| RESEARCH ARTICLE

Exchange Rate Volatility and ESG Performance: An International Empirical Analysis

Hamzeh Al Amosh[1,2,3]

[1]Department of Financial Intelligence, University of South Africa, Pretoria, South Africa | [2]Jadara University Research Center, Jadara University, Jordan | [3]Ministry of Education and Higher Education Qatar, Doha, Qatar

Correspondence: Hamzeh Al Amosh (hamza_omosh@yahoo.com)

ABSTRACT

This study examines the impact of exchange rate volatility (ERV) on environmental, social, and governance (ESG) performance using a large dataset of 15,196 firms from various countries, covering the period from 2012 to 2019. By employing a comprehensive set of statistical tests, including the system generalized method of moments (GMM) estimation technique, the research provides robust empirical evidence on how ERV influences different dimensions of ESG performance. The results reveal a significant negative effect of ERV on ESG performance, indicating that greater exchange rate instability adversely impacts firms' sustainability practices across ESG aspects. Companies may have difficulty complying with evolving regulations and stakeholder expectations when faced with volatile exchange rates, negatively impacting their ESG performance. Regulatory responses to exchange rate fluctuations may also create compliance burdens, and the difficulty in securing resources limits their ability to invest in sustainable technologies and practices. From an efficient market hypothesis (EMH) perspective, these findings suggest that ERV introduces additional risks and uncertainties that the market reflects in corporate valuations and performance metrics, thereby affecting ESG outcomes. The study highlights implications for policymakers, investors, and corporate managers, emphasizing the need for strategies to mitigate the adverse effects of ERV on ESG performance. Limitations of the study and directions for future research are discussed, calling for further exploration of the interplay between macroeconomic factors and corporate sustainability initiatives.

1 | Introduction

The global financial landscape is increasingly influenced by a myriad of factors, among which the stability of exchange rates plays a critical role. Exchange rates, the price at which one currency can be exchanged for another, are pivotal in shaping international trade, investment decisions, and the overall economic health of nations (Feng et al. 2021). Their stability, or lack thereof, has far-reaching implications, affecting everything from multinational corporations' operational costs to the pricing of commodities on the global market. In parallel, the concept of environmental, social, and governance (ESG) metrics has risen to the forefront of corporate and investment discourse (Al Amosh 2024). ESG metrics evaluate a company's collective conscientiousness for social and environmental factors, encompassing a wide range of issues such as carbon emissions, labor practices, and corporate governance structures. The rise of ESG is reflective of a broader shift in the investment community, where stakeholders are increasingly recognizing that long-term sustainable returns are inextricably linked to responsible corporate behavior and societal well-being.

The interplay between exchange rate stability and ESG performance is particularly poignant in today's interconnected world.

Exchange rate volatility (ERV) can have immediate and significant impacts on an organization's financial performance, especially for those operating internationally. These financial fluctuations can, in turn, influence a company's ability to invest in and maintain sustainable practices, potentially impacting its ESG ratings and attractiveness to socially conscious investors. For instance, a company operating in a country experiencing currency devaluation may face increased costs for imported materials (Cooper 2019), which could lead to cost-cutting measures that negatively impact its social and environmental commitments. Conversely, a stable exchange rate environment might provide a more predictable financial landscape, enabling companies to plan and invest more effectively in sustainable practices.

Additionally, investors who incorporate ESG criteria into their investment decisions often look for stability and predictability in their investments. ERV can introduce an additional layer of risk, potentially deterring investment in otherwise sound companies. Understanding how exchange rate stability influences a company's ESG performance can therefore provide valuable insights for investors seeking to balance financial returns with social and environmental impact. Moreover, the concept of ESG itself is evolving. Initially focused on corporate governance and ethical business practices, it has expanded to include a broader range of environmental and social issues. This evolution reflects a growing recognition that sustainable business practices are not just ethical choices, but also key drivers of long-term business success and resilience.

In the evolving landscape of global finance, the stability of exchange rates has emerged as a pivotal factor influencing the dynamics of international trade and investment decisions. Exchange rate stability is a key concern for multinational corporations and investors, as it affects investment returns and economic decisions. The ESG performance of companies, on the other hand, has gained substantial attention, as it is seen as indicative of long-term corporate health and sustainability (Al Amosh, 2024). Research has shown that ESG factors are increasingly considered in investment decisions, reflecting a shift toward more sustainable and socially responsible business practices (Friede, Busch, and Bassen 2015). However, the volatility of exchange rates can significantly impact the financial performance of companies, particularly those with global operations, potentially influencing their ESG performance and sustainability strategies.

Despite the growing body of literature on ESG investing and exchange rates, there remains a significant gap in understanding how exchange rate stability influences ESG performance. Most studies have focused on either the financial implications of exchange rate fluctuations (Bénassy-Quéré, Coupet, and Mayer 2007) or the determinants and impacts of ESG performance (Khan, Serafeim, and Yoon 2016), without integrating the two. This lack of integration leaves a critical void in understanding the comprehensive impact of macroeconomic variables, like exchange rates, on sustainable business practices.

This study aims to explore the intricate relationship between ERV and ESG performance metrics, two dimensions that are increasingly relevant in the context of sustainable and responsible investing. While exchange rate fluctuations reflect the complexities of global economic interactions, ESG metrics represent a growing focus on corporate responsibility and sustainable business practices. The intersection of these two domains offers fertile ground for exploring how financial stability is intertwined with sustainable development goals. Furthermore, this investigation aims to bridge this gap by examining the relationship between exchange rate stability and ESG performance. By integrating these two critical areas, the research provides novel insights into how macroeconomic stability affects corporate sustainability efforts. The findings of this study are expected to offer significant implications for policymakers, investors, and business leaders. For policymakers, understanding this relationship could guide the formulation of economic policies that promote sustainable business practices. Investors may gain a deeper understanding of how exchange rate risks factor into sustainable investment decisions. For business leaders, this research could inform strategies for managing financial risks associated with ERV while advancing their ESG objectives.

By bridging the gap between the fields of international finance and sustainability, this study contributes to the growing body of knowledge on the integration of financial and nonfinancial considerations in decision-making processes. The findings of this research will offer valuable guidance to investors, policymakers, and corporate leaders in assessing the potential risks and opportunities arising from exchange rate fluctuations and their impact on ESG performance. Ultimately, this paper aims to facilitate informed decision-making and promote the adoption of sustainable business practices in an increasingly interconnected and dynamic global landscape.

This study holds significant importance as it seeks to investigate the relationship between ERV and ESG performance, a relationship that has received limited attention in existing literature. To the best of the authors' knowledge, this study represents the first attempt to empirically analyze the potential impact of exchange rate stability on corporate ESG performance. The novelty and relevance of this research lie in several key contributions. Firstly, the study addresses a notable gap in the literature by examining the relationship between exchange rate stability and ESG performance. While previous studies have explored various factors influencing ESG performance, such as corporate governance practices and environmental regulations, the role of exchange rate stability has remained relatively unexplored. By filling this gap, the study contributes to a deeper understanding of the determinants of corporate sustainability. Secondly, by incorporating insights from the efficiency market hypothesis (EMH), the study sheds light on how market efficiency and investor sentiment may influence the relationship between exchange rate stability and ESG performance. Understanding these market dynamics is crucial for investors, policymakers, and corporate decision-makers seeking to navigate the complex interplay between financial markets and sustainability considerations.

