Investor sentiments and performance of ESG funds in emerging and developed markets

Damilola Muyiwa Aboluwodi

216069196

A dissertation submitted in fulfilment of the requirements for the degree of Doctor of Philosophy in Finance

School of Accounting, Economics and Finance

College of Law and Management Studies

Supervisors

Professor Paul-Francois Muzindutsi

Professor Bomi Cyril Nomlala

March 2024

DECLARATION

I, **Damilola M Aboluwodi** declare that:

i. The research study contained in this dissertation is my original work, except where otherwise stated.
ii. This thesis has never been submitted in pursuant of any degree or examination at any other university.
iii. All data, graphs, tables and pictures used have not been copied from any other person or the internet unless fully and specifically acknowledged wherever from other sources.
iv. This thesis contains my initiative and writing and is devoid of other persons' writings unless fully and specifically acknowledged wherever referenced from other sources. Any time a quotation is made:

    1) In a situation of a verbatim quotation, these writings are referenced, and quotation marks used to indicate that they belong to the acknowledged author.
    2) The words of the author(s) have been paraphrased but at the same time the whole information ascribed to them has been duly referenced.

v. This dissertation/thesis does not contain text, graphics or tables copied and pasted from the Internet, unless specifically acknowledged, and the source being detailed in the dissertation/thesis and in the References sections.

Signed……..[redacted]………………

Date: 21-March-2024

DEDICATION

To my Heavenly Father;

my Mother, Victoria Olugbenga Oyegoke Tomomewo;

my dearest Wife, Tshegang Chipeya Aboluwodi; and

to those who choose to press on each day, even in the darkest day, I hope this inspires you to keep the faith as we await your manifestations.

Excelsior.

ACKNOWLEDGEMENT

Habakkuk 2:3

For the vision is yet for an appointed time; But at the end it will speak, and it will not lie.
Though it tarries, wait for it; Because it will surely come, It will not tarry.

Indeed, this has been a remarkable journey of many milestones, that would not have been possible without several people along the way who have nudged me further toward the finish line.

Firstly, my heartfelt thanksgiving to God Almighty for His grace, strength, favors and mercies.

Also, my inestimable appreciation to my Supervisors and their families for their commitment, mentorship, and efforts towards the success of this project.

I would like to further acknowledge my Mum and Wife, who have both been very supportive throughout this journey.

My unreserved appreciation goes to my Maternal family- the Oyegokes, my Dad and Siblings- the Tomomewos, my Uncle- Dr Kunle Oyegoke family, and my many Cousins, especially Moyosore – who has been a true brother.

Also, my special appreciation to my Father-in-law, Dr HM Chipeya, who has been exceptionally supportive and encouraging with his love and unwavering faith in me. A big thank you to the Chipeya and Molete family, for all their support and kindness.

Special thanks to friends and colleagues from: UKZN-SAEF, Cyril's House, "SA-Naija" friends, Naija friends, Every Nation Durban, Every Nation Newlands, The Chitambos Connect group, The Jonkers Connect group, CAC Durban, Spaces and the MRU.

Also, some specific friends I have been gracious to meet along the way, who have shown keen interest in my development (too many but to mention a few); Pastor Wayne and Trish Sanderman, Vuyo Jayiya, Dr Kazeem, Dr Adelakun, Adewumi, Dr Kabelo, Dr Sparkle, Biyi, Chief, Khumalo, Thando, Craig, Kgosi, Schwendingers, Bennets, Thulanis, Fatima, Pim, Julie, Jess, Mark, Linda Fernandez, Hlengiwe, Seyi, Arshad, Salma, Alhaji Ibrahim, Mr Blessing, and Dr Vongani.

Lastly, my gratitude goes to the conferences, reviewers and examiners who have helped to further refine this research work.

ABSTRACT

The niche of sustainable finance, despite relatively new, has become a mainstay in the discourse of global finance. Whilst there are multiple factors driving the research interest in this space, chief amongst this, is the purported consequentiality of sustainability concerns that is relatable to even people lacking financial knowledge. In this light, this study sought to examine the impact of investor sentiments on Environmental, Social and Governance (ESG) index returns and risk performance under bull and bear market conditions in emerging (BRICS) and developed (G7) markets. The study further examined the nature of volatility and the impact of investor sentiments, as well as the return and volatility spillovers among countries within and across the emerging and developed markets. Using the Morgan Stanley Composite Index (MSCI) ESG data from 01/10 /2007 to 31/12/2022, a composite investor sentiments (CIS) index was constructed using eight fundamental market sentiment proxies, which were further included in the empirical models employed.

Firstly, employing a Markov Regime Switching Model, the study examined the impact of investor sentiment on ESG performance in bull and bear market conditions. Herein, findings of the study noted that investor sentiment impacts the performance of ESG funds in emerging markets more than in developed markets regardless of market conditions. More so, whilst the study established ESG performance varies across bull and bear conditions, from the standpoint of ESG return performance, the study established that emerging ESG markets performed better in bull market condition and developed ESG markets performed better in bear market condition. Conversely, from the dimension of ESG volatility performance, the study established that developed markets exhibited a higher volatility in bull market condition and emerging markets exhibited higher volatility in bear market condition.

Secondly, adopting GARCH models such as the EGARCH, GJR-GARCH and GARCH-X models, the study evaluated the nature of volatility and the influence of investor sentiments on volatility of ESG funds in emerging and developed markets. Within this context, the research findings based on the mean equation coefficient suggest that there is a weak-form of market efficiency across emerging and developed ESG market blocs except the USA ESG market. Also, the study empirically established that based on the leverage effect, negative shocks (bad news) are more

likely to increase the volatility of ESG returns than positive shocks (good news) in both emerging and developed market blocs. Additionally, the study established that although investor sentiments impacts the volatility of ESG returns regardless of market characterizations, emerging ESG markets are extensively more susceptible to investor sentiments than developed ESG markets.

Thirdly, utilizing a Multivariate GARCH models such as the DCC-VARMA-AGARCH, DCC-VARMA-GARCH and the CCC-VARMA-AGARCH models, the study explored the nature of return and volatility spillovers dynamics within and across emerging and developed ESG markets. In this regard, findings of the study evidenced that although there is evidence of return spillovers across emerging and developed ESG markets, ESG returns in emerging markets are likely to be adversely affected by the spillovers from developed markets. Also, the study also established that although there is evidence of return spillovers across emerging and developed markets, the developed ESG market bloc especially the USA and the EU, have significant volatility spillover influence on the volatility of emerging ESG markets. In addition to this, the findings of the study further established that negative shocks (bad news) from developed markets increases the volatility spillovers of ESG returns in emerging markets by more than positive shocks (good news), not vice-versa.

In general, these findings accentuate diverse implications from the standpoint of several finance theories. Most evidently, from the perspective of the Efficient Market Hypothesis (EMH) theory, the findings challenge the notion of market efficiency by suggesting that investor sentiment can influence the performance of ESG funds, indicating potential inefficiencies in pricing. Likewise, from the standpoint of behavioral finance theory, the findings emphasize the importance of psychological factors in investment decision-making, highlighting how investor sentiment drives market outcomes. Lastly, the Adaptive Market Hypothesis (AMH) theory acknowledges the dynamic nature of markets and the role of investor behavior in shaping them, suggesting that the impact of sentiment on ESG fund performance is adaptive to market conditions.

This research contributes to the finance literatures in the sphere of sustainable finance and ESG investing. In particular, this study offers novel critical contributions on how investor sentiment is intertwined with the discourse of ESG performance, risk and risk spillovers across market conditions and characterizations. Given these empirical revelations, this study recommends that individual and institutional stakeholders keen on sustainability concerns and ESG investing should consider the influence of market conditions on ESG performance, the distinctiveness of ESG market characterizations with regards to returns and risk spillovers, the subsisting relationships among ESG markets as well as the overarching impact of investor sentiments on ESG performance and volatility. Thus, the empirical establishments of this research are relevant for investment decision making, risk management, global financial markets and development of sustainable finance theory.

Keywords: Sustainable finance; ESG investing; Investor sentiments; Financial markets; Market conditions; Volatility; Market spillovers; BRICS; G7

LIST OF CONFERENCE PRESENTATION AND ARTICLE SUBMISSIONS

Conference presentations

1. **Investor Sentiments and Returns of ESG Funds in Emerging and Developed Markets in Bull and Bear markets**

   Business Rescue Unit (BRU) Conference, 22nd of March 2023

   Durban, KwaZulu-Natal, South Africa.

2. **Investor Sentiments and Performance of ESG Funds in Emerging and Developed Markets**

   South Africa Finance Association (SAFA) Conference, 18th of January 2024

   University of Cape Town, Cape town, South Africa.

Article submissions

1. **Investor Sentiments and Performance of ESG Funds in Emerging Markets Across Bull and Bear Conditions**

   Submitted to the Investment Analysts Journal, Taylor and Francis.

2. **Investor Sentiments and Performance of ESG Funds in Developed Markets Across Bull and Bear Conditions**

   Submitted to the Journal of Asset Management, Springer Nature.

3. **Investor Sentiments and the Nature of ESG Funds Volatility in Emerging Markets: A case study of BRICS markets**

4. **Investor Sentiments and the Nature of ESG Funds Volatility in Developed Markets: A case study of G7 markets**

5. **Analysis of ESG Funds Returns and Volatility Spillovers in Emerging and Developed Markets: A case study of BRICS and G7 markets**

LIST OF ACRONYMS

ADR - Advance/Decline Ratio

AIC - Akaike Information Criterion

AGARCH - Asymmetric Generalized Autoregressive Conditional Heteroskedasticity

ALSI - All Share Index

AMH - Adaptive Market Hypothesis

ARCH-LM - Autocorrelation Conditional Heteroscedasticity-Lagrange Multiplier

ARMA - Autoregressive Moving Average

ASEAN - Association of Southeast Asian Nations

BCI - Business Confidence Index

BEKK - Baba, Engle, Kraft, and Kroner

BDS - Brock, Dechart, and Scheinkman

BCOM - Bloomberg Commodity Index

BCSI - Brazilian Corporate Sustainability Index

BGARCH - Bivariate GARCH

BICS - Brazil, India, China, South Africa

BRICS - Brazil, Russia, India, China, South Africa

CAPM - Capital Asset Pricing Model

CCC - Constant Conditional Correlation

CDP - Carbon Disclosure Project

CCI - Consumer Confidence Index

CFA - Chartered Financial Analyst Institute

CIS - Composite Investor Sentiment

CLI - Composite Leading Indicator

CSR - Corporate Social Responsibility

DCC - Dynamic Conditional Correlation

DLRI - US Dollar Index

DY - Diebold and Yilmaz

EBRD - European Bank for Reconstruction and Development

E-GARCH - Exponential GARCH

EMH - Efficient Market Hypothesis

ESG - Environmental, Social, and Governance

ESGD - Environmental, Social, and Governance Disclosure

ESGI - Environmental, Social, and Governance Integration

ESGR - Environmental, Social, and Governance Ratings

FEV - Forecast Error Variance

FTSE - Financial Times Stock Exchange

GDP - Gross Domestic Product

GARCH - Generalised Autoregressive Conditional Heteroskedasticity

GIIN - Global Impact Investing Network

GJR - Glosten, Jagannathan, and Runkle

GRI - Global Reporting Initiative

ICSS - Iterated Cumulative Sum of Squares

IFC - International Finance Corporation

ICGN - International Corporate Governance Network

IIGCC - Institutional Investor Group on Climate Change

IMF - International Monetary Fund

IPCC - Intergovernmental Panel on Climate Change

ILO - International Labour Organization

IIRC - International Integrated Reporting Council

IPOs - Initial Public Offerings

JB - Jarque-Bera

JP - Johannesburg Stock Exchange

KPSS - Kwiatkowski–Phillips–Schmidt–Shin

LB - Ljung-Box

LM - Lagrange Multiplier

LTI - Long-Term Interest Rates

M-GARCH - Multivariate Generalized Autoregressive Conditional Heteroskedasticity

MPT - Modern Portfolio Theory

MS - Markov Switching

MSM - Markov Switching Model

NIFTY - National Stock Exchange Fifty

NIKKEI - Nikkei Heikin Kabuka

OECD - Organisation for Economic Co-operation and Development

PRI - Principles for Responsible Investment

PCA - Principal Component Analysis

S&P - Standard and Poor’s

SASB - Sustainability Accounting Standards Board

SBP - Social Bond Principles

SBIC - Schwarz Bayesian Criterion

SDFI - Sustainable Development Finance Initiative

SFI - Sustainable Finance Initiative

SIFs - Sustainable Investment Funds

SSE - Shanghai Stock Exchange Composite Index

SRI - Socially Responsible Investing

STI - Short-Term Interest Rates

TBL - Triple Bottom Line

TCFD - Task Force on Climate-related Financial Disclosures

UK - United Kingdom

UN - United Nations

UNEP - United Nations Environment Programme

UNFCCC - United Nations Framework Convention on Climate Change

UNPRI - United Nations Principles for Responsible Investment

US - United States

VaR - Value-at-Risk

VAR - Vector Autoregression

VIX - Volatility Index

WRI - World Resources Institute

WWF - World Wide Fund for Nature

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER ONE: INTRODUCTION

1.1 Overview

Sustainable finance has rapidly emerged as a pivotal focus within the global financial landscape, despite its relatively recent inception. This burgeoning field has captivated scholarly and practical attention alike, propelled by an array of compelling factors. Foremost among these is the palpable significance of sustainability concerns, which resonate with individuals across diverse backgrounds, transcending traditional finance theories (Kempster et al., 2019). Central to this discourse is the exploration of ESG (Environmental, Social, and Governance) fund performance amidst varying market conditions, ranging from bullish to bearish environments. This is because such investigations offer invaluable insights into the profitability, stability, and resilience of sustainable investment options across disparate market blocs and economic climates. Furthermore, comprehending the intricacies of volatility and volatility spillovers within ESG-focused markets is imperative, as sweeping generalizations may entail costly repercussions. More so, given the pivotal role of investor sentiments as a fundamental factor in investment decisions, the findings of this inquiry hold profound relevance for individual and institutional stakeholders committed to fostering a more sustainable world.

Hence, chapter one serves as the cornerstone of this dissertation, laying the groundwork for the exploration of subsequent chapters. This chapter commences with a comprehensive introduction to the study, elucidating the background, problem statement, rationale, objectives, questions and significance of the research endeavour. Building upon this foundation, subsequent chapters are delineated thus: chapter two delves into the conceptual and theoretical framework underpinning the study, whilst chapter three embarks on the first extended article, investigating the interplay between investor sentiments and ESG performance across diverse market regimes and blocs. Thereafter, chapter four extends this inquiry to examine the nuances of investor sentiments and the nature of ESG volatility in both emerging and developed markets. In parallel, the chapter five inquires on the intricate dynamics of ESG return and volatility spillovers within the emerging and developed market. Finally, chapter six draws the dissertation to a close, offering a synthesis of findings, overarching conclusions, and pertinent recommendations for future research studies.

