

RQ 1: How do ESG rating divergences manifest across different agencies (S&P Global, Sustainalytics, Refinitiv, MSCI), and what statistical methods can be used to quantify these divergences?—ESG rating divergences manifest across different agencies due to differences in rating scales and methodologies, and these divergences can be quantified using chi squared tests, Spearman's correlation, and descriptive statistics.

RQ 2: How can XBRL based reporting frameworks address the ESG rating inconsistencies identified in previous research?—XBRL based reporting frameworks

can address ESG rating inconsistencies by facilitating standardized data tagging and reporting, allowing for more transparent and comparable scores across agencies.

RQ 3: What future steps could regulators, policymakers, and rating agencies take to ensure consistent and transparent ESG reporting through XBRL?—Regulators, policymakers, and rating agencies could ensure consistent and transparent ESG reporting by developing a unified taxonomy, enforcing common category and indicator labels, and promoting the adoption of XBRL for both financial and non financial reporting.

ESG ratings can make a big difference in the stakeholders' perception of a business. Not only its reputation, but also investor support may depend on an enterprise's ESG evaluation. Yet, ESG scores can vary greatly for a given company (Avramov et al., 2022). Based on the literature reviewed, XBRL could allow for more consistent, transparent reporting. These benefits apply to both financial and non-financial disclosures (Tóth et al., 2021).

In summary, the present study examined 265 companies that had the best S&P Global ESG ratings (S&P Global, 2023). S&P Global's rating scores for these companies were compared with those computed by three additional ESG agencies (Sustainalytics, Refinitiv, MSCI). A total of 265 companies were subjected to chi square and correlation analyses using data from 4 ESG raters. The results show that individual ESG agencies report different ESG ratings for the same firm.

By adjusting the ESG agencies' scales, the present research largely has eliminated them as a source of unreliable ratings, which leaves utilization of incomparable categories and indicators as the main problem. Hence, the solution recommended here is for ESG agencies to calculate their ratings with information extracted from XBRL databases. Whereas XBRL tagging procedures for annual corporate reports are transparent, the data extracted by the agencies should be identical. This proposal could be helpful to regulators and policy makers too. It could guide them in formulating the EU's planned 2024 ESG rating transparency regulation (EU, 2023).

ESG ratings are shaping both today's stock markets and companies' futures. Furthermore, policy makers and regulators increasingly are emphasizing the importance of ESG reporting by companies. However, practitioners must exercise caution in using those reports because ratings currently are unreliable across ESG agencies. XBRL has the potential to create a transparent, common basis for comparable, reliable ESG ratings. Such understandable, unambiguous ratings certainly will be much appreciated by investors and other stakeholders. So, the next step in this research journey will be to demonstrate that XBRL based ratings are indeed comparable across ESG agencies.

Despite the promising findings of this study, several limitations should be acknowledged. First, the research primarily focuses on a sample of 265 European companies, which may limit the generalizability of the results to other regions or industries. Future research could expand the scope by including a more diverse sample, covering companies from different geographical locations and sectors to validate the findings across a broader spectrum. Second, while the study highlights the potential of XBRL for standardizing ESG reporting, the lack of a universally accepted

taxonomy for ESG data remains a significant challenge. Developing such a taxonomy is essential for the widespread adoption of XBRL in ESG reporting.

The study assumes that the implementation of XBRL will reduce discrepancies in ESG ratings, but the practical challenges of adoption, such as technical barriers and costs, were not extensively analyzed. Future research should explore the practicalities of integrating XBRL into existing reporting frameworks, particularly from a regulatory and operational standpoint.

Furthermore, the research on the potential of this approach to be adopted or resisted by various ESG rating agencies may give further insights into the feasibility of XBRL standardization. In turn, these contributions are important for a wide range of users. This study has important implications for regulators and policy makers since it underlines an urgent need for uniform ESG taxonomies and increased regulatory oversight in pursuit of consistent and transparent disclosure. In this regard, investors also benefit from improved reliability and comparability of ESG ratings to make better decision making aligned with sustainable investment objectives. Lastly, the companies' ESG reporting using XBRL may lead to greater trust by stakeholders in their transparency and foster more sustainable and responsible business.

Author contributions: Conceptualization, BL; methodology, BL; software, BL; validation, BL, and RCR; formal analysis, PM; investigation, BL; resources, BL; data curation, BL; writing—original draft preparation, BL, and RCR; writing—review and editing, BL, and RCR; visualization, PM; supervision, RCR; project administration, BL; funding acquisition, BL. All authors have read and agreed to the published version of the manuscript."

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