The remaining sections of the study are organized as follows: Section 2 examining the theoretical foundations. Section 3 provides a detailed literature review and related empirical studies. Section 4 outlines the research methodology, describing the data sources, sample selection, and the econometric model used for the analysis. Section 5 presents the empirical results, offering a discussion of the findings in the existing literature context and theoretical frameworks. Section 6 concludes the

study, summarizing the main findings, theoretical and practical implications, limitations, and suggestions for future research.

2 | Theoretical Framework

The study is based on a two-pronged theoretical framework, the first of which is established social responsibility theories and the second is the EMH, to provide a comprehensive understanding of how ERV influences corporate behavior toward sustainability.

2.1 | Well-Established Theories of Social Responsibility

Stakeholder theory emphasizes that organizations have a responsibility to consider the interests and concerns of all stakeholders, including shareholders, employees, customers, suppliers, and the broader community (Swart and Shuttleworth 2021). This theory highlights the need for companies to manage their ESG impacts in a manner that aligns with the expectations of these diverse groups. As stakeholders increasingly demand transparency and ethical practices, companies must demonstrate a strong commitment to sustainability (Esterhuyse 2020; Ananzeh 2022). The influence of exchange rate fluctuations plays a crucial role in this dynamic, as it can significantly impact the costs of raw materials, production, and exports. When currency values fluctuate, companies face financial uncertainty, which can lead to increased scrutiny from stakeholders regarding the environmental and resource management practices of the firm. For instance, when a company operates in a region where the currency depreciates, the cost of importing raw materials may rise, placing pressure on operational budgets and environmental strategies. Stakeholders, particularly those concerned with environmental sustainability, may expect companies to optimize resource use and minimize environmental harm despite these economic challenges. This situation forces organizations to strike a balance between maintaining profitability and meeting their environmental commitments, often under the watchful eyes of stakeholders who value responsible stewardship.

Moreover, maintaining stable exchange rates contributes to greater predictability in a company's operations and financial performance, which, in turn, helps preserve stakeholder confidence. Predictability is key to effective risk management, as stable exchange rates allow companies to plan their supply chains, pricing strategies, and long-term sustainability goals with fewer disruptions (Feng et al. 2021). This stability fosters trust among stakeholders, as it signals the company's ability to navigate financial challenges while upholding its commitment to ESG practices. In this way, stable exchange rates not only help companies meet their financial targets but also enable them to fulfill their broader social and environmental responsibilities. Additionally, stable exchange rates allow companies to engage more effectively with their stakeholders by providing a consistent foundation for communication and strategic planning. When companies can reliably predict financial outcomes, they are better equipped to understand and respond to stakeholder concerns, ensuring that their sustainability efforts are in line with stakeholder expectations. As a result, organizations can build stronger, more enduring relationships with their stakeholders, further solidifying their reputations as socially responsible entities.

Institutional theory posits that organizations are influenced by institutional pressures and norms, which guide their behaviors and strategic decisions to achieve legitimacy and competitive advantage within their respective environments. Also, regulatory responses to ERV play a crucial role in shaping corporate behaviors toward ESG practices. Governments and regulatory bodies often respond to economic instability caused by exchange rate fluctuations by implementing policies that affect corporate reporting requirements and performance expectations. For instance, during periods of heightened volatility, regulators may prioritize stability measures that influence how companies allocate resources toward sustainable initiatives (Al Amosh, Khatib, and Ananzeh 2024). Moreover, exchange rate stability provides companies operating in stable currency environments with a comparative advantage (Alshubiri 2022). These firms are perceived as more reliable and less risky by investors, particularly those focused on ESG criteria. Stability in exchange rates enhances predictability in financial outcomes and reduces the uncertainty associated with international investments. Consequently, companies in stable currency environments may find it easier to attract ESG-conscious investors and access sustainable investment funds compared to their counterparts facing greater currency volatility.

Resource dependency theory highlights the interdependence between organizations and external resources, such as capital and market access, which are crucial for their operations and strategic initiatives (Pfeffer and Salancik 2015). This theoretical perspective provides insights into how exchange rates impact these external dependencies and, consequently, influence organizations' ESG performance. Stable exchange rates can significantly affect ESG performance through two primary mechanisms as described in the literature. Firstly, stable exchange rates may facilitate easier access to international capital markets for companies committed to ESG practices. When exchange rates are stable, companies face reduced uncertainty in financial transactions and international investments. This stability enhances investor confidence and lowers perceived risks associated with currency fluctuations, making it more attractive for companies to secure financing for sustainable initiatives. Moreover, stable exchange rates can improve the terms on which capital is obtained, potentially lowering borrowing costs and improving overall financial health, which are critical for funding ESG projects.

Secondly, exchange rate stability can create favorable market opportunities for companies to invest in sustainable technologies and practices (Guzman, Ocampo, and Stiglitz 2018). Predictable exchange rates contribute to a stable economic environment, enabling companies to plan and execute long-term investments in ESG initiatives without the disruption of currency volatility. This stability fosters confidence among stakeholders, including consumers, investors, and regulators, facilitating smoother adoption of sustainable practices. Furthermore, companies operating in stable currency environments may seize competitive advantages in international markets by leveraging favorable exchange rates to expand their sustainable offerings and capitalize on growing global demand for environmentally and socially responsible products and services.

2.2 | Efficient-market hypothesis (EMH)EMH

This theory argues that financial markets efficiently incorporate all available information into asset prices (Ţiţan 2015). Exchange rate stability can serve as an indicator of economic stability, signaling a favorable business environment with reduced uncertainty for investors. According to EMH, financial markets are quick to adjust asset prices in response to new information. Thus, stable exchange rates may lead to increased investor confidence and optimism about the economic prospects of a country or region. Stable exchange rates reduce currency risk and enhance predictability in returns, making investments in regions with stable currencies more attractive to investors. Companies operating in such environments may benefit from increased access to capital and lower financing costs, allowing them to invest in ESG initiatives and enhance their overall sustainability profile. Moreover, exchange rate stability may signal economic stability, leading to increased investor confidence and potentially higher valuations for companies with strong ESG performance. Companies with strong ESG performance are likely to be viewed favorably by investors, as they demonstrate a commitment to sustainable business practices and long-term value creation (Bofinger et al. 2022).

Stable exchange rates may signal economic stability, leading to increased investor confidence and potentially higher valuations for companies with strong ESG performance. This underscores the importance of considering market factors and investor sentiment in analyzing the impact of exchange rate stability on corporate behavior and sustainability outcomes. When exchange rates remain stable over time, they often serve as a reliable indicator of economic stability, signaling to investors that a country or region is characterized by robust economic fundamentals and predictable macroeconomic conditions. This stability fosters investor confidence and optimism about the economic prospects of the region, encouraging capital inflows and stimulating investment activity.