1.2 Background

In recent times, there has been a growing recognition of the urgent need for Environmental, Social, and Governance (ESG) principles to be integrated into investment decision-making (Döttling and Kim, 2021). This is due to increasing concerns about the impact of business activities on the environment, society, and corporate governance. Climate change, social inequality, and corporate scandals have highlighted the importance of investing in companies that meet high ESG standards (Schoenmaker and Schramade, 2018). In response, many investors are now seeking to invest in companies that are committed to sustainable business practices and have strong ESG performance. Moreover, regulatory bodies are introducing measures to enforce compliance with ESG principles, making it imperative for businesses to prioritize ESG considerations in their decision-making processes (Dwivedi et al., 2022).

Leading the discourse on sustainability and responsible investing is the United Nations Principles for Responsible Investment (UNPRI), which conceptualized responsible investment as a strategy and practice that incorporates environmental, social and governance (ESG) factors in investment decisions and active ownerships (UNPRI, 2021). ESG investing can be described as any form of investment style that considers some or all of the ESG factors and concerns when crafting an investment portfolio (ESL, 2022). The term ESG is widely used interchangeably with terms such as Socially Responsible Investment (SRI), sustainable investing, ethical investing, and impact investing (UNPRI, 2021; ESL, 2022). These investing styles utilize a set of criteria to screen investment assets to be included in a portfolio based on critical concern for ESG issues (Boffo and Patalano, 2020). In this context, environmental issues include climate change, resource depletion, pollution, deforestation to name a few (UNPRI, 2021). Likewise, social concerns comprise of issues such as human rights, modern slavery, child labor, working conditions, and employee relations (UNPRI, 2021). Lastly, governance concerns include executive pay, board diversity and structure, political lobbying and donations, tax strategy, bribery and corruption etcetera (UNPRI, 2021).

The roots of ESG investing can be traced back to the 1700s when the Quaker and Methodist churches in the USA and Europe created an "Exclusion list" to prohibit investments in gambling, slave labor, tobacco, and alcohol (Capannoli, 2019). In the 1960s, ESG gained traction through social responsibility investments, boycotting companies supporting the Vietnam War, influenced by the civil rights movement (Lorenzi, 2023). This strategy was mirrored in the 1980s during the global boycott of South African products, contributing to the end of Apartheid (Widyawati, 2020). The 1990s saw the emergence of the "Triple Bottom Line," focusing on People, Planet, and Profit (Nogueira and Madaleno, 2022), and the establishment of the UNFCCC and UNEPFI to promote global sustainability (UNEPFI, 2024). In the 2000s, the UN Global Compact encouraged CEOs to implement universal sustainability principles, marking the first formal advocacy for the ESG approach (Rasche et al., 2023). The financial significance of ESG was further highlighted by the UNEPFI report in 2005, emphasizing its fiduciary importance in investment decisions (Zhao et al., 2023).

Moreover, Döttling and Kim (2022) noted that there is a plausible close link between ESG principles and investment funds flow as investors increasingly prioritize sustainable investments. Likewise, ESG investment funds which focus on investing in companies that meet high ESG standards, have also seen significant growth in recent years (Boffo and Patalano, 2020). As the stocks of companies rated highly for their sustainability efforts have shown improved gains, many ESG funds have also consistently bested broader stock indexes (Reuters, 2021; BCG, 2023). For instance, The MSCI World ESG Leaders' index had risen 22% in the year 2021, compared with the MSCI World Index's gain of 15% (Reuters, 2021). Likewise, the MSCI Emerging Markets ESG Leaders Index, for example, outperformed MSCI's broader Emerging Markets Index by 54% in 2021 (BCG, 2023). This further affirms a possible alignment of ethical concerns with investment decisions. In addition to this, there is a notion that the integration of ESG principles can help identify companies that are well-managed with a long-term perspective, and are likely to outperform their peers (Arvidsson and Dumay, 2022). As a result, companies that prioritize ESG considerations may be more attractive to investors, leading to an increase in funds flowing into such companies (El Ghoul and Karoui, 2021). This growing evidence suggests that companies with strong ESG performance are more likely to deliver superior financial returns over the long-term, making them an attractive investment option for investors (Ashwin Kumar et al., 2016).

From a markets characterization perspective, ESG trends are increasingly important in both emerging and developed markets (Boffo and Patalano, 2020; Widyawati, 2020). This is evidently so as there is a growing interest in ESG investing, as investors seek to align their investments with their values and beliefs (Widyawati, 2020). For instance, According to the Bank for International

Settlements (BIS) report, ESG funds have soared over the past five years by more than tenfold, and currently have an approximate value of $2.7 trillion (BIS, 2021). Witnessing an exceptional growth in 2021, the World Investment Report noted that ESG net investment reached $557 billion (58% increase from 2020), and a threefold increase from 2019 (WRI, 2022). The report further stated that the majority of ESG funds are domiciled in developed markets, with European ESG funds comprising of 85% of the total global ESG funds. However, a recent report by the Boston Consulting Group (BCG) observed that assets managed by ESG-focused mutual funds and exchange-traded funds targeting emerging markets increased sporadically by over 80% between 2018 and 2022 (BCG, 2023). Regardless of these recent trends, it is worth noting that globally, sustainable funds still only account for about 4% of total open-ended funds. They hence have plenty of growth potential; especially in emerging markets (WRI, 2022).

With regards to the cyclicality of markets, like other investment options ESG funds are not immune to economic fluctuations and changing market conditions. Studies (Ferson and Schadt, 1996; Rizvi et al., 2020) have shown that the performance of investment funds may vary comparatively under different market conditions based on investment styles. For instance, while some funds relatively outperform their benchmark during a positive market state (bullish market condition), some funds with a distinct style may manifest more economic resilience and minimal losses during a market downturn; i.e. in bearish market conditions (Rizvi et al., 2020). Empirically, in a bull market, where investor confidence is high, companies with strong ESG performance may outperform their peers as investors prioritize sustainable investments (Wu et al., 2017). The possible dynamics in ESG under different conditions can be linked to changes in investor sentiment, where companies with poor ESG performance may struggle to attract investment and may underperform (Capelle-Blancard et al., 2021). In a bear market, where investor confidence is low, companies with strong ESG performance may be more resilient to market shocks and may be better positioned to weather economic downturns (Mandal and Murthy, 2021). Companies with poor ESG performance may face greater financial risks and may be more vulnerable to economic downturns. In both bull and bear market conditions, companies that prioritize ESG considerations may be more attractive to investors, and this trend is likely to continue as investors increasingly prioritize sustainable investments (Freiberg et al., 2020).

Furthermore, the possible dynamics in ESG under different market conditions and characterization can be linked to changes in investor sentiment. This may be due to the fact that behavioral aspects such as investor sentiments are increasingly important, and ESG trends and performance may be driven by sentiments rather than financial returns (Wang et al., 2023). Therefore, understanding investor sentiments towards ESG concerns under changing market conditions remains a key point of interest in research discourse especially in the context of developed and developing markets. This is crucial as it could reveal the level of investors' steadfastness towards ESG funds regardless of bull and bear market conditions. Also, knowing if the sentiment toward ESG funds is generalizable among emerging and developed markets, could provide insight on plausible spillovers or co-movements among these markets. Hence, assessing the dynamics of ESG performance in the contexts of market conditions and characterization (emerging and developed markets) is critical for improving ESG investment decisions.

In conclusion, ESG trends, principles, performance, and investor sentiments are becoming increasingly intertwined in today's changing market conditions of bull and bear markets. This is because the global investing landscape is fast evolving and issues of sustainability are becoming a more pressing concern than just maximizing returns on investment. Also, with retail investing on the rise, it is interesting to understand the dynamics of how investors act towards in ESG concerns based on investor sentiments and changing market conditions. Hence, the motivation for this research is grounded in the pressing need to bridge the gap between financial performance and sustainable investing. As an investment professional, the researcher has observed the growing demand for ESG-focused products and the lack of comprehensive understanding regarding their performance across different market conditions. This research aims to provide critical insights into ESG return and volatility dynamics, which are essential for optimizing investment strategies and risk management. By addressing these gaps, the researcher hopes to equip investors, asset managers, and policymakers with the knowledge to make informed decisions that align with both financial goals and sustainability principles. Ultimately, this study aspires to contribute to the advancement of ESG investing, fostering a more resilient and responsible financial market.

1.3 Problem statement

In recent times, there has been increased global awareness on taking ESG concerns more seriously. This is evident in the reactions to recent ESG scandals such as the British Petroleum (BP) and Facebook scandals. While BP was fined the sum of $53.8 billion for its Deepwater Horizon oil spill (Grayson, 2019), Facebook lost over $119 billion of its market value due to sale of its users' data to Cambridge Analytica without their consent (Degirmenci, 2020). Like several recent ESG scandals, these cases have shown the costly consequences of undermining the severity of ESG concerns. At present, reactions to ESG breaches have emphasized the pertinent need for ESG compliance among corporations as non-compliance could result in market reactions such as significant drop in share prices and market values of companies. As a result of this, fund managers are becoming increasingly concerned about ESG compliance status of firms when making portfolio decisions as it could bear significant impact on fund performance. For instance, a study conducted by NASDAQ in 2019, revealed that over a five-year period, the best ESG-rated funds significantly outperformed the least ESG-rated funds globally (Nasdaq, 2019). However, there remains a concern that the key principal concept of maximizing the risk-adjusted investment returns maybe compromised due to the possible growing investor sentiment towards ESG compliance. While this behavioral trend towards ESG funds may be as result of the global "woke culture", increased corporate transparency, media accessibility, and retail investing. This heightened awareness has increased the flow of investment, returns and volatility of ESG compliant funds, regardless of market conditions and characteristics.

There remains a dearth of literatures on investors sentiments and performance of ESG funds. This is evident as several empirical studies have noted scholarly inputs on how investor sentiments impact stock markets (Baker and Wurgler, 2007b; Hu et al., 2021), funds (Chen et al., 2017; Wang et al., 2020) and even alternative investments (Balcilar et al., 2017; Anamika et al., 2023). Likewise, few scholars have inquired on performance of ESG funds in the purview of returns (Ashwin Kumar et al., 2016; Jain et al., 2019) and volatility (Meher et al., 2020; Zhou and Zhou, 2021). Howbeit, it is unknown how investor sentiments impact returns and volatility of ESG funds under changing market conditions and characterizations. Furthermore, the question of plausible interdependencies among ESG markets remains scholarly void and demands empirical contributions.

From a market condition perspective, increased sentiment towards ESG and its effects may be observed better by considering the performance of ESG funds under changing market conditions. This is because changes in bull and bear market conditions are expected to affect both return performance and volatility performance of ESG funds. Studies such as Apau et al. (2021) and Kunjal et al. (2021) have considered non-ESG funds returns and volatility performance in changing market conditions. However, there is a dearth of literatures on how ESG funds perform in bullish and bearish market conditions, especially with consideration to the influence of investor sentiments.

Likewise, from a market characterization perspective, there is a need to further investigate these dynamics in the context of developing and developed markets. Owing to the fact that these markets present different market environment for ESG funds as they have distinct market characteristics in terms of liquidity, risk, regulatory frameworks etc. Based on these distinctions, sentiments towards ESG compliance may not be generalizable in developed and developing markets. In addition to this, it remains unclear whether the growing sentiment towards ESG investments may have ignited returns and volatility spillovers or co-movement among ESG in developing and developed markets. Hence, it is essential to inquire on the level of market connectedness by investigating possible return and volatility spillovers or co-movements between the markets and investor sentiments within the context of ESG funds. Understanding these dynamics is crucial as it provides a standardized empirical understanding of ESG performance for informed investment decisions. Also, it could serve as a gauge of how steadfast ESG proponents in their investment philosophy and concern for ESG are concerns under changing market conditions across emerging and developed markets.

1.4 Research aim, objectives and questions

The aim of the research study is to examine the effect of investor sentiments on the performance of ESG funds in emerging and developed markets during bull and bear market conditions. In addition to this, the research seeks to understand the nature of ESG funds volatility in emerging and developed markets and the interconnectedness of ESG funds in emerging and developed markets. To achieve this aim, the following specific objectives have been developed, with each objective listed below. Each objective was expounded on and further investigated in separate chapters, with Objectives one, two and three being further discussed in chapters three, four and five respectively.

Objective 1: The first objective of this dissertation is to critically examine the performance of ESG funds under different market conditions and blocs. It also aims to ascertain the impact of investor sentiments on ESG performance (returns and risk) across market conditions and blocs. This objective is addressed in Chapter three and the sub-objectives are:

1. to determine and compare the impact of investor sentiment on ESG performance in different market conditions (bull vs bear) within emerging markets;
2. to determine and compare the impact of investor sentiment on ESG performance in different market conditions (bull vs bear) within developed markets; and
3. to compare the impact of investor sentiment on ESG performance across emerging markets and developed markets under different market conditions (bull vs bear).

Objective 2: The second objective of this dissertation is to critically examine the nature of ESG index volatility within and between different markets blocs of emerging and developed markets. This objective is also aimed at investigating the impact of investor sentiments on ESG volatility in emerging and developed ESG markets blocs. To effectively achieve this, Chapter four undertakes the following sub objectives:

1. to determine and compare the nature of ESG volatility in emerging and developed markets considering for volatility stylized facts such as asymmetry, mean reversion, and persistence; and
2. to determine and compare the impact of investor sentiments on ESG volatility in emerging and developed ESG markets blocs.

Objective 3: The third objective of the research is to critically examine the nature of volatility spillovers of ESG markets within and between different blocs of emerging and developed markets. In the fifth chapter of this dissertation, the objectives are to:

1. to determine and compare the nature of ESG volatility spillovers within the emerging markets bloc;
2. to determine and compare the nature of ESG volatility spillovers within the developed markets bloc; and

3. to compare the nature of ESG volatility spillovers between the emerging and developed ESG markets blocs.

Research questions

In order to accomplish the aforementioned objectives, this research work sought answers to the flowing pertinent questions.

Based on the first core chapter as contained in the chapter three of this dissertation, the corresponding questions are:

1. How does investor sentiment impact ESG performance in different market conditions in emerging markets?
2. How does investor sentiment impact ESG performance in different market conditions in developed markets?
3. How does the impact of investor sentiment on ESG performance under different market conditions differ between emerging and developed market blocs?

Based on the second core chapter as contained in the chapter four of this dissertation, the corresponding questions are:

1. What is the nature of ESG volatility in emerging and developed markets considering for volatility stylized facts such as asymmetry, mean reversion, and persistence?
2. How does investor sentiments impact on ESG volatility in emerging and developed ESG markets blocs?

Based on the third core chapter as contained in the chapter five of this dissertation, the corresponding questions were:

1. What is the nature of ESG volatility spillovers in emerging markets?
2. What is the nature of ESG volatility spillovers in developed markets?
3. How does the nature of ESG volatility spillovers between the emerging and developed ESG markets blocs compare?

1.5 Theoretical framework and research scope

This section of the research provides a briefly discusses the applicable theories that are considered in the course of this research investigation. Furthermore, the scope of the research study was also highlighted and discussed.

1.5.1 Theoretical framework

1.5.1.1 Theoretical transition from Efficient Market Hypothesis (EMH), Behavioural Finance Theory (BFT), to Adaptive Market Hypothesis (AMH)

For decades, the Efficient Market Hypothesis (EMH) was widely dominant in explaining asset pricing and investment performance in the finance literature (Singh et al., 2021a). This theory holds that investors are rational individuals who will make rational and efficient decisions (Yildirim, 2017). However, this theory has become less universally accepted by scholars in recent years who have remained puzzled by the inability of EMH to provide relevant explanations for market inefficiencies and events such as size effect, seasonal and day-of-the-week effect, excess volatility, short-term effects and long-run return reversal, and market crashes (Sharma and Kumar, 2019).

Due to these perceived flaws, the Behavioural Finance Theory (BFT) have proposed a shift from the rationality assumption of the EMH theory, and consideration of behavioural biases or heuristics among investors (Ángeles López-Cabarcos et al., 2020). The perspective of this modern school of thought suggests that these biases provided evidence that markets are not only inefficient, but investors are also irrational (Yildirim, 2017). This intellectual debate has shaped the finance theory over the years as some proponents have firm beliefs in market efficiency and rationality, while others have a resolved bias toward the behavioural finance theory (De Bondt et al., 2015b).

In recent years, a new school of thought has advocated for the combination of both perspectives. Such is the case with the Adaptive Market Hypothesis (AMH) classic by Andrew Lo (Lo, 2004). Initially, the theory of adaptive markets was founded on biological evolutionary processes including competition, mutation, reproduction, and natural selection (Levin and Lo, 2021). Individuals make decisions based on their past experiences and their 'best estimates as to what might be optimal. Further, the theory posits that under stable market conditions, heuristics are likely to generate optimal or rational decisions for investors. Nonetheless, in unstable market conditions, which are characterized by hazards and uncertainty, behavioral biases may take on a variety of forms. Consequently, the AMH theory asserts that 'rational' decisions are ever-changing as investors implement new patterns in response to shifting market conditions (Lo, 2004).

1.5.1.2 The advent of style investing

Style investing is an investment approach in which securities are classified into categories and portfolios are allocated based on the style and sentimental choices of investors rather than individual securities (Barberis and Shleifer, 2003). In the finance literature, there are several sentimental investment styles based on the beliefs of investors. Notable among these are styles that focus on value, growth, momentum, actively managed portfolios, passive and index funds etcetera (Ben-David et al., 2022). Whilst most of these investment styles are primarily driven by economic return, this is not the case for an impact-focused investing style. The Impact-focused investing style, or simply impact investing, is an investment strategy/style that seeks to achieve social or environmental goals, while generating profit (Chen, 2022).

This investment style prioritizes a defined impact goal or set of goals over economic return via the use of Socially responsible (SRI) and/or environmental, social, and governance (ESG) investing approaches (Chen, 2022). While the integration of ESG factors is used to enhance traditional financial analysis by identifying potential risks and opportunities beyond the fundamental and technical valuations (Sepetis, 2019), the SRI strategy goes a step further by actively eliminating or selecting investments according to specific ethical guidelines based on religion, personal values, or political beliefs (Chen, 2022).

According to the State Street Global Advisors framework, the five primary strategies for ESG investing are exclusionary screening, positive screening, ESG integration, impact investing and active ownership (Kumar et al., 2018). These strategies reflect a wide range of objectives that include avoiding or reducing ESG risks, generating higher investment returns and seeking measurable impact, among others.

1.5.2 The research scope

Adopting a quantitative research approach, this research inquiry utilized secondary data in the form of daily prices of ESG stock market indices primarily sourced from the Bloomberg database terminal. The study selected MSCI ESG indices for countries within the BRICS and G-7 markets. Therefore, for Brazil, Russia, India, China and South Africa; the MSCI ESG Leaders Index for Brazil, Russia, India, China and South Africa were chosen as the ESG indices for BRICS, respectively. Of noteworthy, due to the war in Ukraine at the time of this study, MSCI ESG data for Russia has been removed from all databases, as its been perceived as a breach to the ESG principle. Likewise, for Japan, France, Italy, Germany, Canada, the UK and USA; MSCI ESG Leaders Index for Japan, France, Italy, Germany, Canada, the UK and USA, were chosen as the ESG indices for G7, respectively.

In addition to the MSCI ESG Indices for each member country and individual market under consideration, the study further included the MSCI ESG Emerging Market Index and the MSCI ESG Developed Market Index as benchmark indices for broad reference and comparative purposes. The MSCI ESG Leaders Indexes target companies that have the highest environmental, social and governance (ESG) rated performance in each sector of the parent index. For each selected country, an index comprises of a 50% sector representation per the parent index, with inclusion of companies that have the highest MSCI ESG rating in each sector.

The daily ESG indices utilised in this study span between January 31st, 2011 and January 2nd, 2023, for Brazil, India, China, South Africa, and emerging market index. Whereas the start for which the indices were obtained for the G7 member countries and the developed market index varies for the individual members of the group, the end date of January 2, 2023, remains the same for the different countries and markets considered. Following the standard practice in the literature, the ESG is expressed in returns for the sake of the empirical analysis; therefore, it is measured as the log of the first difference of the ESG indices that is utilized in this study so as to express the ESG indices in returns.

Thereafter, to achieve the first set of objectives, as contained in the chapter three, the study favored a Markov Switching Model (MSM) as the most appropriate in the context of this study. This model allowed for the effective investigation of ESG returns and volatility dynamics across different market conditions as defined as the bear and bull periods. Likewise, to actualize the second set of objectives in the chapter four, a variety of Generalized Autoregressive conditional

Heteroskedasticity (GARCH) models such as the simple GARCH (1,1) model, exponential GARCH (EGARCH) model, Glosten, Jagannathan, and Runkle GARCH (GJR-GARCH) model were employed. These models were deemed appropriate in understanding the nature (persistence, mean reversion, asymmetry, clustering and risk premium) of ESG volatility in emerging and developed markets. Lastly, in the fifth chapter on the nature of ESG return and volatility spillovers in the emerging markets and developed markets, considered multivariate GARCH (MGARCH) models such as the Constant Conditional Correlation (CCC)-GARCH model, the Dynamic Conditional Correlation (DCC)-GARCH model and the Vector Autoregressive Moving Average (VARMA)-GARCH. The has an additional feature that enables it to capture shock spillovers in the mean equation thus making it the most appropriate to effectively satisfy the objectives of this chapter.

The rationale behind selecting specific models and methods for each chapter of the study on ESG returns and volatility dynamics was guided by the research objectives and the nature of the data. In Chapter 3, the Markov Switching Model (MSM) was chosen to investigate how investor sentiment influences ESG performance across different market conditions (bull and bear periods). This model's ability to capture regime shifts aligns well with the study's need to analyze varying ESG dynamics under different market sentiments. Alternative regime-switching models like Threshold Autoregressive (TAR) models and Hidden Markov Models (HMM), offer similar capabilities in modeling regime changes. In Chapter 4, various Generalized Autoregressive Conditional Heteroskedasticity (GARCH) models (GARCH (1,1), EGARCH, GJR-GARCH) were employed to explore the nuanced nature of ESG volatility in emerging and developed markets, considering aspects like persistence, mean reversion, and asymmetry. These models were selected for their capability to model time-varying volatility dynamics effectively. An alternative method is the stochastic volatility model (SV models) which is also known for its ability to capture complex volatility patterns. In Chapter 5, Multivariate GARCH (MGARCH) models (CCC-GARCH, DCC-GARCH, VARMA-GARCH) were utilized to examine ESG return and volatility spillovers between emerging and developed markets, highlighting their capacity to capture dynamic interdependencies and shock spillovers across multiple markets. Alternative approaches could be the Vector Autoregressive (VAR) model, which also combines machine learning techniques (VAR-X) to capture nonlinearities and dependencies more comprehensively. These choices were made after careful evaluation of their suitability to address the study's objectives, considering trade-offs between model complexity, interpretability, and computational feasibility.

1.6 Research gaps, significance and contribution of the research study

Without any iota of doubt, majority of existing studies have considered the performance of traditional financial markets such as the stock, bond and foreign exchange markets. However, due to increasing trend towards ESG issues, financial markets have witnessed a rise in the demand for more ESG focused products. Whilst this has inadvertently led to the culmination and development of ESG markets, there is yet a reckoning lack/research gap in the understanding of ESG performance under different market conditions. Given, how changing market regimes have significantly affected existing traditional financial markets, it's no gainsaying that this research study makes a significant contribution in the understanding of ESG return and volatility performance in bull and bear market conditions, as well as the expected duration in each market state, across the market blocs. This empirical evidence is relevant and useful for investors, asset managers, academics and policy makers who seek to optimize investment performance across market conditions.

Also, empirical literatures have argued that market characterizations of emerging and developed markets plays a critical role in risk-return performance of financial assets. Considering for traditional financial markets such as stocks, bonds and foreign exchange, there is an abundance of empirical studies that have attempted to explain risk-return performance and its underlying drivers, based on market characterizations. Again, due to the relative infancy of ESG funds and markets, there remains a dearth of evidence (research gap) commenting on ESG return and volatility performance within and across distinct market blocs of BRICS and G7 markets. This empirical evidence is relevant for investors, asset managers and policy makers that are interested in understanding the nature of emerging and developed markets, specifically as it pertains to matters of sustainability and sustainable finance.

Regardless, of the lacking literatures on ESG performance, there remains an assumption that the return and volatility performance of traditional assets and markets are largely influenced by fundamental and macroeconomic variables. However, episodical evidences of human behavioral biases have shown that fundamental and macroeconomic variables are insufficient in understanding risk -return performance of financial assets and markets. This reality has been further exacerbated by the wide digitization and participation in retail investing as a result of technological revolution and mass communication. At a time of sudden awakening to global sustainability issues, the democratization of investing with its associative human bias reverberates beyond just traditional investment options to more sustainable choices. Therefore, a significant contribution of this study relates to elucidating on the role of investor sentiment in the performance of ESG funds in emerging and developed markets. This offers critical insight to inform future decisions, policies and research made by stakeholders such as investors, fund managers, institutions and academics.

By investigating asymmetry, persistence, mean reversion, and risk premium within ESG markets, this study aims to contribute valuable insights to both academia and practitioners. Understanding the asymmetry of volatility in ESG markets can shed light on how positive and negative shocks impact asset prices differently, influencing investment strategies and risk management. Persistence analysis will provide crucial information on the duration of volatility episodes, aiding in the development of more accurate forecasting models. Mean reversion exploration is essential for assessing the tendency of ESG market volatility to revert to its historical average, facilitating informed decision-making. Additionally, studying the risk premium associated with ESG markets' volatility can offer a nuanced perspective on the relationship between risk and return in sustainable investments. This research, therefore, contributes to the broader comprehension of the distinctive volatility characteristics of ESG markets and their implications for investors, policymakers, and financial institutions. In particular, the empirical evidence is relevant for investors and asset managers who seek to optimize investment performance via understanding the nature of ESG volatility in emerging and developed markets.

Focusing on the differential patterns of volatility within and between emerging and developed ESG markets, this research study addresses a critical gap in the existing literature on ESG and sustainable finance. The recognition of inherent variations in volatility patterns within emerging ESG markets is essential for unraveling unique risk dynamics associated with these economies. Therefore, juxtaposing these findings with developed markets, this research offers a significant contribution by providing a comprehensive comparative analysis. This comparative lens further illuminates the distinct nature of volatility patterns in these market blocs, which also enhance the accuracy of risk assessment models that traditionally treat emerging and developed markets homogeneously. Unveiling volatility behaviors within and across ESG market blocs, provides guidance to investors and stakeholders in crafting more tailored strategies via enhanced understanding of global financial interconnectedness.

Regarding investor sentiment and ESG volatility, the study addresses a notable gap in the existing literature, as there is limited empirical evidence on how investor sentiment influences the volatility of ESG markets (emerging and developed). Acknowledging the pivotal influence of behavioral biases in financial markets, this study contributes to the development of more robust risk management framework on the basis of elucidating the scant knowledge on sentiment-induced volatility in emerging and developed ESG market blocs. This contribution was made via the adoption of the GARCH-X model which aided in the understanding of how the composite investor sentiment (CIS) impacts on ESG volatility nature within and across emerging and developed markets. As a novel contribution, the empirical evidence is crucial for academic scholarship on ESG and sustainable finance, as well as for investors and practitioners seeking to optimize investment decisions.

By delving into ESG markets interconnectedness, this study contributes valuable insights with profound implications for both academic discourse and practical decision-making. Foremost, the understanding of return volatility spillovers is crucial for unraveling how shocks in one ESG market may impact others, facilitating the knowledge of ESG in both emerging and developed markets. This knowledge further helps to discern the directions (unidirectional or bidirectional) of the spillover among the markets, as well as how spillover effects (positive or negative) propagates within ESG markets Furthermore, investigating volatility spillovers is essential for gauging the contagion effects within ESG markets. This outcome of this research sheds light on whether heightened volatility in one market spills over to other ESG markets, such insights are pivotal for the understanding ESG markets from the standpoint of market risk, interdependence and resilience. Thus, this research investigation contributes significantly by addressing the dearth of evidence on return and volatility spillovers in ESG markets.

Finally, by exploring how return spillovers differ between emerging and developed ESG markets, the research aims to fill a notable void/gap in the existing literature by investigating the distinctions in return and volatility spillovers within and across emerging and developed markets. Providing in-depth clarity on the dynamics of market interconnectedness across ESG market blocs, this study uncovers unique patterns of contagion and transmission of market shocks in these distinct financial landscapes. Unraveling whether heightened volatility in one sector propagates differently in emerging markets compared to developed ones can guide the formulation of more precise risk models. This knowledge is essential for creating resilient investment strategies that account for the varied nature of spillovers in different market contexts. Hence, this research makes a significant contribution by offering clarity on how return and volatility spillovers manifest within and across emerging and developed markets. Furthermore, this empirical evidence is relevant for investors, asset managers and policy makers that are interested in understanding the nature of ESG spillovers within and across emerging and developed markets, specifically as it pertains to matters of returns and volatility market interconnectedness.

In summary, this research study fills critical gaps in understanding ESG performance under various market conditions, providing practical applications for investors, asset managers, and policymakers. By analyzing ESG return and volatility in bull and bear markets, the study offers insights for optimizing investment strategies. The study further highlights the differential risk-return performance between emerging and developed markets, aiding in tailored investment decisions. The exploration of investor sentiments impact on ESG volatility can inform more robust risk management frameworks. Additionally, examining asymmetry, persistence, mean reversion, and risk premium in ESG markets helps develop accurate forecasting models. By understanding return and volatility spillovers, the research guides stakeholders in managing contagion effects and enhancing market resilience, ultimately supporting informed decision-making in sustainable finance.