Furthermore, stable exchange rates reduce currency risk and enhance predictability in returns, making investments in regions with stable currencies more attractive to investors. This can result in increased demand for securities from companies with strong ESG performance, leading to higher valuations and lower financing costs. As a result, companies with strong ESG performance may enjoy a competitive advantage in accessing capital and attracting investment.

ERV is the fluctuation of the price of one currency against another and is a measure of the standard deviation of a change in value. These fluctuations can have a variety of different effects on companies. At one end of the scale, or in other words, for certain types of companies, changes in exchange rates can mean that international investment projects either become far too dangerous to carry out or too profitable to resist. At the other end, it could mean that a company is forced to alter prices and profit margins in order to stay competitive, selling its product in a foreign country but at a price similar to the one at home.

Moreover, high ERV is cited as the reason for currency risk, which is described as the potential for unexpected detrimental changes in the exchange rate. Currency risk is widely perceived to be a risk specific only to multinational companies, as it arises from international business activity. ERV can change the value of incoming investment money, alter the price of imports and exports, and can hinder or improve competitiveness in different industries. All these effects are still dependent on the direction and magnitude of exchange rate changes, but they all imply that ERV can be either bad or good for ESG performance. Although the nature of these effects may seem obvious, it is very difficult to generalize and say how ERV does affect any one specific activity, as it is dependent on a variety of other factors.

The EMH asserts that financial markets efficiently incorporate all available information into asset prices, making it difficult for investors to consistently outperform the market through active trading or analysis of publicly available information (Fama 1970). This hypothesis is based on the idea that investors quickly adjust asset prices in response to new information, leading to prices that accurately reflect the intrinsic value of assets (Fama 1991). Under EMH, the efficiency of financial markets has profound implications for corporate behavior and performance. If markets are indeed efficient, then companies operating within them are incentivized to respond to market signals and adjust their strategies accordingly. This includes considerations of ESG factors, as these are increasingly recognized as material to long-term business success (Clarkson et al. 2014). The efficient market hypothesis (EMH) implies that market participants incorporate information about a company's ESG performance into its stock price, reflecting investors' expectations of future financial performance and risk. Companies with strong ESG practices may be perceived as less risky and more sustainable, leading to potentially higher valuations and lower costs of capital (Hong and Kacperczyk 2009). Conversely, companies with poor ESG performance may face higher costs of capital and decreased investor interest due to perceived risks and liabilities associated with environmental and social issues (Eccles, Ioannou, and Serafeim 2014).

Moreover, EMH suggests that market participants are sensitive to broader macroeconomic factors, including exchange rate stability, which can influence investor confidence and risk perceptions. Stable exchange rates may signal economic stability, fostering investor confidence and positively impacting the valuation of companies with strong ESG performance (Chen et al. 2018). Empirical studies provide support for the link between market efficiency, ESG performance, and company valuation. Research by Derwall et al. (2005) found that companies with higher ESG ratings tend to exhibit higher financial performance and valuation, suggesting that investors incorporate ESG considerations into their investment decisions. Similarly, studies by Edmans (2011) and Dimson et al. (2015) found a positive correlation between corporate social responsibility (CSR) activities and financial performance, indicating that market participants value companies with strong ESG practices.

3 | Literature Review and Hypotheses Development

Exchange rate stability with financial stability plays a crucial role in shaping the performance and behavior of companies, influencing their strategic decisions, investment patterns, and overall

sustainability. While existing literature has extensively explored various aspects of financial stability, including its macroeconomic implications and regulatory frameworks, relatively fewer studies have directly examined its impact on corporate performance. Simultaneously, the integration of ESG considerations into business strategies has emerged as a prominent driver of long-term sustainability and value creation for companies across various industries. Nonetheless, empirical studies did not provide insight into the relationship between the exchange rate stability and companies' ESG performance.

Exchange rate stability influences companies' investment decisions, particularly those with significant exposure to international markets. Research by Dao, Minoiu, and Ostry (2021) highlights the importance of stable exchange rates in promoting cross-border investments and reducing uncertainty for multinational corporations. Stable exchange rates can enhance investor confidence and encourage companies to pursue long-term investment projects, including those aligned with policies of different countries (Yin, Si, and Wang 2024; Liu and Lee 2022; Dong et al. 2023). Financial stability also influences companies' risk management practices, as firms seek to mitigate the impact of external shocks and market volatility. According to Cheng and Gan (2023), financial stability enhances firms' ability to manage risks effectively, reducing their exposure to systemic risks and vulnerabilities. This, in turn, can contribute to greater resilience and sustainability in the face of economic uncertainty.

On the other hand, the relationship between financial stability and corporate governance has been examined extensively in the literature. Studies by Malik et al. (2022) and Anginer et al. (2018) emphasize the role of strong governance mechanisms in promoting financial stability and mitigating agency conflicts within firms. Effective governance structures, including board oversight and transparency measures, can help companies navigate turbulent financial environments and uphold investor confidence. Financial stability is also associated with improved market performance for companies. Moreover, the firms operating in stable financial systems tend to achieve higher market valuations and better access to financing (Avramov et al. 2022; Chiaramonte et al. 2022; Bhattacherjee, Mishra, and Bouri 2024). Stable financial markets foster investor confidence and facilitate capital flows, creating favorable conditions for corporate growth and profitability.

For companies engaged in international operations, exchange rate stability is essential for effective risk management. Volatile exchange rates can introduce currency risk, affecting companies' financial performance and cash flow stability (Hung 2021). Study by Georgiadis and Zhu (2021) emphasizes the role of exchange rate stability in reducing currency risk exposure and enhancing firms' ability to manage foreign exchange risk effectively. Also, stable exchange rates can confer a competitive advantage to companies operating in international markets (Schnabel 2011). Additionally, firms located in regions with stable currencies may benefit from lower transaction costs, improved pricing competitiveness, and enhanced access to global markets. This competitive advantage can translate into superior financial performance and sustainable growth for companies with strong ESG practices. Furthermore, the relationship between ERV and market performance has been examined in various studies. Research by Blau

(2018) finds that exchange rate stability positively influences stock market returns and investor sentiment, particularly in emerging market economies. Stable exchange rates can attract foreign investment and foster liquidity in financial markets, contributing to higher market valuations for companies.

While direct empirical evidence linking exchange rate stability to companies' ESG performance may be limited, stable exchange rates contribute to broader sustainable development goals by fostering economic stability and growth. The United Nations Sustainable Development Agenda recognizes the importance of stable financial systems in promoting inclusive and sustainable economic growth (United Nations 2015). Exchange rate stability supports these objectives by providing a conducive environment for companies to invest in sustainable practices and contribute to social and environmental progress. By influencing investment decisions, risk management strategies, competitive advantage, market performance, and alignment with sustainable development goals, exchange rate stability may indirectly contribute to companies' ability to integrate ESG considerations into their operations and decision-making processes. Stable financial markets provide a conducive environment for companies to invest in sustainable practices and contribute to broader social and environmental objectives.

Exchange rate fluctuations play a significant role in shaping interest rates, which in turn have implications for the state of demand and supply of money in the economy. These issues ultimately affect the performance of companies operating in both domestic and international markets (Liu and Lee 2022). Exchange rate movements can influence interest rates through various channels. When a country's currency depreciates, its central bank may respond by raising interest rates to stabilize the currency and attract foreign capital inflows. Conversely, a currency appreciation may prompt the central bank to lower interest rates to stimulate domestic demand and prevent an overvaluation of the currency.