1.7 Delimitation of the study

The delimitation of this research study can be understudied from three dimensions of the research scope, the conceptualization of investor sentiment and the adoptive models.

Commencing with the research scope delimitation, this study considered emerging ESG markets as defined as five-member countries from the standpoint of the BRICS economies. However, due to the Russia-Ukraine war, Russia was barred as an ESG market by all database providers such as Bloomberg. Another delimitation relating to the scope of the study was the birth of the BRICS Plus which was formed at the near-completion of this study. Whilst several studies have ideated emerging markets as MENA, ASEAN, ECOWAS and so on, this study conceptualized emerging markets as BRICS as considered by other authors (Abou-Zaid, 2011; Hossenidoust et al., 2013). Likewise, with regard to developed ESG markets, the G7 countries were favored. In a similar vein to the emerging markets, there is no standard conceptualization of developed markets as some studies have considered market blocs such as the EU and the G10 as advanced economies/ market blocs.

Secondly, with regards to the construct of investor sentiment as a research delimitation, there is no one size fit all conceptualization of investor sentiment. Based on empirical studies, such as Baker and Wurgler (2007c), He et al. (2022), and Gric et al. (2023) investor sentiment has been captured as market-based sentiment, media-based sentiment, survey-based sentiment, et cetera. However, due to the global nature of this study, it was deemed appropriate to define investor sentiment as market-wide sentiment through a composite metric consisting of global sentiment indicators. This approach has been widely adopted by closely similar studies (Rupande et al., 2019; Muguto and Muzindutsi, 2022) that have considered international market blocs.

Lastly, the final research delimitation of this study relates to the availability of different measures of ESG indices as computed by varying providers of sustainable finance data such as Sustainalytics, Refinitiv, MSCI, Vigeo Eiris et cetera. Given the availability of alternative data sources, the choice for the use of the MSCI data was due to its robustness to cover all the ESG markets in both the emerging and developed markets as represented by the BRICS and G7 market blocs. In addition to this, the MSCI data is widely accessible and available on the Bloomberg terminal. This in no way does not discredit other studies that have employed alternative ESG indices from other data providers where possible.

1.8 Structure of the thesis

This research thesis is intentionally structured in the form of extensive focused chapters that are designed around the core aim of the study as well the objectives and questions highlighted in sections 1.3, 1.4 and 1.5 respectively. Adopting this architecture, the chapters three, four and five of this study corresponds to the research objectives one, two and three, sequentially. More explicitly, the structure of the dissertation goes thus:

The chapter one introduces the study, providing the background and other relevant details that sets the context of the study. Thereafter, the chapter two focuses on the theoretical framework upon which the study hinges on within the finance literature. The chapter three being the first extended article on the first set of objectives, expounds on investor sentiments and ESG performance in different market regimes (bull vs bear) and market blocs (emerging markets vs developed markets). Likewise, the chapter four of this study which corresponds to the second set of objectives, delves on the investor sentiments and ESG volatility in emerging and developed markets. More so, the chapter five otherwise the third extended article of this study, corresponding to the third set of objectives, extensively considers the nature of ESG return and volatility spillovers in emerging and developed markets. Lastly, the chapter six of this dissertation being the final chapter, offers the summary of findings, general conclusion, recommendations and suggestions for future studies.

1.9 Definitions of key terms and concepts

- ***Adaptive Market Hypothesis (AMH):*** A theory combining elements of Efficient Market Hypothesis (EMH) and Behavioral Finance, suggesting that market participants adapt their strategies based on changing market conditions.
- ***Behavioral Finance Theory (BFT):*** Challenges the EMH by suggesting that psychological factors and biases influence investor behavior and market outcomes.
- ***Environmental, Social, and Governance (ESG):*** Criteria used to assess the sustainability and ethical impact of investments in companies and businesses.
- ***Ethical Investing:*** Investing based on ethical principles, often avoiding companies involved in activities deemed harmful or unethical.

- ***Impact Investing:*** Investing with the intention of generating measurable social or environmental impact alongside financial return.
- ***Socially Responsible Investment (SRI):*** Investment strategy that considers both financial return and social/environmental good, often by excluding or selecting investments based on ethical guidelines.
- ***Sustainable Finance:*** Integration of environmental, social, and governance (ESG) criteria into financial decision-making to promote sustainable development.
- ***Triple Bottom Line:*** Framework that evaluates business performance based on economic, social, and environmental criteria.
- ***United Nations Principles for Responsible Investment (UNPRI):*** Initiative advocating for the incorporation of ESG factors into investment practices to better align with broader sustainability goals.s

1.10 Conclusion of chapter one

In closing, the subject matter of ESG, though a relatively new niche area in empirical finance, has continued to arouse interest and awareness globally. Therefore, there is a keen interest to unravel the phenomenon from the dimensions of investor sentiment, volatility and spillovers in emerging and developed markets. Hence, as the first chapter of this research dissertation, this chapter of the study introduced the research providing a background on ESG. Subsequent sections of this chapter clarified the problem statement, research aim, objectives and questions in tandem with the phenomenon of investor sentiment and ESG performance in market blocs and conditions. Furthermore, upon discussing the theoretical and methodological landscape, the chapter also highlighted the delimitations as well as the significance and contributions of the study. Finally, the study explained the structure of the thesis and its chapters, including technical chapters designed in the form of extended literatures. The next chapter of this dissertation focuses on theoretical framework.

CHAPTER TWO: THEORETICAL FRAMEWORK

2.1 Introduction

Ravitch and Carl (2019) asserts that the essence of a theoretical framework in the course of an academic research study is to offer a framing context which links the subject matter of the research inquiry, with relevant foundational theories. Given this context, this research study considers the phenomenon of ESG within the confines of applicable finance theories. Prior to the exposition/deep dive on the theories, it was crucial to begin with a conceptual framework on ESG funds which entails discussions relating to the conceptualization of ESG funds, decomposition of ESG investing, strategies for incorporating ESG into investment process as well as the challenges currently limiting ESG investing in both emerging and developed markets.

Subsequently, this chapter expounded on the fundamental theories underlying performance of ESG funds across market conditions and characterizations considering for the role of investor sentiments. Herein, the study captured relevant financial economic theories such as the Efficient Markets Hypothesis (EMH) theory, the Behavioral Finance (BF) theory, the Adaptive Market Hypothesis (AMH) theory, and the Sustainable Finance (SF) theory. This section begins by discussing the evolution and axioms of the Efficient Market Hypothesis (EMH), as well as the forms as of the EMH theory and its flaws which gave rise to the BF theory. Thereafter, the BF theory was explored succinctly covering its axioms, framework of sentiments, biases and limits to arbitrage as well as its impediments which spurred the conception of the AMH theory. Given the inadequacies of both the EMH and BF theories, this section of the research study delved further on the AMH theory. Which has been widely perceived as a theoretical arbiter, which tries to provide a theoretical reasoning to mitigate the flaws of both the EMH and BF theories. The AMH theory, which follows a biological evolutionary perspective was also considered as a significant theory within the theoretical framework of this study, as the study seeks to understand possible market adaptations of bull and bear conditions in both emerging and developed markets. Thus, the axioms, implications and criticisms of the AMH theory were thoroughly discussed. Lastly, the SF theory was also considered as a key applicable theory to the understanding of ESG funds as an integral type of sustainable investment. Therefore, the section further elucidates on the SF theory, highlighting the United Nations Sustainable Development Goals (UN SDG), definitions and theoretical perspectives of SF as well as limiting factors to the effective implementation of the SF theory.

2.2 Conceptualization of ESG Funds

Originally, what is now known as ESG investing can be traced back to the 1700s when the Quaker and Methodist church in USA and Europe, devised an “Exclusion list” based on its religious and moral stance (Capannoli, 2019). This list prohibited its members from investing and patronizing certain organizations involved in gambling, slave labour, tobacco and sale of alcohol. The 1960s, witnessed the rise of the social responsibility investment, as ESG became more mainstream as the mutual fund industry, the civil rights movement and other human rights institutions advocated for the boycotts of companies involved in the support of the Vietnam war (Martini, 2021). Likewise, in the 1980s, the same strategy was replicated in Apartheid South Africa as there was a global boycott of South African products and business in protest to the Apartheid regime, further crippling the South African economy and ending the Apartheid era (Statman, 2020).

In the early 1990s, the concept of the “Triple Bottom Line” was birthed, with the main idea of encouraging corporate organisations to focus beyond the single “P” (Profit), and on other “Ps” (People and Planet) (Nogueira et al., 2022). This further culminated the launch of the United Nations Framework Convention on Climate Change (UNFCCC), as well as the United Nations Environment Programme Finance Initiative (UNEPFI) in 1992. Whilst the former was tasked with the responsibility of stabilizing greenhouse emissions of companies and industries (Preqin, 2022), the latter was established as the first organization to engage the finance sector on global sustainability (UNEPFI, 2024). To further strengthen UNFCCC, the early 2000s witnessed the establishment of the United Nations Global Compact (UNGC) which was launched in 2000, as a voluntary initiative that is based on the commitments of CEOs to implement universal sustainability principles in line with the UN goals (Rasche, 2020). Of noteworthy, in 2004, the United Nations Global Compact (UNGC) published a report which was the first documented evidence advocating for the ESG approach. This approach emphasizes that corporations should establish rules for integrating the ESG concept into their asset management and security brokerage services. The was further supported by ground breaking evidence showcasing financial relevance of ESG, in the proposed report of the United Nations Environment Programme Finance Initiative

(UNEPFI) in 2005, further stressing the fiduciary responsibility of incorporating ESG metrics when making investment decisions (Zhao et al., 2023).

Eccles et al. (2020), notes that these reports laid the foundational blocks for the creation of the United Nations Principles for Responsible Investment (UNPRI). The UNPRI was launched in 2006, by the former UN Secretary-General Kofi Annan, to inspire the world largest institutional investors to develop and commit the principles for Responsible Investment such as the incorporation of ESG concerns in investment analysis and decision making (Bauckloh et al., 2019). Following the success of the UNPRI initiative, the 2010s have evident that ESG concerns have become a major agenda in the mainstream financial services industry. This is evident in the inclusion of ESG related issues in the SDGs, the creation of the Task Force on Climate-related Financial Disclosures (TCFD) in 2015, the creation of the Intergovernmental Panel on Climate Change (IPCC) in 2018, as well as the recent creation of the Sustainable Finance Disclosure Regulation (SFDR) in 2021 (Preqin, 2022).

Today, environmental, social, and governance (ESG) investing is an investment approach that considers a company's performance on ESG factors as indicators of long-term financial performance. ESG investing seeks to identify companies that prioritize sustainability, social responsibility, and good governance and that are likely to have stronger financial performance over the long term. As a form of ethical investment style, ESG investing follows an investment approach that seeks to consider both financial returns and the impact of an investment on society and the environment. Ethical investors look for investments that align with their personal values, such as environmental sustainability, human rights, and good governance. This investment style/philosophy avoids investments in companies that have a negative impact on society or the environment, such as those involved in the production of tobacco, weapons, or fossil fuels. Other forms of ethical investment style include socially responsible investing (SRI), which is an investment approach that seeks to consider both financial returns and positive social impact. Similar to this is the impact investing, which is an investment approach that seeks to generate positive social or environmental impact alongside financial returns. Another type of ethical investing style is the religious or values-based investing, which is an investment approach that seeks to align investments with an individual's religious or moral values.

Ethical investing has gained popularity in recent years as more and more investors seek to align their investments with their values and make a positive impact on the world. While ethical investing may have historically been seen as a trade-off for financial returns, many studies have shown that companies with strong ESG performance can offer competitive financial returns over the long term. The ESG investing approach involves analyzing an organization's performance on ESG factors, which comprise of environmental, social and governance factors.

2.2.1 Decomposing ESG investing and strategies

Whilst there is no standard conceptualization of ESG, the CFA institute attempts a decomposition of ESG via the table below (Bouyé et al., 2021):

Table 2.1: ESG Componential Issues

Environmental Issues	**Social Issues**	**Governance Issues**
Climate change and Carbon emissions	Customer satisfaction	Board composition
Air and Water pollution	Data protection and privacy	Audit committee structure
Deforestation	Human rights	Executive compensation
Biodiversity	Gender and diversity	Whistleblower schemes
Energy efficiency	Labor standards	Bribery and corruption
Water scarcity	Community relations	Political contributions
Waste management	Employee engagements	Lobbying

Source: CFA Institute (CFA, 2017)

Zhao et al. (2023) notes that the environmental, social, and governance (ESG) concept involves three components: the environment, social responsibility, and corporate governance.

- ***Environmental factors in ESG investing***

Brooks and Oikonomou (2018) describes environmental factor as the need for enterprises to improve their environmental performance and decrease the environmental costs associated with their production and operation. Within this context, ESG investors evaluate a firm's environmental performance to determine its long-term viability and its prospects for future financial success (Zumente and Bistrova, 2021). Companies that have a favorable influence on the environment, such as those engaged in renewable energy or sustainable agriculture, may be seen as more advantageous investment prospects compared to those that have an adverse effect. Furthermore, ESG investors may also consider a company's susceptibility to environmental hazards, such as the consequences of climate change or limited resources (Jinga, 2021). This implies that companies with substantial exposure to environmental concerns may have financial difficulties in the future, making them less appealing as investment opportunities.

- ***Social factors in ESG investing***

Gao et al. (2021) explains social responsibility from the standpoint of ESG, to mean that a company demonstrates adherence to rigorous legal standards and upholds strong economic and social ethics, while prioritizing human rights and fostering positive ties with the wider community. ESG investors evaluate a company's long-term viability and future financial prospects by analyzing its performance on social considerations. Herein, investors prefer companies that place a high value on social responsibility, such as those that have robust labor policies and a commendable track record in upholding human rights, as compared to those that have a detrimental social influence (Ruggie et al., 2020). Furthermore, ESG investors may also consider a company's susceptibility to social risks, such as potential harm to its image due to adverse media attention or customer boycotts. Companies that are very vulnerable to social hazards may have financial difficulties in the future, which might diminish their appeal as investment opportunities (Karwowski and Raulinajtys-Grzybek, 2021). ESG investors seek to discover firms that are strategically positioned for long-term success and actively contribute to societal improvement by considering social concerns.