Changes in interest rates influence the cost of borrowing and saving, thereby impacting the demand for and supply of money in the economy (Bastida, Guillamon, and Benito 2014). Higher interest rates tend to reduce borrowing and increase saving, leading to a decrease in the supply of money. Conversely, lower interest rates stimulate borrowing and discourage saving, leading to an increase in the supply of money (Bikker and Gerritsen 2018). Besides, the state of demand and supply of money has direct implications for company performance. Changes in interest rates can affect consumer spending, investment decisions, and overall economic activity, which in turn influence companies' revenue growth, profitability, and investment opportunities. Given the interconnectedness of exchange rates, interest rates, and company performance, firms often employ risk management strategies to mitigate the impact of exchange rate fluctuations on their operations. These strategies may include hedging currency exposures, diversifying revenue streams across regions, and optimizing financing structures to minimize exposure to interest rate risk.

Additionally, exchange rate fluctuations and interest rate changes can have multifaceted implications for the ESG performance of companies. By influencing consumer behavior, investment

decisions, access to financing, and governance practices, these macroeconomic factors shape companies' environmental practices, social impact, and governance structures. It is evident that exchange rate stability plays a critical role in shaping the strategic decisions, investment patterns, and overall sustainability performance of companies. Stable exchange rates can reduce uncertainty, enhance investor confidence, and promote cross-border investments, which are crucial for companies, particularly those with significant international exposure. Furthermore, financial stability supports effective risk management practices, competitive advantage, and improved market performance, all of which are essential for sustainable growth and strong ESG performance. Based on the above discussion, this study proposes the following hypotheses:

H 1. *ERV negatively impacts the overall ESG performance of companies.*

H 1a. *ERV negatively impacts the environmental performance of companies.*

H 1b. *ERV negatively impacts the social performance of companies.*

H 1c. *ERV negatively impacts the governance performance of companies.*

4 | Methodology

The study focuses on a different group of countries around the world and examines data from the period spanning 2012 to 2019. Global countries are chosen due to their diverse economic environments and regulatory frameworks, which make them suitable for analyzing the relationship between exchange rate stability and ESG performance. ESG performance data obtained from the Thomson Reuters Eikon database. This database provides comprehensive coverage of ESG metrics for publicly listed companies, including environmental impact, social responsibility initiatives, and governance practices. In addition, exchange rate stability data sourced one recommended database for exchange rate data is the International Monetary Fund (IMF) DataMapper (Ha, Stocker, and Yilmazkuday 2020; Nor, Masron, and Alabdullah 2020). The IMF DataMapper offers a wide range of macroeconomic indicators, including exchange rate stability metrics such as ERV, currency reserves, and exchange rate regimes, which are essential for assessing the stability of currencies. Table 1 shows the distribution of the study sample.

4.1 | Research Models

4.1.1 | ERV Model

Based on the existing literature and the methods described, the proxy for ERV in the current study would be derived using the Generalized Autoregressive Conditional Heteroscedasticity (GARCH) model (Dada 2021; Kearney and Patton 2000). The GARCH model is well-suited for capturing the inherent risks in exchange rates due to its ability to model time-varying volatility and its flexibility over simpler models like the standard devia-

TABLE 1 | The sample distribution among countries.

Country	Freq.	Percent	Cumulative
China	1791	11.79%	11.79%
Canada	1659	10.92%	22.70%
Germany	924	6.08%	28.78%
Australia	1928	12.69%	41.47%
Singapore	315	2.07%	43.54%
United Kingdom	2216	14.58%	58.13%
Qatar	158	1.04%	59.17%
Switzerland	1661	10.93%	70.10%
Turkey	329	2.17%	72.26%
Taiwan	864	5.69%	77.95%
Saudi Arabia	142	0.93%	78.88%
Thailand	322	2.12%	81.00%
USA	2135	14.05%	95.05%
Brazil	78	0.51%	95.56%
South Africa	674	4.44%	100.00%
Total	15196	100%	

tion approach. Following the steps and equations to calculate ERV:

1. **Calculate the Real Exchange Rate (REER)**

The REER can be calculated as follows:

$$REER_{it} = \frac{E_{it} \times P_{it}}{P_t^*}$$

where:

E_{it} is the nominal exchange rate for country i at time t.

P_{it} is the price level in the domestic country.

P_t^* is the price level in the foreign country.

2. **Estimate ERV using GARCH (1,1)**

The GARCH (1,1) model is defined as:

$$\sigma_t^2 = \delta_0 + \psi_1 \sigma_{t-1}^2 + \psi_2 e_{t-1}^2$$

where:

σ_t^2 is the variance (volatility) of the exchange rate at time t.

e_{t-1} is the error term at time $t-1$.

$\delta 0, \psi 1, \psi 2$ are coefficients to be estimated.

3. **Generate ERV**

TABLE 2 | Measurement of the study variables.

Variable	Symbols	Measure
ESG performance	ESG_Rating	Overall ESG performance
Environmental performance	ENV_Rating	The environmental performance score
Social performance	SOC_Rating	The social performance score
Governance performance	GOV_Rating	The governance performance score
Exchange rate volatility	ERV	The real effective exchange rate (REER) is calculated, and exchange rate volatility (ERV) is estimated using the GARCH (1,1) model.
Board size	Board_Size	The total number of board directors
Board diversity	Board_Diversity	Proportion of female directors to total board members
Board independence	Board_Ind	Percentage of nonexecutive board members
Firm size	FSize	Logarithm of total company assets
Return on assets	ROA	Net income as a proportion of total assets
Leverage	Leverage	Ratio of total debt to total assets
Liquidity	Liquidity	Ratio of total current assets to total current liabilities
Gross domestic product	GDP	Natural logarithm of gross domestic product growth rate
Investor protection rate	Inv_Protection	Country's investor protection index from World Bank Database
Lending interest rate	LIR	The interest rate set by banks to fulfil the short- and medium-term financing requirements.
Country		The country fixed effect
Year		The year fixed effect
Sector		The sector fixed effect
ε		Error term
i		The company
t		The year

Abbreviations: ENV, environmental; ERV, exchange rate volatility; ESG, environmental, social, and governance; GDP, gross domestic product; GOV, governance; LIR, lending interest rate; SOC, social; ROA, return on assets.

ERV is then generated as:

$$ERV_{it} = \delta_0 + \psi_1 ERV_{it-1} + \psi_2 e_{it-1}^2$$

where:

ERV_{it} represents the ERV for country i at time t.

4.1.2 | The Main Study Model

To investigate the impact of ERV on ESG performance, a series of econometric models were employed. These models aim to quantify the relationship between ERV and various dimensions of ESG performance while controlling for other relevant factors such as board characteristics, firm size (FSize), financial performance, and macroeconomic conditions. The following models outline the relationships between these variables. Table 2 also provides the definitions and measurements of the variables:

(Model 1)

$$
\begin{aligned}
ENV\_Rating_{it} &= \beta_0 + \beta_1 \, ERV_{it} + \beta_2 Board\_Size_{it} + \beta_3 Board\_Diversity_{it} \\
&+ \beta_4 Board\_Ind_{it} + \beta_5 FSize_{it} + \beta_6 ROA_{it} + \beta_7 \, Leverage_{it} \\
&+ \beta_8 \, Liquidity_{it} + \beta_9 \, GDP_{it} + \beta_{10} \, Inv\_Protection_{it} \\
&+ \beta_{11} \, LIR_{it} + Year + Country + Sector + \varepsilon_{it}
\end{aligned}
$$

(Model 2)

$$
\begin{aligned}
SOC\_Rating_{it} &= \beta_0 + \beta_1 \, ERV_{it} + \beta_2 Board\_Size_{it} + \beta_3 Board\_Diversity_{it} \\
&+ \beta_4 Board\_Ind_{it} + \beta_5 FSize_{it} + \beta_6 ROA_{it} + \beta_7 \, Leverage_{it} \\
&+ \beta_8 \, Liquidity_{it} + \beta_9 \, GDP_{it} + \beta_{10} \, Inv\_Protection_{it} \\
&+ \beta_{11} \, LIR_{it} + Year + Country + Sector + \varepsilon_{it}
\end{aligned}
$$

(Model 3)

$$\begin{aligned} \text{GOV\_Rating}_{it} &= \beta_0 + \beta_1\,\text{ERV}_{it} + \beta_2\text{Board\_Size}_{it} + \beta_3\text{Board\_Diversity}_{it} \\ &\quad + \beta_4\text{Board\_Ind}_{it} + \beta_5\text{FSize}_{it} + \beta_6\text{ROA}_{it} + \beta_7\,\text{Leverage}_{it} \\ &\quad + \beta_8\,\text{Liquidity}_{it} + \beta_9\,\text{GDP}_{it} + \beta_{10}\,\text{Inv\_Protection}_{it} \\ &\quad + \beta_{11}\,\text{LIR}_{it} + \text{Year} + \text{Country} + \text{Sector} + \varepsilon_{it} \end{aligned}$$

(Model 4)

$$\begin{aligned} \text{ESG\_Rating}_{it} &= \beta_0 + \beta_1\,\text{ERV}_{it} + \beta_2\text{Board\_Size}_{it} + \beta_3\text{Board\_Diversity}_{it} \\ &\quad + \beta_4\text{Board\_Ind}_{it} + \beta_5\text{FSize}_{it} + \beta_6\text{ROA}_{it} + \beta_7\,\text{Leverage}_{it} \\ &\quad + \beta_8\,\text{Liquidity}_{it} + \beta_9\,\text{GDP}_{it} + \beta_{10}\,\text{Inv\_Protection}_{it} \\ &\quad + \beta_{11}\,\text{LIR}_{it} + \text{Year} + \text{Country} + \text{Sector} + \varepsilon_{it} \end{aligned}$$

where: ENV_Rating_{it} represents environmental performance, SOC_Rating_{it} represents social performance, GOV_Rating_{it} represents governance performance, ESG_Rating_{it} represents overall ESG Performance, and it is modeled as a function of the explanatory variables including ERV_{it}, Board size (Board_Size_{it}), Board diversity ($\text{Board\_Diversity}_{it}$), Board independence ($\text{Board\_Ind}_{it}$), Return on assets ($\text{ROA}_{it}$), Leverage ($\text{Leverage}_{it}$), Liquidity ($\text{Liquidity}_{it}$), Gross domestic product (GDP_{it}), Investor protection rate ($\text{Inv\_Protection}_{it}$), Lending interest rate (LIR_{it}), alongside fixed effects (year, country, and sector) and an error term (ε_{it}). Table 2 shows the study variables measurement.

5 | Results and Discussion

5.1 | Descriptive Analysis

Table 3 provides the descriptive statistical results. As shown, the ERV index shows a mean of 0.052, with a relatively low standard deviation of 0.019, indicating moderate stability in the economic environments of the sampled companies. This index ranges widely from 0 to 99.782, reflecting varying degrees of economic stability across the sample. Environmental (ENV_Rating), social (SOC_Rating), governance (GOV_Rating), and overall ESG ratings (ESG_Rating) exhibit means of 31.884, 41.908, 43.551, and 40.225, respectively. These scores suggest moderate to high performance levels in ESG practices among the studied firms. However, the wide standard deviations (ranging from 18.514 to 25.663) indicate significant variability in ESG performance across the sample, highlighting diverse levels of commitment to sustainability. Board characteristics such as Board_Size (mean = 12.642) and Board_Diversity (mean = 16.425) illustrate the composition and diversity within governance structures. The standard deviations (4.632 and 12.221, respectively) indicate considerable variation in board sizes and diversity levels among the firms, influencing their decision-making processes and oversight of ESG strategies.

TABLE 3 | Descriptive statistics analysis.

Variables	Mean	Std. dev.	Min	Max
ERV	0.052	0.019	0.015	0.105
ENV_Rating	31.884	18.514	0	98.332
SOC_Rating	41.908	21.336	0	98.564
GOV_Rating	43.551	25.663	0	99.405
ESG_Rating	40.225	20.441	0	94.511
Board_Size	12.642	4.632	4	26
Board_Diversity	16.425	12.221	0	45
Board_Ind	51.821	43.221	1.366	97.54
FSize	18.665	17.644	9.541	29.301
ROA	11.207	26.501	−11.225	79.145
Leverage	0.004	0.255	−6.087	1.088
Liquidity	3.452	9.151	0.021	45.56
GDP	22.389	1.133	19.12	94.05
Inv_Protection	6.172	0.512	4.23	6.28
LIR	3.5	1.513	1.1	6.5

Abbreviations: ENV, environmental; ERV, exchange rate volatility; ESG, environmental, social, and governance; GDP, gross domestic product; GOV, governance; LIR, lending interest rate; SOC, social; ROA, return on assets.

Financial metrics include ROA, leverage, and liquidity, with means of 1.207, 0.004, and 3.452, respectively. ROA's high standard deviation (66.501) reflects substantial variability in profitability across firms, influenced by diverse operational efficiencies and market conditions. Leverage, with a mean close to zero and a small standard deviation (0.255), suggests conservative financial leverage strategies among the sample. Liquidity's mean (3.452) and standard deviation (9.151) indicate varying degrees of cash flow stability and financial risk management practices. GDP, a macroeconomic indicator, shows a mean of 22.389, indicating diverse economic environments across the firms' operating regions. The narrow standard deviation (1.133) suggests relatively stable economic conditions but with some variability in economic growth rates and market dynamics. Also, investment protection (Inv_Protection) has a mean of 6.172 and a small standard deviation (0.512), indicating consistent levels of legal and regulatory safeguards for investments across the sample. The LIR exhibits a mean of 3.5 and a standard deviation of 1.513, reflecting moderate variability in borrowing costs across the firms' jurisdictions, influencing their capital allocation decisions and financial strategies.