- ***Governance factors in ESG investing***

Câmara (2022) conceptualizes governance as it relates to ESG, as a scientific management system in which the rights of shareholders and the management of the board of directors must be reasonably divided, centering on those who can be delegated responsibilities. ESG investors assess a company's commitment to governance principles in order to gauge its ability to sustain itself over time and its potential for future financial prosperity (Gasperini, 2020). Entities that have strong governance frameworks, which include autonomous boards and transparent practices, are often seen as more desirable investment opportunities in contrast to those with insufficient governance. In addition, ESG investors may also consider a company's susceptibility to governance risks, such as the possibility of mismanagement or corruption. Companies that have a high level of governance risks may have financial difficulties in the future, which might make them less appealing as investment opportunities (Freiberg et al., 2020). ESG investors aim to evaluate governance factors in order to identify companies that are strategically positioned for long-term success and are efficiently managed with a strong emphasis on accountability and transparency.

2.2.2 Approaches/strategies for incorporating ESG concerns into investment process

The 2022 Global Sustainable Investment Review (GSIR) report states that inculcating ESG concerns in investment decision process can be implemented via five broad approaches (GSIA, 2022), which are:

i. Screening strategy: ESG screening strategies can be described as approaches to ESG investing which utilizes rules/filters based on established criteria that assess whether an investment option or asset class is permissible for ESG investing purpose (GSIA, 2022). In this purview, screening-based strategy can be broadly categorized in three approaches of norms-based screening approach, negative or exclusionary screening approach, and positive or best-in-class screening approach.

- ***Norms-based screening approach:*** According to the European Sustainable investment forum (Eurosif), norms based screening can conceptualized as the evaluation of investments to ensure compliance with minimal standards of business or issuer conduct, as defined by internationally recognized norms such as those established by the United Nations (UN), International Labour Organization (ILO), Organization for Economic Cooperation and Development (OECD), and non-governmental organizations such as Transparency International (Eurosif, 2023).

- ***Negative or Exclusionary screening approach***: Negative screening is the deliberate rejection of firms, industries, or nations that are deemed contentious from the pool of potential investments (Bouyé et al., 2021). Otherwise known as exclusionary investing strategy, this ESG strategy involves deliberately excluding some investments or categories of investment, such as firms, industries, or nations, from the available pool of investment options (Eurosif, 2023). This strategy employs a systematic method to eliminate firms, industries, or nations from the list of acceptable investments if they are engaged in particular activities that meet certain criteria. Typical requirements include arms, explicit material, tobacco, and experimentation on animals. Exclusions may be implemented either at the level of particular funds or mandates, or more broadly at the level of asset managers or asset owners, including the complete spectrum of assets in their portfolio. For instance, an extensive disinvestment or exclusionary campaign occurred in the 1980s targeting South Africa as a direct reaction to the apartheid system. The most recent divestment initiative focuses on fossil fuels in relation to climate change and impacts several industries, including coal mining and steel production (Bouyé et al., 2021).
- ***Positive or best-in-class screening approach:*** Positive screening in ESG investing involves applying filters to a universe of securities, issuers, investments, sectors, or other financial instruments to rule them in, based on their positive performance on ESG factors relative to industry peers or specific environmental, social, or governance criteria (UNPRI, 2023). It involves identifying companies with strong ESG practices and including those that meet certain ESG criteria. Similarly, the best-in-class technique encompasses positive screening or index-adjusted weighting (ESG tilting) by evaluating a firm's or country's attributes in relation to its peers (Bouyé et al., 2021). The technique involves selecting or weighting assets within a universe, category, or class based on ESG criteria, with a focus on the leading or best-performing options (Eurosif, 2023). This strategy entails choosing or assigning value to the top-performing or most enhanced firms or assets as determined by ESG research, within a certain investment scope. Currently, companies such as Sustainalytics, MSCI, and other suppliers provide environmental, social, and governance (ESG) ratings and market indexes for various institutions, including governments and corporations. Investors have the option to use other sources or create their own procedures (Bouyé et al., 2021).

ii. ESG Integration: ESG integration is the process of incorporating environmental, social, and governance (ESG) factors into the investment process and decision-making process with the aim to improve risk-adjusted returns (GSIA, 2022). ESG integration involves analyzing a company's ESG performance and considering this information when making investment decisions. ESG integration is different from traditional investment approaches that focus solely on financial factors such as earnings, revenues, and stock prices. Instead, ESG integration considers both financial and non-financial information to arrive at a more comprehensive understanding of a company's long-term sustainability and its potential for future financial performance. Herein, Investors often conduct an analysis to identify the financially significant ESG factors, and they may use scoring systems to evaluate assets based on a certain set of standards (Bouyé et al., 2021).

iii. Thematic investing: The United Nations Principles for Responsible Investments (UNPRI) defines ESG thematic investing as an investing approach the which is fixated on ESG trends rather than specific companies or sectors, enabling investors to access structural shifts that can change an entire industry (UNPRI, 2023). Likewise, the Global Sustainable Investment Alliance (GSIA) describes this strategy as investing on the basis of themes and assets that are tailored to have specific contributions to environmental and social sustainable solutions (GSIA, 2021). This approach enables investors to allocate capital towards companies and projects that promote environmental stewardship, social equity, and sound governance practices while driving innovation and growth in thematic sectors such as renewable energy, clean technology, and social inclusion (Daugaard et al., 2023). For example, an investor may choose to invest in companies that are involved in renewable energy production or energy efficiency, as these companies are well-positioned to benefit from the growing demand for clean energy solutions.

iv. Impact investing: The Global Impact Investing Network (GIIN) conceptualizes impact investing as an ESG investing strategy that is aimed at making intentional investment choices that are intended to have positive and measurable environmental, social and governance impact whilst generating economic returns (GIIN, 2021). The network further asserts that impact investments have four defining characteristics which include- an intentional commitment to social and environmental issues, pursuit of financial return on investment, impact investing across a range of asset classes, and measurement and reporting of impact made by underlying assets to environmental and social issues.

v. Active ownership and stewardship: The Global Sustainable Investment Review (GSIR) describes this ESG approach involves the use of rights and influence of an investor to safeguard and augment the long-term value for beneficiaries and clients which encompasses a shared ESG interest (GSIA, 2022). Active ownership is engaging in a conversation with firms or nations over environmental, social, and governance (ESG) matters and exercising ownership privileges, such as voting and expressing opinions (Bouyé et al., 2021). This is especially important for bondholders since they lack voting rights as a mechanism for making changes. This ownership strategy offers an alternative to the act of departing or selling the shares or bonds of corporations that engage in actions deemed undesirable. It also provides an option to divesting based on particular sector-wide assets, such as eliminating fossil fuels as stranded assets.

2.2.3 ESG investor organizations, associations and Initiatives

Inderst and Stewart (2018) categorized relevant global institutions that are committed to different aspects of ESG concerns globally. the table below presents a summary of these organizations and initiatives per their relevant areas of commitments.

Table 2.2: Categorization of international Organizations and Initiatives relating to ESG

Responsible and Sustainable Investment	**Corporate Governance, Accounting, and Disclosure**	**Green and Climate change Investment Associations**	**Initiatives**	**Impact Investing**
UN Global Compact (UNGC)	International Corporate Governance Network (ICGN)	Institutional Investor Group on Climate Change (IIGCC)	Carbon Disclosure Project (CDP)	Global Impact Investing Network (GIIN)
UN Principles for Responsible Investment (PRI)	Global Reporting Initiative (GRI); Global Sustainability Standards Board (GSSB)	Investor Group on Climate Change (IGCC)	Asset Owners Disclosure Project (AODP)	
EuroSIF, UKSIF, USSIF, SIF Japan, ASrIA, RIA Canada, RIA Australasia, etc	Sustainability Accounting Standards Board (SASB)	Asia Investor Group on Climate Change (AIGCC)	Montreal Carbon Pledge	
Global Sustainable Investment Alliance (GSIA)	The FSB Task Force on Climate-related Financial Disclosures (TCFD)	GIC Global Platform	Portfolio Decarbonization Coalition	
Equator Principles	Asian Corporate Governance Association (ACGA)	Ceres	Action 100+	
International Capital Market Association (ICMA), Green Bond Principles (GBP), and Social Bond Principles (SBP)			Extractive Industries Transparency Initiative (EITI)	
			United Nations Environment Program (UNEP) Initiative	
			Finance for Tomorrow	
			Climate 100+	
			Net Zero Alliance	
			Tobacco-Free Alliance	

Source: Inderst and Stewart (2018)

2.2.4 Challenges facing ESG Investing

Whilst providing a primer for central banks globally, Bouyé et al. (2021) stresses some impediments currently hindering the global success of ESG investing. Amongst these are:

- ***Shortage of quality data***

  Availability and integrity of data are crucial factors for investors. Information that is pertinent, timely, and comparable serves as the foundation for implementing and monitoring the impact of multiple ESG strategies (Asif et al., 2023). Investors continue to be devoid of consistent disclosures and accounting frameworks. One illustration of this is when corporations may omit ESG-related information from their regular financial statements, thereby complicating integration.
- ***Regulatory inconsistencies regarding fiduciary roles and responsibilities***

  Regulation can serve as an impediment or facilitator to ESG investing. When considering this matter, whether ESG investing aligns with the investor's fiduciary duty is among the most crucial factors (Savi and Ostrovnaya, 2023). Although legislation pertaining to fiduciary duty differs across nations, preliminary decisions specified that fiduciaries may only consider financial returns when acting in the best interests of the beneficiaries. Presently, guidance in a number of nations mandates that fiduciaries integrate ESG factors into their decision-making processes.
- ***Difficulties in measuring and reporting ESG impacts***

  It is difficult to determine whether impact investments produce the intended results. The quality and scope of voluntary issuer disclosure standards observed in the impact bond market can vary (Atkins et al., 2023). Due to the voluntary nature of the market, the primary concern of policymakers and investors is whether current certifications and standards produce the intended environmental outcomes (Economist, 2020). How can investors in green bonds and comparable instruments ascertain that the promised environmental benefits have been realized? Green bond evaluations are conducted by firms including Sustainalytics, VigeoEiris, Oekom Research, Moody's, Cicero, and Trucost, which is currently a component of the S&P Dow Jones Indexes. However, despite the verification of carbon footprint reduction by these assessments for a particular project, the extent to which carbon emissions are reduced at the firm level remains uncertain (Ehlers and Packer, 2017)

- ***Low market liquidity***

  Conventional bonds are typically more readily traded than thematic bonds. As stated by Díaz and Escribano (2020) the liquidity of a financial instrument is determined by the ability to conduct a transaction swiftly and with minimal price volatility. The market's limited liquidity could potentially be attributed to the preponderance of long-term institutional investors, who tend to retain green bonds until their maturity dates. (Fender et al., 2019) report that the bid-ask spread for green bonds is greater than that of conventional bonds. Therefore, trading green bonds is more expensive, indicating that the green bond market segment has less liquidity.

- ***Small market capitalization and limited ESG-financial instrument options***

  A notable limitation pertains to the scale of the impact bond market. The market for labelled green bonds has expanded to encompass asset-backed securities (ABS), municipal and sub-national issuers, project and infrastructure assets, and asset-backed securities (ABS) (Gilchrist et al., 2021). Furthermore, fixed-income investors who focus on designated bonds have fewer alternatives for incorporating ESG factors. There are active and passive investment instruments available to equity investors, such as smart beta instruments and exchange-traded funds (ETFs). On the contrary, the selection of investment vehicles for fixed-income investors is comparatively restricted, and passive investment instruments are presently in their nascent stages.

2.3 Foundational theories underpinning ESG investing

From a theoretical standpoint the niche of environmental finance, especially ESG focused investing is underpinned by critical financial theories including the efficient markets hypothesis (EMH) theory, the behavioral finance theory, the adaptive markets hypothesis (AMH) theory, as well as the recent theory of sustainable finance.

2.3.1 The Efficient Markets Hypothesis (EMH) theory

Exploring the performance of Environmental, Social, and Governance (ESG) funds in emerging and developed markets within the context of the Efficient Market Hypothesis (EMH) sheds light on the efficiency of market pricing mechanisms and the influence of investor sentiments. This theory posits that asset prices reflect all available information, yet the ESG landscape challenges this notion by highlighting the impact of non-financial factors on investment decisions.

Commencing with the origins of EMH, it has been argued that the earliest works and discussions on market efficiency can be traced to the dissertation of the prominent French mathematician, Louis Bachelier in 1900. In his remarkable doctoral study, Bachelier (1900) acknowledged that the market price of an asset is a reflection of all information – past, present and future events. However, the conceptualization of market efficiency was first envisioned and anticipated in the works of Gibson (1889) titled "The stock markets of London, Paris, and New York, where by the author posited that when shares become publicly known in the open market, their acquisition value is based on the judgement of the best intelligence concerning the shares (Gibson, 1889). Following these works, Pearson (1905) ideated the term random walk as the path taken by a drunkard, who staggers in an unpredictable and random pattern.

Laying the foundation for future landmark studies, these assertions gained momentum in the 1960s and found prominence via the works of Mandelbrot and Mandelbrot (1963) Granger and Morgenstern (1963), Cootner (1964), Samuelson (1965), and the focal studies of Eugene Fama (1965a, 1965b). Paul Cootner (1964) in his classical book posited the Random Walk hypothesis, Fama (1965b) suggested that the stock market behavior is such that follows a random walk pattern, hence further suggesting that the random walk pattern results in "efficient" markets. The concept of market efficiency describes a market where by relevant information is rapidly incorporated into prices of financial assets, hence eliminating the possibility of abnormal profits. Although, the works of Fama (1965a) was the first to offer a definition for the term efficient, Samuelson (1965) in his research investigation was the first to provide an empirical argument for "efficient markets" using the concept of martingales, instead of the random work hypothesis.

The concept of efficient market hypothesis (EMH) was first devised and coined by Harry Roberts in 1967. Roberts (1967) captioned the term in the study "Statistical versus clinical prediction of the stock market". Further marking the distinction between the weak and strong forms of EMH.

However, in a foremost major event study conducted by Fama et al. (1969), the notion that stock markets are efficient was solidify with significant evidence based on the findings of the study. There on, Fama (1970) proceeded to publish the first of the trilogy of landmark papers titled: Efficient capital markets: A review of theory and empirical work. Earning him his Nobel prize, Fama (1970) conceptualized the standard definition of efficient markets as “a market whereby prices always “fully reflect” all available market information. Improving on the works of Roberts (1967), He further highlighted three forms of market efficiency to be weak form EMH, semi-strong EMH and strong EMH.

2.3.1.1 Axioms of the Efficient Market Hypothesis (EMH) theory

According to Shleifer (2000), EMH is built on three assumptions that form its theoretical bases (Kamoune and Ibenrissoul, 2022):

Rationality of investors: The Efficient Market Hypothesis (EMH), as defined by Shleifer (2000), is predicated on the fundamental supposition that investors act rationally. Assuming market participants are rational decision-makers who assess securities in accordance with the principle of maximizing their expected utility, this fundamental premise is established. The rationality assumption posits that investors systematically and impartially evaluate all accessible information prior to reaching decisions that maximize their overall utility or satisfaction. The notion of rationality is firmly grounded in neoclassical economic theory, which postulates that, equipped with the knowledge at their disposal, individuals make judicious decisions motivated by self-interest. Notable advocates of this viewpoint consist of Fama (1970) and Samuelson (1973), whose seminal contributions to the EMH were predicated on the assumption of rational investor conduct.