5.2 | Correlation Matrix

The correlation matrix presented in Table 4 provides a comprehensive overview of the relationships between the key variables in the study. The correlations range from strong to weak, indicating varying degrees of association. The negative correlation (−0.355) between ERV and environmental performance (ENV_Rating) suggests that higher ERV is associated with lower environmental performance. This is logical, as firms in volatile economic environments may have fewer resources to invest in environmental

TABLE 4 | Matrix of correlations between variables.

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
(1) ERV	1.000														
(2) ENV_Rating	−0.355	1.000													
(3) SOC_Rating	−0.721	0.481	1.000												
(4) GOV_Rating	−0.616	0.164	0.122	1.000											
(5) ESG_Rating	−0.594	0.318	0.424	0.181	1.000										
(6) Board_Size	−0.462	0.204	0.163	0.196	0.285	1.000									
(7) Board_Diversity	−0.287	0.294	0.355	0.135	0.377	0.035	1.000								
(8) Board_Ind	−0.017	−0.045	0.047	0.062	0.019	0.071	0.126	1.000							
(9) FSize	0.599	0.425	0.022	0.314	0.433	0.322	0.232	0.063	1.000						
(10) ROA	−0.165	0.177	0.522	0.011	0.605	0.085	0.263	−0.239	−0.008	1.000					
(11) Leverage	0.088	−0.086	−0.188	−0.007	−0.244	−0.103	−0.101	−0.227	0.204	−0.309	1.000				
(12) Liquidity	−0.096	0.057	−0.052	0.263	0.074	0.121	0.099	0.161	0.222	0.211	−0.505	1.000			
(13) GDP	−0.112	0.051	0.077	0.141	0.132	−0.061	0.111	0.154	0.150	0.294	−0.650	0.714	1.000		
(14) Inv_Protection	−0.151	−0.211	−0.073	−0.201	−0.243	−0.144	−0.151	0.191	0.169	−0.255	0.414	0.486	0.206	1.000	
(15) LIR	0.316	−0.471	−0.236	−0.257	−0.179	−0.015	−0.178	−0.106	−0.134	−0.206	0.534	−0.603	−0.523	−0.334	1.000
VIF	1.267	—	—	—	—	1.273	1.359	1.344	1.138	1.834	1.978	2.269	3.883	1.552	1.247

Abbreviations: ENV, environmental; ERV, exchange rate volatility; ESG, environmental, social, and governance; GDP, gross domestic product; GOV, governance; LIR, lending interest rate; SOC, social; ROA, return on assets; VIF, variance inflation factor.

initiatives. A strong negative correlation (−0.721) indicates that ERV significantly reduces social performance (SOC_Rating). Economic instability can lead to reduced corporate social responsibility efforts. The negative correlation (−0.616) between ERV and governance performance (GOV_Rating) suggests that firms in volatile environments may struggle with maintaining strong governance practices. The overall ESG performance (ESG_Rating) is negatively correlated with ERV (−0.594), reinforcing the notion that ERV hampers comprehensive ESG efforts.

The correlations between board size (Board_Size) and various ESG ratings (ENV, SOC, GOV, and overall ESG) are positive but moderate, indicating that larger boards might contribute to better ESG performance. This aligns with the idea that larger boards can offer diverse perspectives and resources. Board diversity (Board_Diversity) shows positive correlations with all ESG ratings, especially with overall ESG performance (0.377). Diverse boards are likely to be more attuned to social and environmental issues, thus enhancing ESG performance. The correlations between board independence (Board_Ind) and ESG ratings are generally weak, with the highest being governance performance (0.062). This suggests that while board independence is important, its direct impact on ESG performance might be limited.

FSize is positively correlated with all ESG ratings, particularly with overall ESG performance (0.433). Larger firms typically have more resources and capabilities to invest in ESG initiatives. ROA shows strong positive correlations with social performance (0.522) and overall ESG performance (0.605). Profitable firms are better positioned to allocate funds toward ESG activities, indicating a virtuous cycle where financial performance supports and enhances ESG efforts. The correlation between leverage and ESG ratings is generally negative, with leverage showing the strongest negative correlation with overall ESG performance (−0.244). This suggests that firms with higher debt levels may have fewer resources available for ESG initiatives. Liquidity, on the other hand, has a mixed relationship with ESG ratings, showing a positive correlation with governance performance (0.263) but weaker correlations with other ESG dimensions. This implies that firms with better liquidity may be better at maintaining governance standards, though the impact on environmental and social performance is less clear.

GDP growth shows a positive correlation with most ESG ratings, particularly with overall ESG performance (0.132), suggesting that a stronger economy supports better business and ESG performance. Investor protection has negative correlations with ESG ratings, which is somewhat counterintuitive as better investor protection is generally expected to support ESG initiatives. This might indicate that in some contexts, stronger investor protection mechanisms are associated with stricter regulatory environments that might prioritize financial performance over ESG activities. Finally, the LIR shows negative correlations with ESG ratings, indicating that higher interest rates can be detrimental to firm performance in terms of ESG activities. High borrowing costs may limit a firm's ability to invest in long-term ESG projects, thus hindering overall ESG performance. On the other hand, the variance inflation factor (VIF) values suggest that multicollinearity is not a significant concern in this dataset, as all VIF values are below 4, which is generally considered acceptable.

5.3 | Regression Results

The regression results in Table 5 present the impact of ERV, proxied by ERV, on various components of ESG performance. The results indicate that the instability of exchange rates negatively affects the sustainability practices of companies in all their ESG dimensions. ERV introduces significant financial uncertainty, which can have a direct impact on a company's budget and financial planning. When companies face unpredictable fluctuations in exchange rates, they often must allocate more resources to manage these risks, such as through hedging strategies or adjusting their pricing models. This financial strain can limit the funds available for sustainability initiatives, as companies might prioritize financial stability and core operations over ESG investments. In periods of high ERV, companies might prioritize short-term financial goals over long-term sustainability objectives. The immediate need to manage exchange rate risks and maintain profitability can overshadow longer-term investments in environmental and social initiatives. For instance, a company facing increased costs due to exchange rate fluctuations might cut back on expenses related to environmental protection or social responsibility to preserve its profit margins. Moreover, ERV can disrupt supply chains, leading to increased costs and inefficiencies. These disruptions can affect a company's ability to source sustainable materials or maintain ethical labor practices, as cost pressures may force them to opt for cheaper, less sustainable options. This can negatively impact both environmental and social performance.

The findings align with previous empirical literature that highlights the challenges posed by uncertainty for corporate performance. Studies by Al Amosh, Khatib, and Ananzeh (2024), Avramov et al. (2022), and Bhattacherjee, Mishra, and Bouri (2024) have demonstrated that crises and periods of uncertainty affect the overall economy, weakening corporate sustainability initiatives. During such times, companies face heightened financial pressures and operational challenges, prompting them to prioritize immediate survival and core business functions over long-term sustainability goals. Additionally, disrupted supply chains and fluctuating currency values can force companies to opt for less sustainable practices to maintain profitability. This shift in focus away from sustainability is supported by empirical evidence showing that firms in stable economic environments generally perform better in ESG metrics compared to those grappling with economic crises. Consequently, the uncertainty and financial strain inherent in crises undermine the commitment and resources that companies can allocate to their sustainability initiatives. On the other hand, the significant impact of board diversity and independence on ESG performance (Board_Diversity: 0.278** for ENV_Rating, 0.058** for SOC_Rating, 0.096*** for GOV_Rating, 0.741*** for ESG_Rating; Board_Ind: 0.305*** for ENV_Rating, 0.318*** for SOC_Rating, 0.744* for GOV_Rating, 0.396* for ESG_Rating) supports the notion that strong governance structures can help mitigate some of the adverse effects of uncertainty situations such as ERV on ESG practices, as noted in studies by Yin, Si, and Wang (2024) and Dong et al. (2023).

Theoretically, according to EMH, asset prices fully reflect all available information. However, during periods of high ERV, the market faces increased uncertainty and difficulty in accurately

TABLE 5 | The effect of ERV on ESG.

	(1) ENV_Rating	(2) SOC_Rating	(3) GOV_Rating	(4) ESG_Rating
ERV	0.215***	0.361***	0.171***	0.205***
	(−6.74)	(−5.88)	(−2.588)	(−4.334)
Board_Size	0.003	0.006	0.104	−0.001
	(−1.122)	(−1.329)	(−0.512)	(−0.162)
Board_Diversity	0.278**	0.058**	0.096***	0.741***
	(1.539)	(1.415)	(1.841)	(1.668)
Board_Ind	0.305***	0.318***	0.744*	0.396*
	(2.295)	(2.353)	(2.738)	(0.077)
FSize	4.305*	5.435*	4.725**	7.552*
	(2.223)	(3.163)	(−2.955)	(3.085)
ROA	2.739***	1.691*	.186*	1.311***
	(6.928)	(3.256)	(0.394)	(2.699)
Leverage	1.792	1.842	1.419	0.291
	(−0.857)	(−0.756)	(0.527)	(−0.162)
Liquidity	0.028***	0.021***	0.018**	0.013***
	(6.214)	(6.776)	(1.987)	(2.732)
GDP	0.03*	0.01	0.72*	0.409**
	(0.175)	(0.384)	(1.085)	(2.195)
Inv_Protection	247.462*	205.352**	301.641**	116.955*
	(−2.924)	(2.189)	(2.072)	(0.911)
LIR	247.462**	205.352*	301.641*	116.955**
	(−2.924)	(2.189)	(2.072)	(0.911)
Country FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes	Yes
_cons	112.491	189.246	432.511***	221.637**
	(1.821)	(1.658)	(2.652)	(2.305)
R^2	0.366	0.541	0.441	0.287
Hausman test	218.875	274.282	216.995	205.457
	0.001	0.001	0.001	0.001

Note: t-values are in parentheses.

Abbreviations: ERV, exchange rate volatility; ESG, environmental, social, and governance; GDP, gross domestic product; LIR, lending interest rate.

***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

pricing assets. The negative significant impact of ERV on ESG performance suggests that ERV is an important factor that markets consider when evaluating a firm's ESG performance. Investors may perceive firms in volatile exchange rate environments as riskier investments due to their potential inability to effectively manage ESG risks. This perception is reflected in the negative and significant coefficients for ERV across all ESG dimensions, indicating that ERV is viewed unfavorably by the market as it signals potential instability in ESG performance. Moreover, ERV introduces unpredictability in cost structures, profit margins, and investment returns, making it challenging for companies to commit to long-term ESG initiatives. This uncertainty can lead investors to demand higher risk premiums, diverting resources away from sustainable practices to more immediate financial stability concerns (Eccles, Ioannou, and Serafeim 2014). Consequently, companies may deprioritize their ESG commitments, leading to lower ESG ratings as observed in the regression results. This aligns with EMH, suggesting that in the presence of significant market inefficiencies caused by volatility, companies' ability to maintain robust ESG performance is compromised.

The negative and significant coefficients for ERV across all ESG dimensions (ENV_Rating: −0.215, SOC_Rating: −0.361, GOV_Rating: −0.171, ESG_Rating: −0.205) suggest that ERV adversely affects ESG performance. This indicates that unstable exchange rates might lead to higher costs and uncertainty, which

in turn could limit a firm's ability to invest in and prioritize ESG initiatives. Stakeholders may perceive these firms as less capable of managing ESG issues responsibly during times of exchange rate instability. Moreover, the negative significant impact of ERV on ESG performance suggests that ERV can undermine these efforts by creating an unstable institutional environment. Firms might struggle to comply with evolving regulations and stakeholder expectations when faced with volatile exchange rates, thus negatively impacting their ESG performance. Regulatory responses to exchange rate fluctuations might also create additional compliance burdens, making it harder for firms to maintain their ESG standards.

Resource dependency theory emphasizes that organizations depend on external resources, such as capital and market access, which can be influenced by exchange rate factors. The negative effects of ERV on ESG performance suggest that ERV complicates access to international capital markets for companies committed to ESG practices. This difficulty in securing resources limits their ability to invest in sustainable technologies and practices. The significant positive coefficients for firm size (FSize: 4.305 for ENV_Rating, 5.435 for SOC_Rating, 4.725 for GOV_Rating, and 7.552 for ESG_Rating) indicate that larger firms, which likely have better access to resources, are better able to mitigate the negative effects of ERV on ESG performance. The findings underscore the importance of stable macroeconomic environments for promoting corporate ESG initiatives and suggest that firms can improve their ESG performance by leveraging stability in exchange rates to better meet stakeholder expectations, conform to institutional pressures, and access necessary resources. Conversely, ERV presents a significant challenge, underscoring the need for robust risk management and adaptive strategies to maintain and enhance ESG performance in unstable economic conditions.

5.4 | Robustness Test

To check the robustness of the results, an additional analysis was performed using the system generalized method of moments (GMM) estimation. The results of the system GMM analysis, presented in Table 6, confirm the robustness of the main findings. The coefficients for the lagged dependent variables are significant and positive across all models, indicating that past ESG performance significantly influences current performance. Specifically, the coefficients for lagged ENV_Rating, SOC_Rating, GOV_Rating, and ESG_Rating are 0.132 ($p < 0.05$), 0.114 ($p < 0.01$), 0.139 ($p < 0.01$), and 0.184 ($p < 0.01$), respectively, demonstrating the persistence effect. Moreover, ERV continues to exhibit a significant negative effect on all dimensions of ESG performance. The coefficients for ERV are -0.215 ($p < 0.01$) for ENV_Rating, -0.361 ($p < 0.01$) for SOC_Rating, -0.171 ($p < 0.01$) for GOV_Rating, and -0.205 ($p < 0.01$) for ESG_Rating. These results suggest that increased ERV adversely impacts companies' sustainability practices, reaffirming the findings from the initial regression analysis.

6 | Conclusions

The primary objective of this study was to investigate the impact of ERV on corporate ESG performance. Utilizing a robust global dataset, the study aimed to provide empirical evidence on how fluctuations in exchange rates influence sustainability practices across firms. The theoretical underpinning of this research was guided by established theories such as stakeholder theory, institutional theory, resource dependency theory, and the EMH. Our analysis revealed that ERV negatively affects all dimensions of ESG performance—ESG. Specifically, the results demonstrated that increased ERV leads to significant declines in environmental ratings, social ratings, governance ratings, and overall ESG ratings. These findings underscore the destabilizing effect of exchange rate fluctuations on corporate sustainability initiatives and align with the theoretical expectations that economic instability can hinder a firm's ability to maintain robust ESG practices.