Randomness of non-rational trades: For situations in which investor rationality is compromised, Shleifer's second supposition presents a contingency plan. Their transactions are presumed to be arbitrary, in accordance with this postulate, when investors deviate from rationality. Based on this supposition, any potential impact on market prices may be effectively negated by the unpredictability of non-rational trading activities Shleifer (2000). Noise trading, in which uninformed or irrational investors participate in transactions that fail to mirror the underlying market fundamentals, can be likened to the concept of randomness in irrational trades (Wouassom, 2017). This viewpoint is consistent with the concept of market efficiency, which asserts that prices accurately reflect all pertinent information and promptly rectify any price fluctuations caused by irrational behavior (Grossman and Stiglitz, 1980).

Influence of rational arbitragers: The third fundamental assumption of the EMH pertains to the function of logical arbitragers in preserving the efficacy of the market (Shleifer, 2000). Rational arbitragers are envisioned as observant market participants who exploit mispricing in securities to generate profits and, in doing so, eradicate any influence that irrational investors may have on market prices. This assumption is predicated on the notion that arbitrage activities function as a corrective mechanism in an efficient market, guaranteeing that prices precisely mirror all pertinent information. Extensive research has been devoted to the concept of rational arbitrage in the finance literature; for instance, Black (1986) and Grossman and Stiglitz (1980) published seminal works that emphasized arbitrage's significance in ensuring market efficiency.

Although these assumptions form the basis of the Efficient Market Hypothesis, however academics have criticized and debated them. Kahneman and Tversky (1979) and Thaler (1980) have shown investor rationality errors and irrational decision-making. Arbitrage may not remedy market inefficiencies, particularly when transaction costs and other frictions are present, according to empirical evidence. Despite these concerns, EMH assumptions affect financial economics conversations and research.

2.3.1.2 Forms of the Efficient Market Hypothesis (EMH) theory

Rossi (2015) discusses the several forms of the Efficient Market Hypothesis (EMH) theory to consist of the weak form, semi-strong form and strong form of market efficiency.

The weak form efficient market hypothesis (EMH)

The weak form of the Efficient Market Hypothesis (EMH) posits that the current price of an asset incorporates all historical trade information, including past price and volume data (Rossi, 2015). Consequently, the application of technical analysis, which entails using historical price and volume data to forecast future price movements, is considered inadequate within this framework. Thus, past asset price patterns or trends are viewed as unreliable indicators of future asset prices. Among the tests for weak-form market efficiency, including return predictability, are correlation tests, runs tests, filter rules, moving average rules, channel rules (such as trading range breakout rules), and relative strength tests (Leković, 2018). When the correlation coefficient is zero, it indicates no correlation between observed returns, supporting the validity of weak-form EMH. However, if the correlation coefficient deviates from zero, it suggests the potential for return prediction, indicating a departure from weak-form market efficiency. This deviation from efficiency is exemplified by the inertia effect, where investors are inclined to invest in securities that have previously performed well, anticipating similar future results. Conversely, the reversal effect occurs when there is negative correlation between series of return on securities, implying that negative returns follow positive returns and vice versa.

Empirical studies, notably by De Bondt and Thaler (1985), De Bondt and Thaler (1987), Fama and French (1988), and Lehmann (1990) have provided evidence of negative autocorrelation and the reversal effect. De Bondt and Thaler (1985) and De Bondt and Thaler (1987) analyzed monthly stock returns on the New York Stock Exchange (NYSE) from 1926 to 1982, revealing significant findings in this regard. Further investigations by Lo and MacKinlay (1988) observed positive autocorrelation in weekly and monthly returns, while Jegadeesh (1990) confirmed positive autocorrelation in long-term periods but negative correlation in short-term periods. Similarly, Nisar and Hanif (2012) identified positive autocorrelation in daily, weekly, and monthly returns across major South Asian capital markets, with Raquib and Alom (2015) corroborating these findings in the Bangladeshi capital market. Nevertheless, Fama (1970) cautioned that the rejection of the random-walk model does not necessarily imply market inefficiency. He argued that the independence assumption is overly restrictive and not essential for EMH, as market efficiency only demands the martingale process of asset returns with zero expected profits for investors, as proposed by Samuelson (1965).

The semi-strong form efficient market hypothesis (EMH)

The semi-strong form of the Efficient Market Hypothesis (EMH), as elucidated by Rossi (2015), asserts that prevailing asset prices encapsulate all publicly accessible information, encompassing historical data, financial statements, economic indicators, and news. This implies that fundamental analysis, involving the scrutiny of financial statements and other publicly available data, proves insufficient for consistently identifying undervalued or overvalued assets (Woo et al., 2020). In the domain of semi-strong-form market efficiency tests, also recognized as tests of announcements or event studies, as expounded by Leković (2018), the primary objective is to ascertain whether alterations in security values occur prior to, during, or subsequent to the announcement of significant events. These events encompass a spectrum ranging from initial public offerings (IPOs) and company acquisitions to block trades, changes in discount rates, stock splits, and company earnings disclosures. Ball (1978) contends that stock prices gradually adjust to information on earnings, providing investors with the opportunity to attain above-average returns. This strategy entails waiting for positive (negative) news about company earnings before making stock purchases (sales), posing a challenge to the notion of semi-strong-form market efficiency.

The strong form efficient market hypothesis (EMH)

The strong form of the Efficient Market Hypothesis (EMH) asserts that current asset prices incorporate all available market information, including both public and private data (Rossi, 2015). This encompasses insider information, which refers to confidential knowledge about a company. Under the presumption of strong-form EMH validity, even individuals with privileged information would be unable to consistently outperform market returns, as asset prices would reflect all relevant public and non-public information (Leković, 2018). Tests for strong-form market efficiency, also known as tests for private information, aim to ascertain whether insider-based trading leads to above-average returns. Several studies Seyhun (1986); Betzer and Theissen (2009) and Goergen et al. (2019) affirmatively demonstrate that insider trading yields risk- and transaction-cost-weighted above-average returns. Insiders leverage their privileged information to purchase stocks before their prices ascend and sell them before declines occur. However, this evidence is tainted by its association with unlawful behavior, significantly diminishing its credibility, as insider trading is prohibited by law in many countries, such as the UK since 1980.

An alternative avenue of evidence pertains to the performance of mutual funds. These institutional investors dedicate resources, including knowledge, time, and capital, to gather information regarding company performance (Leković, 2018). Unlike insider information, this information is private but legal. Numerous studies indicating that mutual funds fail to surpass market returns serve as robust evidence supporting the validity of strong-form EMH. Conversely, studies suggesting that mutual funds can outperform the market serve as a counterargument against strong-form EMH validity.

An illustrative example of profitable insider trading often cited in finance literature involves transactions executed on the American capital market by Ivan Boesky, one of the most successful arbitrageurs in history (Perino, 2020). Boesky strategically invested in stocks of companies expected to be acquired by others, leveraging privileged information about the impending takeovers obtained from an investment banker. This privileged information allowed Boesky to buy stocks before the broader market was aware of the impending acquisitions and sell them after prices surged. However, Boesky's success was short-lived, as the U.S. Securities and Exchange Commission (SEC) swiftly charged him with insider trading, resulting in a three-year prison sentence, a $100 million fine, and a securities trading ban (Perino, 2020).

2.3.1.3 Weaknesses and Criticisms of the Efficient Market Hypothesis (EMH) theory

The Efficient Market Hypothesis (EMH) has been subject to substantial scrutiny and critique, revealing a spectrum of challenges to its theoretical underpinnings and practical implications. Brown (2020) highlights one of the earliest challenges to EMH presented in an ongoing dialogue regarding the accuracy of the random walk hypothesis, which serves as a representation of EMH. This discourse, spanning publications such as those by Jensen (1967) and Van Horne and Parker (1967), set the stage for further examination of EMH's validity.

Kelikume et al. (2020) underscore a critical turning point in the reception of EMH, noting a shift from broad acceptance among financial and behavioral economists during the 1970s to 1990s to heightened criticism in the late 1990s, particularly in light of global economic crises such as the dot-com bubble and the subsequent United States sub-prime mortgage crisis. These events, characterized by excessive speculation and notable deviations from EMH assumptions, prompted questioning of the theory's relevance and explanatory power.

Leković (2018) synthesizes a multifaceted critique of EMH, identifying two primary categories of challenges. The first revolves around theoretical paradoxes, wherein adherence to EMH assumptions leads to conceptual inconsistencies. For instance, the paradox arises when all market participants believe in market efficiency, potentially undermining the very efficiency they aim to maintain (Brown, 2020). Conversely, increasing skepticism among participants paradoxically enhances market efficiency but diminishes the benefits of research and analysis. The second category of challenges stems from observed market anomalies, which represent systematic deviations from EMH expectations (Woo et al., 2020). These anomalies, too widespread and recurrent to dismiss as random errors, cast doubt on the theory's explanatory power.

Moreover, Lo (2007) delves into specific anomalies that pose significant challenges to EMH, such as the 'size effect' and the 'January effect', which defy rational explanations within EMH's framework due to their regularity and public awareness. Additionally, Grossman and Stiglitz (1980) challenge the very possibility of perfectly efficient markets, arguing that such markets would lack incentives for information gathering and trading, leading to market collapse. This perspective highlights the necessity of market inefficiencies to sustain economic activity and incentivize informed trading.

Furthermore, behavioral critiques of EMH emphasize the limitations of assuming rational decision-making among investors. Psychological biases, such as overconfidence, overreaction, and loss aversion, documented by researchers like Kahneman and Tversky (1979) and Barber and Odean (2001) undermine the notion of rationality central to EMH. These critiques suggest that investors often exhibit predictable and irrational behaviors that deviate from EMH's assumptions. Hence, the critiques of the efficient market hypothesis (EMH) theory has necessitated the emergence and development of a more practical theory that considers the behavioral nature of humans in investment decision making.

In summary, evaluating investor sentiments and ESG performance through the lens of the Efficient Market Hypothesis reveals nuances that challenge its assumptions. This exploration underscores the evolving nature of market efficiency, particularly in the realm of sustainable investing, where non-financial factors exert significant influence on investment decisions and outcomes.

2.3.2 The Behavioral Finance Theory

Understanding the intersection of investor sentiments and the performance of Environmental, Social, and Governance (ESG) funds in both emerging and developed markets is essential, particularly when viewed through the lens of Behavioral Finance theory. This is because the Behavioral Finance Theory unveils the psychological factors that drive investment decisions, which are capable of shaping the landscape of sustainable investing.

Unlike the classical finance theory such as the efficient market hypothesis (EMH), the philosophy of the modern finance theory recognizes that behavioral patterns impact investment decisions (Agudelo Aguirre and Agudelo Aguirre, 2024). This argument introduced "behavioural finance" and inspired landmark financial economics studies like (Kahneman and Tversky, 1979; Thaler, 1980; Mehra and Prescott, 1985; Shefrin and Statman, 1985; Daniel et al., 1998; Shiller, 2015).

According to Hirshleifer (2015), behavioral finance is the incorporation of psychology into the domain of finance, namely studying cognitive biases at the individual level. Conversely, Baddeley (2018) contends that the term "behavioural finance" has several interpretations. Behavioural finance is the study of how individual economic actors make financial choices and decisions, and how these choices affect financial markets and institutions. Behavioural finance serves as an intermediary between the fields of finance and psychology. The objective of this is to elucidate the discrepancies and irregularities that arise in investment decision-making as a result of deviations from the normative model. According to Çömlekçi and Özer (2018), decision processes have a significant effect on perception and might potentially shape human behavior. Hence, behavioral finance has emerged as a unique subject within the field of social sciences that recognizes and examines these phenomena.

The core tenet of behavioural finance is that the conventional finance theory of neoclassical economics overlooks the psychological aspects that impact people' financial and investment choices in real-world scenarios (Ángeles López-Cabarcos et al., 2020). Empirical evidence shows that in modern times, a thorough understanding of finance requires a solid grasp of the psychological and intellectual dimensions of human nature. The psychological elements have a substantial influence on certain important concepts in finance, such as corporate finance, money management, and investment behavior (Agudelo Aguirre and Agudelo Aguirre, 2024).

Consequently, the need for enhanced comprehension has led to the utilization of psychological theories to tackle empirical investigations stemming from finance theory. The rise of behavioral finance as a supplement to contemporary finance theory has been motivated by the need for precision in defining fundamental assumptions, as well as the merging of key psychology theories with the finance theory.

2.3.2.1 Axiom of the Behavioral Finance theory

The modern philosophy of behavioral finance theory offers alternative foundations for each of the five core assumptions of the classic finance viewpoint known as the Efficient Market Hypothesis (EMH). It incorporates comprehension of people' preferences, as well as their cognitive and emotional predispositions and fallacies. According to Statman (2014), the principles of behavioral finance suggest that:

- ***Individuals exhibit irrational behavior:*** The field of behavioral finance underscores the recognition that individuals often exhibit irrational behavior in financial decision-making (Jha, 2016). Contrary to the assumption of rationality prevalent in traditional economic theory, behavioral finance acknowledges the presence of cognitive biases, emotional influences, and heuristic-driven decision-making among investors. Kahneman and Tversky (1979) pioneered the exploration of cognitive biases, highlighting phenomena such as loss aversion and overconfidence, which lead individuals to deviate from rational decision-making processes. Moreover, Thaler (1980) introduced the concept of mental accounting, wherein individuals compartmentalize their financial decisions, leading to suboptimal outcomes. These insights challenge the notion of investor rationality and underscore the importance of understanding psychological factors in financial behavior.
- ***Individuals create portfolios according to behavioral portfolio theory:*** Behavioral portfolio theory expands upon traditional portfolio theory by recognizing that individuals construct portfolios not only based on anticipated returns and risk but also considering social factors such as social duty and social standing (Shefrin and Statman, 2000). Barberis and Huang (2008) elaborate on this perspective, highlighting how individuals' investment decisions are influenced by social norms, peer behavior, and cultural factors. By integrating social considerations into portfolio construction, behavioral portfolio theory provides a more comprehensive framework for understanding investor behavior and asset allocation decisions.
- ***Individuals adhere to the principles of behavioral life-cycle theory:*** Behavioral life-cycle theory acknowledges the complexities individuals face in managing their finances over their lifetime (Razek, 2011). Unlike traditional life-cycle theory, which assumes rational and forward-looking behavior, behavioral life-cycle theory recognizes obstacles such as

lack of self-control, procrastination, and short-term thinking that impede individuals' ability to effectively save and spend. Thaler and Benartzi (2004) contribute to this discourse by introducing the concept of "save more tomorrow," which addresses individuals' tendency to procrastinate savings decisions. By incorporating insights from behavioral economics, behavioral life-cycle theory offers a nuanced understanding of saving and spending behavior over the life span.

- ***Individuals adhere to the principles of Behavioral Asset Pricing Theory:*** Behavioral asset pricing theory extends traditional asset pricing models by incorporating factors beyond risk and return expectations (Shefrin, 2008). Similarly, Shiller (1981) introduces the concept of "animal spirits," which refers to irrational and unpredictable behavior driving asset prices. This theory suggests that individuals' investment decisions are influenced by psychological factors, such as mood swings and social trends, which impact asset valuations. Additionally, Baker and Wurgler (2006a) provide empirical evidence supporting the role of sentiment and investor psychology in asset pricing. By integrating insights from behavioral finance, behavioral asset pricing theory offers a richer understanding of market dynamics and asset valuation processes.
- ***Individuals understand that markets are not perfectly efficient:*** While markets may not always efficiently reflect fundamental values, they exhibit a level of efficiency in terms of being challenging to outperform consistently. Fama (1970) introduced the concept of market efficiency, which posits that asset prices fully reflect all available information. However, behavioral finance challenges the notion of perfect market efficiency by highlighting anomalies and inefficiencies resulting from irrational behavior. Lo and MacKinlay (2011) provide empirical evidence of market anomalies, such as the January effect and momentum strategies, suggesting that markets may deviate from efficiency. Thus, while markets may not be perfectly efficient in the classical sense, they remain difficult to outperform consistently due to the presence of informational and psychological complexities.

2.3.2.2 Framework of the Behavioral Finance theory

The framework of Behavioral Finance theory provides a comprehensive lens through which to understand the intricate dynamics of investor sentiments and their impact on the performance of ESG funds across both emerging and developed markets. Based on the idea that human psychology often deviates from rational financial models, Behavioral financial theory examines cognitive biases, emotional responses, and social impacts on investment decisions. In the context of ESG investing, where non-financial factors play a pivotal role, understanding investor sentiments becomes particularly crucial. Baddeley (2018) highlighted that the fundamental principles of behavioral finance revolve on three key pillars: sentiments, behavioral preferences, and limits to arbitrage.

i. Sentiments and biases

In the paradigm of behavioral finance, sentiments refer to the emotions, beliefs, and biases that influence individuals' investment decisions. While these sentiments often originate at the individual level, their collective impact can significantly affect financial markets and the broader economic system (De Bondt et al., 2015a). During events like the 2008 global financial crisis, researchers have scrutinized the role of sentiments in driving asset prices, showcasing the divergent perspectives of behavioral and neoclassical finance on risk and return behaviors (Bourghelle et al., 2023). Psychological research consistently demonstrates that individual perspectives are susceptible to errors. Empirical data has shown that these mistakes may be ascribed to cognitive deficits, which pertain to the way people think (Agudelo Aguirre and Agudelo Aguirre, 2024). As a result, people often create heuristics, which are broad principles, to simplify the process of making decisions. However, research has shown that these heuristics often display systemic deficiencies or biases, which include the following:

- **Anchoring Bias**: This cognitive bias involves individuals relying heavily on an initial reference point or anchor when making decisions, failing to adjust adequately in ambiguous situations (Zik-Rullahi et al., 2023; Obeng, 2020). For example, investors might anchor their valuation of a stock to its historical price, overlooking fundamental factors that could influence its future performance.

- **Representativeness Heuristic**: In this bias, individuals classify situations based on patterns from past experiences or current beliefs, often leading to judgments influenced by stereotypes or perceived similarities to previous events (Zik-Rullahi et al., 2023; Obeng, 2020). For instance, investors may perceive a new technology stock as promising solely based on its resemblance to previously successful tech companies, ignoring other crucial factors.

- **Overconfidence**: Overconfidence refers to individuals' inflated level of certainty in their skills and predictions, often leading them to overestimate the precision of their projections (Zik-Rullahi et al., 2023; Obeng, 2020). For instance, a trader might believe they have superior stock-picking abilities, leading them to take excessive risks without considering potential downsides.

- **Confirmation Bias**: This bias involves actively seeking, interpreting, and recalling information that aligns with one's existing beliefs, while disregarding contradictory evidence (Zik-Rullahi et al., 2023; Obeng, 2020). For instance, an investor might only focus on news articles that support their bullish outlook on a particular stock, ignoring warning signs of potential risks.

- **Availability Bias**: Individuals tend to overestimate the frequency or probability of events based on how easily they can recall examples of such events from memory (Zik-Rullahi et al., 2023; Obeng, 2020). For instance, investors might perceive a market downturn as more likely if recent negative news headlines are readily available, even if the overall economic fundamentals suggest otherwise.

- **Attribution Bias**: This bias involves attributing successes or setbacks to internal or external factors in a manner that lacks objectivity (Ahmed, 2020). For example, an investor might attribute their portfolio gains solely to their own stock-picking skills while blaming external market conditions for any losses.

- **Hindsight Bias**: Hindsight bias occurs when individuals perceive past events as more predictable or anticipated after they have occurred, leading to distorted assessments of previous investment choices (Dervishaj, 2021; Obeng, 2020). For instance, investors might mistakenly believe they had foreknowledge of a market crash after it occurs, overlooking the uncertainties and risks that were present at the time.

ii. Behavioral preferences

The behavioral preference framework analyzes how investor risk and return preferences impact their decision-making process in uncertain scenarios. The prospect theory is often considered the dominant preference model in the field of behavioral finance. Nevertheless, there are other models, including the SP/A theory, the regret theory, the affect theory, and the self-control theory. Examining various preference models within the behavioral finance framework provides valuable insights into the intricate interplay of psychological factors in investment choices (De Bondt et al., 2015a).

- **Prospect Theory:** Established by Kahneman and Tversky in 1979, prospect theory delves into how cognitive illusions influence decision-making in the face of uncertainty (Ahmed, 2020). It challenges conventional economic assumptions and sheds light on why individuals often deviate from rational decision-making. Loss aversion, a critical aspect of prospect theory, emphasizes that individuals weigh potential losses more heavily than equivalent gains, illustrating their aversion to negative outcomes (Zik-Rullahi et al., 2023).
- **Loss Aversion:** Loss aversion, rooted in prospect theory, explores how individuals' decision-making is influenced by their aversion to potential losses compared to their desire for gains (Ahmed, 2020). This principle suggests that people prioritize avoiding losses, indicating a psychological bias toward negative outcomes. Understanding loss aversion is crucial for comprehending why investors may act to mitigate losses rather than optimize gains (Zik-Rullahi et al., 2023).
- **Framing:** Framing involves the deliberate use of language and presentation to influence how people perceive and make choices regarding a specific issue or solution (Ahmed, 2020). In the context of behavioral finance, framing affects investor decisions, as individuals may prefer options framed in terms of potential rewards rather than losses (Zik-Rullahi et al., 2023). Framing showcases the psychological impact of information presentation on decision-making.

- **Mental Accounting:** Mental accounting explores how individuals mentally categorize and organize financial resources based on criteria like income source, purpose of money, or time period (Ahmed, 2020). These cognitive constructs influence financial perceptions and decision-making, often deviating from traditional economic models (Zik-Rullahi et al., 2023). Mental accounting illuminates the role of subjective categorization in financial choices.
- **Regret Aversion:** Regret aversion investigates how individuals make decisions to avoid experiencing regret in the future (Zik-Rullahi et al., 2023). This behavioral bias suggests that people may prioritize choices that minimize the likelihood of regret, even if those choices do not optimize economic outcomes. Regret aversion emphasizes the emotional aspect of decision-making.
- **Herd Behavior:** Herd behavior involves individuals mimicking the choices of others, driven by the desire to avoid being left behind or facing regret (Gu, 2022). By doing thus, people may avoid being left behind by the prevailing trend, which enables them to minimize feelings of regret by rationalizing that they would face the same consequences as others (Liu et al., 2019). This behavioral tendency is rooted in social conformity and the comfort found in collective decision-making. Herd behavior is particularly prominent when new investors conform to prevailing trends without conducting independent analysis (Swadia, 2020).

iii. Limits to arbitrage

Limits to arbitrage are a fundamental idea in the field of behavioral finance, which examines the impact of psychological variables and biases on financial decision-making and market results (Ahmed, 2020). Arbitrage, the exploitation of price disparities in financial markets, is fundamental to efficient markets. However, behavioral factors impose limits on arbitrage, making it challenging for arbitrageurs to correct market mispricing (Ljungqvist and Qian, 2016). Psychological variables, such as overreaction or underreaction to information, may hinder arbitrage strategies, leading to persistent market inefficiencies.

2.3.2.3 Weaknesses and Criticisms of Behavioral Finance theory

Although the behavioral finance theory has helped to understand how psychological factors affect financial decisions, it still faces criticisms and limits like any other theoretical framework (De Bondt et al., 2015a; Leković, 2020). This section of the theoretical review discusses the drawbacks of the behavioral finance theory.

Lack of unified theoretical core: One major critique of the behavioral finance theory is the absence of a unified theoretical core comparable to neoclassical finance (De Bondt et al., 2015b). Unlike neoclassical finance, which provides a structured framework based on rational decision-making, behavioral finance encompasses various psychological theories without a single overarching model (Leković, 2020). As a result, behavioral finance lacks a unified framework, leading to diverse and ad hoc models for pricing assets. This diversity poses challenges in fully understanding investor behavior. For instance, the prospect theory, a foundational concept in behavioral finance, faces limitations in explaining real-world investor behavior, and multiple behavioral explanations for momentum lack mutual consistency.

Despite the absence of a single unified theory, behavioral finance is supported by a wealth of empirical evidence demonstrating systematic patterns of investor behavior that cannot be fully explained by traditional finance theories (Virigineni and Rao, 2017). This empirical framework could suggest that a diversity of theories may be necessary to capture the complexity of human decision-making in financial markets.

Neglect of social, cultural, and historical factors: A second critique, as outlined by De Bondt et al. (2015b), revolves around the narrow focus on psychological mechanisms within behavioral finance. The study of behavioral finance should not solely concentrate on impulses and predispositions but also delve into social, cultural, and historical factors shaping economic and financial events. Individuals, being social-historical creations, enact roles shaped by societal expectations. A call is made for a more in-depth examination of the tangible content, structure, and style of intuitive economic stories, considering variations across cultures, such as how Swiss citizens perceive home ownership compared to Americans. However, counterarguments assert that behavioral finance actively incorporates these dimensions through qualitative research methods, cross-cultural studies, and historical analyses. For instance, studies such as Barber and Odean (2001) have examined of cultural differences in trading behavior, and Shiller (2015) have investigated the historical analysis of financial bubbles. These contributions have demonstrated how the behavioral finance theory draws from fields such as psychology, sociology, and anthropology to elucidate on social, cultural, and historical influences on investor behaviors.

Micro-level study of "mistakes": The third criticism, echoing De Bondt et al. (2015b), emphasizes the need for behavioral finance to move beyond the micro-level study of typical "mistakes." While acknowledging the tendency of CEOs, entrepreneurs, and investors toward unrealistic optimism, questions arise about the root causes of such behavior. Is over-optimism context-specific? Does it stem from past personal success or represent an inherent aspect of the American character? A broader critique questions the definition of a mistake, introducing the concept of the "logic of appropriateness" alongside the traditional "logic of consequences." Whilst the logic of appropriateness, argues that investors base decision on social conventions, cultural influences, and prior experiences rather than logical estimates of projected results. This perspective proposes that herd behavior and emotional biases influences investment decisions. In contrast, the logic of consequences stresses decision-making based on predicted outcomes, taking into consideration risk, reward, and likelihood. This calls for a consideration of norms and collective beliefs in addition to efficiency concerns, acknowledging criteria such as sustainable development and equity. Regardless of this criticism, counterarguments suggest that understanding individual biases is essential for comprehending aggregate market behavior. For instance, Hirshleifer (2015) acknowledges how individual biases can lead to collective phenomena like asset price bubbles and crashes. More so, Barberis and Thaler (2003) further expounded on how investor sentiment affects asset prices, highlighting the importance of incorporating micro-level information in investment decisions.

Disconnect from institutional rationality: Moreover, De Bondt et al. (2015b) highlight a significant disconnect between the emphasis on human frailties in behavioral research and the reality that, globally, people lead prosperous lives. This critique challenges the orthodox economic theory, which places the pinnacle of rationality in individual brains. Instead, the authors argue that rationality and well-being derive from organization, whether spontaneous or deliberate. They emphasize the crucial role of institutions, which enable societal cooperation and economic organization, leading to improved collective well-being. Despite this criticism, counterarguments have stressed how institutional frameworks can be influenced by behavioral biases. For instance, Lerner et al. (2015) noted how institutional investment decisions can be influenced by herd behavior and overreaction to market news. Additionally, De Bondt and Thaler (1985) found biases of institutional investors contributed to the momentum effect in stock returns.

In summary, delving into investor sentiments within the context of Behavioral Finance theory offers profound insights into the dynamics of ESG fund performance across diverse market settings. By recognizing and addressing behavioral biases, investors can better navigate the complexities of ESG investing, fostering sustainable outcomes in both emerging and developed markets.

2.3.3 The Adaptive Market Hypothesis (AMH)

Examining the investor sentiments and performance of Environmental, Social, and Governance (ESG) funds in emerging and developed markets through the lens of the Adaptive Market Hypothesis (AMH) provides a dynamic perspective. AMH suggests that market participants adapt and learn over time, incorporating new information and adjusting their strategies, offering a more realistic portrayal of financial markets.

The Adaptive Market Hypothesis (AMH) is a comprehensive paradigm that has been developed to analyze the behavior of financial markets and the individuals involved in them. The AMH, based on the groundbreaking research of Andrew Lo (Lo, 2005; Lo, 2004), which diverges from conventional theories by recognizing the widespread impact of human irrationality, such as loss aversion and overconfidence, and situating these behaviors within an evolutionary framework of human adaptation (Phan Tran Trung and Pham Quang, 2019). Lo's fundamental claim that the behavior of financial markets reflects the adaptable character of human behavior emphasizes the evolutionary basis of the AMH. Expanding upon this basis, the theory suggests that market efficiency depends on several environmental elements, such as the quantity of rivals, profit possibilities, and the flexibility of market players (Lo, 2005). The AMH suggests that the integration of the Efficient Market Hypothesis (EMH) and Behavioral Finance (BF) is dependent on investors' capacity to acquire knowledge and adjust their strategies in response to changing market circumstances. This enables the cyclic progression of market inefficiencies (Lo, 2012).

Within the framework of the AMH, the comprehension of human behavior surpasses the conventional division between rationality and irrationality (Statman, 2019). Instead, it explores the complicated mechanisms of the human brain, specifically focusing on the neocortex, which is linked to abstract thinking and sophisticated goal-driven actions. The neocortex, found only in mammals, is crucial for human cognitive functions such as reasoning, communication, and coordination. These skills have been vital in the success of Homo sapiens in their surroundings (Lo, 2012).The AMH postulates that human decision-making is impacted by a confluence of decision-making systems, whereby logical reasoning is just one aspect. The neurological viewpoint enhances our comprehension of how people react to fluctuating market situations within the framework of adaptive market hypothesis (AMH).