The results have several implications for various stakeholders, such as governments, analysts, investors, corporate managers, and policy makers. For governments, the findings emphasize the need for regulatory bodies to consider exchange rate stabilization as a means of enhancing corporate sustainability efforts. Governments could implement monetary policies or engage in international cooperation to reduce ERV. Stable exchange rates allow firms to focus more on long-term sustainability goals rather than being disrupted by short-term financial fluctuations. This contributes to national sustainability targets and the achievement of global environmental and social objectives. Corporate managers and executives should consider strategies to mitigate the negative impact of ERV on ESG performance. This includes adopting financial hedging instruments to minimize exposure to currency fluctuations and diversifying operations across multiple regions to reduce financial risks. Additionally, diversifying revenue streams across multiple currencies or geographic regions can help mitigate the adverse effects of ERV. Firms should also consider integrating sustainability into their core strategy, ensuring that ESG initiatives remain resilient, even during economic downturns.

For investors and financial analysts, understanding the adverse effects of ERV on ESG performance is essential. Investors should prioritize companies with robust risk management systems that address exchange rate fluctuations, ensuring that these companies can maintain their ESG commitments despite economic instability. Financial analysts should integrate currency risks into their ESG assessments and consider the potential impact on long-term sustainability when advising clients. On the other hand, firms operating internationally must recognize that ERV can introduce uncertainty into their sustainability programs, especially those that require significant resources. Developing adaptive mechanisms to shield ESG initiatives from economic disturbances is crucial. Collaborating with local governments and aligning sustainability practices with specific market conditions can further strengthen a firm's ability to withstand external economic pressures. For nongovernmental organizations (NGOs) and advocacy groups, the destabilizing impact of exchange rate fluctuations on corporate ESG efforts highlights the need for NGOs and advocacy groups to engage in dialogue with corporations, governments, and policymakers. These groups can advocate for stronger safeguards and support mechanisms that enable firms to maintain sustainable practices even during times of economic volatility. Additionally, they can help create platforms for collaboration between public and private sectors, addressing

TABLE 6 | System GMM analysis.

	(1) ENV_Rating	(2) SOC_Rating	(3) GOV_Rating	(4) ESG_Rating
Lagged. ENV_Rating	0.132**			
	(5.732)			
Lagged. SOC_Rating		0.114***		
		(4.316)		
Lagged. GOV_Rating			0.139***	
			(2.638)	
Lagged. ESG_Rating				0.184***
				(3.852)
ERV	0.215***	0.361***	0.171***	0.205***
	(−6.74)	(−5.88)	(−2.588)	(−4.334)
Board_Size	0.003	0.006	0.104	−0.001
	(−1.122)	(−1.329)	(−0.512)	(−0.162)
Board_Diversity	0.278**	0.058**	0.096***	0.741***
	(1.539)	(1.415)	(1.841)	(1.668)
Board_Ind	0.305***	0.318***	0.744*	0.396*
	(2.295)	(2.353)	(2.738)	(0.077)
FSize	4.305*	5.435*	4.725**	7.552*
	(2.223)	(3.163)	(−2.955)	(3.085)
ROA	2.739***	1.691*	0.186*	1.311***
	(6.928)	(3.256)	(0.394)	(2.699)
Leverage	1.792	1.842	1.419	0.291
	(−0.857)	(−0.756)	(0.527)	(−0.162)
Liquidity	0.028***	0.021***	0.018**	0.013***
	(6.214)	(6.776)	(1.987)	(2.732)
GDP	0.03*	0.01	0.72*	0.409**
	(0.175)	(0.384)	(1.085)	(2.195)
Inv_Protection	247.462*	205.352**	301.641**	116.955*
	(−2.924)	(2.189)	(2.072)	(0.911)
LIR	247.462**	205.352*	301.641*	116.955**
	(−2.924)	(2.189)	(2.072)	(0.911)
Country FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes	Yes
_cons	114.291	189.266	451.423***	212.667**
	(1.921)	(1.678)	(2.451)	(2.345)
Hansen J	0.346	0.561	0.481	0.247
AR (1) Test	1.368***	2.446***	1.369***	1.446***
AR (2) Test	1.154	1.382	1.462	1.457

Note: t-values are in parentheses. Lagged. ENV_Rating (t−1) is past dependent variable (lagged value of ENV_Rating). Lagged. SOC_Rating (t−1) is past dependent variable (lagged value of SOC_Rating). Lagged. GOV_Rating (t−1) is past dependent variable (lagged value of GOV_Rating). Lagged. ESG_Rating (t−1) is past dependent variable (lagged value of ESG Rating). Arellano–Bond test for AR (2) is used to look for possible autocorrelation issues. Hansen J test is used to look for possible over-identification restrictions in the model.

Abbreviations: ENV, environmental; ERV, exchange rate volatility; ESG, environmental, social, and governance; GDP, gross domestic product; GMM, generalized method of moments; GOV, governance; LIR, lending interest rate; SOC, social; ROA, return on assets.

***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

the external risks posed by macroeconomic factors like currency instability.

For analysts and shareholders, the findings of this study are particularly relevant. ERV can significantly impact a company's ESG performance, which, in turn, affects its long-term financial stability and reputation. Shareholders should be aware of the risks associated with currency fluctuations, as companies with strong ESG commitments may struggle to maintain these efforts during periods of economic instability. Analysts play a key role in assessing these risks, making it crucial for them to incorporate ERV into their evaluations of corporate sustainability performance. When providing recommendations to shareholders or potential investors, analysts should consider how a company's exposure to currency fluctuations could influence its ESG outcomes. Companies with effective strategies to hedge against exchange rate risks or that operate in more stable currency environments may be better positioned to sustain strong ESG performance, making them more appealing for long-term investment. Moreover, shareholders seeking sustainable investments should focus on firms with robust risk management systems. Companies that proactively mitigate the effects of ERV—through hedging strategies, operational diversification, or other financial tools—are more likely to preserve their ESG performance. Such firms present a more stable and responsible investment option, especially for investors who prioritize sustainability in their portfolios.

This study has several limitations that future research could address. Firstly, the dataset is limited to specific years and regions, which may not capture all the nuances of ERV and ESG performance globally. Expanding the temporal and geographical scope of the data could provide more comprehensive insights. Secondly, while this study focuses on the direct impact of ERV on ESG performance, future research could explore mediating factors or mechanisms, such as the role of corporate governance structures or industry-specific effects. Additionally, further research could investigate the long-term effects of ERV on ESG performance, as well as how firms adapt their sustainability strategies over time in response to persistent economic uncertainty. It would also be valuable to examine the influence of FSize and industry characteristics in shaping the resilience of ESG practices against currency fluctuations. Future researchers could explore the impact of ERV on specific sustainability initiatives, such as carbon emissions reduction programs or green bond financing. Future studies could also assess whether economic instability leads to potential greenwashing, where firms may exaggerate their ESG efforts to maintain investor confidence during volatile times.

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