The AMH places great importance on how behavior adjusts to changing market circumstances. The AMH does not classify humans as either absolutely rational or entirely irrational. Instead, it portrays them as knowledgeable, forward-looking, and competitive investors who adapt their tactics in accordance with changing economic realities. In his work, Lo (2012) demonstrates the adaptive nature of this method by citing John Maynard Keynes, who emphasizes the need of altering one's perspective in response to evolving information. According to the AMH, efficient and irrational markets are seen as opposite ends of the spectrum, with neither completely representing the condition of the market at any certain time. The theory asserts that grasping the dynamics of adaptation is crucial for knowing the intricate and constantly evolving structure of financial markets.

2.3.3.1 Axioms of the Adaptive Market Hypothesis (AMH) theory

Jaye (2017) asserts that the main idea behind the adaptive markets hypothesis is that financial markets are governed more by the laws of biology than by the laws of physics. Improving on the work of Andrew Lo (Lo, 2005), the recent research of dos Santos et al. (2023) highlighted six basic tenets of the adaptive markets, which are further summarized thus:

- ***Individuals act in their own interests****:* The AMH recognizes the underlying assumption that people behave as rational actors while seeking their own self-interests in financial markets (Lo, 2005). This principle of the theory is consistent with the evolutionary (adaptive) character of people, the rationality component of behavioral finance, and provides more insight into the reasons for market inefficiencies.

- ***Individuals make mistakes:*** The recognition of human fallibility and the inclination of humans to commit errors is a vital component of the AMH theory (Lo, 2005). The theory acknowledges that market players may depart from entirely rational decision-making due to cognitive biases, emotional reactions, and limits in information processing, as explained by behavioral finance.
- ***Individuals learn and adapt***: The tenet posits that market is always in equilibrium and stationary, so protecting investors from the need to learn and adapt, and preventing them from making any errors. Nevertheless, the theory of Adaptive Market Hypothesis (AMH) asserts that despite investors acting in their own self-interest, they often commit errors and subsequently acquire knowledge from these errors, leading to adjustments in their behavior (Lo, 2005).
- ***Competition drives adaptation and innovation***: Competition serves as a catalyst for adaptation and innovation in a dynamic market environment, a concept central to the Adaptive Market Hypothesis (AMH). As market participants vie for a competitive edge, the pressure to outperform peers fosters the evolution of trading strategies and risk management techniques (Lo, 2005).
- ***Natural selection draws the ecology of the market:*** The AMH axiom posits that natural selection plays a significant influence in molding individuals who participate in the market. For instance, if investors had losses in their prior investments, they are more inclined to withdraw from the market (Mandacı et al., 2019).
- ***Evolution determines the dynamics of the market***: In contrast to the EMH, AMH claims that because trends, panics, bubbles and crashes occur in the market, arbitrage chances happen time to time, and market timing is a crucial problem to grab the profit opportunities. Likewise, the profitability of investment strategies might experience temporary fluctuations in response to environmental factors (Lo, 2004).

2.3.3.2 Implications of the Adaptive Market Hypothesis (AMH) theory

Lo (2012) highlights the practical implications of the AMH theory for all market players including- investors, policy makers and fund managers to be:

- ***Adaptive Risk-Reward Trade-off:*** Lo (2012) emphasizes that the AMH offers significant implications for various market participants, particularly investors. The theory challenges the stability of the risk-reward trade-off, asserting that it fluctuates based on the population of market participants and the prevailing business environment. This fluctuation, particularly during market dislocations, leads investors to adjust their holdings, shifting towards safer investments during times of heightened fear (Urquhart, 2013).
- ***Dynamic Nature of Market Efficiency:*** Urquhart (2013) further extends this idea, proposing that characteristics like value and growth may act as 'risk factors' intermittently. The AMH posits that market efficiency is not an all-or-nothing condition but a continuum influenced by the proportion of investors utilizing cognitive versus instinctive faculties. Lo (2012) supports this by suggesting that market efficiency is akin to the energy efficiency of appliances, varying based on participants' adaptation to the market environment.
- ***Adaptation in Investment Policies***: A third implication of the AMH revolves around the need for adaptive investment policies (Lo, 2012). Traditional approaches may suffice when AMH assumptions align with current conditions. However, during periods of extreme fear or greed, traditional strategies may lose effectiveness, requiring adaptation. Urquhart (2013) underscores that the success of investment strategies is contingent on the specific market environment, challenging the notion of strategies being consistently profitable.
- ***Market Efficiency Cycles and Diversification:*** The AMH introduces the idea of cyclical efficiency variations over time (Lo, 2005). Contrary to the Efficient Market Hypothesis (EMH), which assumes markets move towards efficiency, the AMH acknowledges cyclical efficiency dynamics. Lo's analysis of historical market data reveals periods when the market was more efficient in the 1950s than in the early 1990s. Urquhart (2013) underscores the adaptability of investment strategies to changing market conditions, suggesting that strategies may decline temporarily but regain profitability when environmental conditions become conducive.
- ***Transformation of Alpha and Market Dynamics:*** A fourth implication involves the transformation of alpha under the AMH. Lo (2004) argues that under the AMH axioms, alpha should ideally be zero, as any profitable opportunity will be adopted by many investors, reducing alpha to equilibrium levels. This contrasts with the EMH, which acknowledges the existence of arbitrage opportunities. The AMH implies that market

dynamics, such as trends, panics, bubbles, and crashes, are inherent features of natural market ecologies.

- ***Challenges to Traditional Asset Allocation:*** Finally, the AMH has distinct implications for asset allocation, challenging the traditional paradigm of static portfolios (Lo, 2012). In a volatile environment where risk premiums and volatility of volatility vary, static asset-based portfolio weights may prove less useful for decision-making. This challenges the stability assumptions of traditional asset allocation models.

2.3.3.3 Weaknesses and criticisms of the Adaptive Market Hypothesis (AMH) theory

Although the Adaptive Market Hypothesis (AMH) has received attention and acclaim for its incorporation of behavioral finance and evolutionary principles, it is not impervious to criticism. Below are many criticisms, accompanied by corresponding references:

- ***Lack of Formalization and Empirical Testing:*** Critics contend that the AMH is deficient in formalization, which hinders its ability to undergo thorough empirical testing. Lo concedes that the AMH has a drawback, recognizing that it is more of a conceptual framework rather than a precise and testable theory (Lo, 2004).
- ***Difficulty in Behavioral Predictions***: The AMH's dependence on adaptive behavior increases subjectivity and complicates the ability to forecast precise behavioral reactions under different market situations. The absence of precise details restricts the practical usefulness of this information for investors and policymakers (Lo, 2005).
- ***Too much emphasis on biological evolution***: Critics contend that the AMH's comparison of financial markets to biological development is too metaphorical, placing too much emphasis on the latter. The speculative nature of applying biological evolution notions to market dynamics has been questioned (Lo, 2005).
- ***Inconsistency with EMH***: The AMH aims to reconcile the Efficient Market Hypothesis (EMH) with behavioral finance, although it may not completely answer the critiques of the EMH. Critics contend that it fails to provide a definitive answer to the ongoing debate about market efficiency (Lo, 2005).

- ***Limited Attention to Institutional Factors****:* One criticism of the AMH is its little focus on institutional variables that influence market behavior. Further examination of how institutions influence adaptive strategies might strengthen the notion (Lo, 2005).

In conclusion, the Adaptive Market Hypothesis (AMH) provides critical knowledge on how investor sentiments shape the performance of ESG funds across diverse markets. By acknowledging the adaptive nature of market participants, especially in the context of ESG investments, this study seeks out insights that go beyond traditional models, further reflecting the evolving landscape of sustainable investing in both emerging and developed markets.

2.3.4 The Sustainable Finance Theory

Within the framework of Sustainable Finance Theory, exploring investor sentiments and the performance of Environmental, Social, and Governance (ESG) funds in emerging and developed markets offers crucial insights into the alignment of financial objectives with sustainability goals. This theory emphasizes the integration of environmental, social, and governance factors into investment decisions, shaping market dynamics and investor behavior.

The evolution of economic models has been characterized by an inherent bias towards resource abundance and a disregard for environmental externalities (Schoenmaker and Schramade, 2018). Economic models have always concentrated on labor and capital, ignoring natural resource scarcity and carbon emissions. This neglect has made our economic models unsustainable in the face of environmental threats. Adams (2021) suggests that a low-carbon, circular economy is a major change to solve these issues. An early transition allows for incremental changes, whereas a late transition risks shocks and the depreciation of stranded assets

Likewise, the dynamics of mass production within competitive economic systems have perpetuated exploitative labor practices, including long working hours, underpayment, and child labor. Once common in the industrialized world, many techniques are now outsourced to underdeveloped nations. Social rules supporting decent labor, education, and healthcare have been implemented to address these inequities and create a more inclusive economy. This shift is guided by the UN's 2030 Agenda for Sustainable Development, which emphasizes behavioral change toward sustainable and equitable economic practices (Rask, 2022). Sustainable development covers three interconnected dimensions: economic, social, and environmental. Climate change, biodiversity loss, and resource depletion threaten Earth's systems. Poverty, malnutrition, and poor healthcare highlight the need to overcome societal inequities. Sustainable development ensures that current and future generations have fair access to food, water, healthcare, and energy while minimizing environmental damage (Leal Filho et al., 2019).

The imperative for finance to contribute to sustainable development arises from its role in allocating capital to its most productive use. Busch et al. (2016) asserts that sustainable finance accelerates the transition to a more sustainable economy by investing in ecologically and socially responsible initiatives and enterprises. This requires incorporating economic, social, and environmental factors into financial decisions, can help analyze and manage environmental uncertainties like carbon emissions' effects on climate change via risk pricing, hence, enabling sustainable investment decision-making (Lyu and Scholtens, 2024).

2.3.4.1 The United Nations Sustainable Development Goals (SDGs)

The United Nations Sustainable Development Goals (SDGs) outline a comprehensive framework for addressing pressing global challenges across economic, societal, and environmental domains (Schoenmaker and Schramade, 2018). These 17 goals provide a roadmap for achieving a more sustainable and equitable future for all (UnitedNations, 2015)

Table 2.3: The United Nations Sustainable Development Goals (SDGs)

Economic Goals	**Societal Goals**	**Environmental Goals**	**Overall Goal**
Goal 8: Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all	Goal 1: End poverty in all its forms everywhere	Goal 6: Ensure availability and sustainable management of water and sanitation for all	Goal 17: Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development
Goal 9: Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation	Goal 2: End hunger, achieve food security and improved nutrition and promote sustainable agriculture	Goal 13: Take urgent action to combat climate change and its impacts	
Goal 10: Reduce inequality within and among countries	Goal 3: Ensure healthy lives and promote well-being for all at all ages	Goal 14: Conserve and sustainably use the oceans, seas and marine resources for sustainable development	
Goal 12: Ensure sustainable consumption and production patterns	Goal 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all	Goal 15: Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, halt and reverse land degradation and halt biodiversity loss	
	Goal 5: Achieve gender equality and empower all women and girls		
	Goal 7: Ensure access to affordable, reliable, sustainable and modern energy for all		
	Goal 11: Make cities and human settlements inclusive, safe, resilient and sustainable		
	Goal 16: Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels		

Source: UnitedNations (2015)

2.3.4.2 Conceptualizations of sustainable finance

The conceptualization of sustainable finance encompasses a multifaceted discourse, elucidated through various lenses and dimensions of thought. As posited by Ozili (2022), sustainable finance can be broadly categorized from two primary perspectives. The first perspective perceives sustainable finance through the prism of ESG (economic, social, and governance) concerns, emphasizing the integration of environmental, social, and governance factors into financial decision-making processes. In contrast, the second perspective views sustainable finance as a financial architecture aimed at meeting the long-term needs of either a local or the global economy.

Within the realm of ESG-focused definitions, several authors have provided nuanced interpretations of sustainable finance. Gerster (2011) defines sustainable finance as finance that conscientiously considers environmental, social, and governance factors in its operations. Ryszawska (2016) expands this definition by conceptualizing sustainable finance as a mechanism that supports sustainable development across the economic, environmental, and social dimensions. Similarly, Schumacher et al. (2020) characterize sustainable finance (SuFi) as financial products and services that meticulously incorporate pertinent ESG factors into financing and investment decisions within the financial sector. Bakken (2021) further refines this perspective by defining sustainable finance as investment decisions that explicitly factor in the ESG considerations of economic activities or projects.

Moreover, Ozili (2021) echoes the sentiment of sustainable finance as finance that integrates ESG considerations into investment decisions within the financial sector. Beyond the ESG lens, the United Nations Environment Programme (2017) defines sustainable finance as finance that aligns with the long-term needs of a sustainable and inclusive economy across economic, social, and environmental dimensions (UNEP, 2017). Furthermore, the International Capital Market Association (2020) broadens the scope of sustainable finance by incorporating climate, green, and social finance while emphasizing the importance of wider considerations concerning the economic sustainability of funded organizations and the stability of the overall financial system (ICMA, 2020).

2.3.4.3 Theories of Sustainable Finance

The theories of sustainable finance encompass a range of frameworks and principles that advocate for the integration of environmental, social, and governance (ESG) factors into financial decision-making processes. These theories emphasize the importance of aligning financial objectives with long-term sustainability goals, aiming to promote economic growth while mitigating environmental degradation and social inequality. By considering the broader impacts of investments, sustainable finance theories seek to foster a more resilient and equitable global financial system. Ozili (2022) presented some theories of sustainable finance. The theories include:

i. ***The Priority Theory of Sustainable Finance***

The priority theory of sustainable finance posits that sustainability considerations should take precedence over purely financial objectives in investment decision-making. This theory emphasizes the primacy of environmental, social, and governance (ESG) factors in guiding investment allocations. Proponents argue that prioritizing sustainability can lead to long-term value creation and resilience in financial markets Ozili (2022). By integrating sustainability metrics into investment strategies, investors can mitigate risks associated with environmental degradation, social inequality, and governance failures, thereby contributing to both financial and societal well-being (Boffo and Patalano, 2020).

ii. The Resource Theory of Sustainable Finance

The resource theory of sustainable finance focuses on the efficient allocation and utilization of resources to support sustainable development goals (Ozili, 2022). This theory underscores the importance of mobilizing financial resources towards environmentally sound projects and initiatives that promote social equity and economic prosperity. It advocates for leveraging financial capital as a catalyst for positive environmental and social change, while ensuring the prudent management of resources to maintain their long-term viability (Ozili, 2022). By aligning financial incentives with sustainability objectives, the resource theory seeks to optimize resource allocation and foster inclusive growth (Wibowo, 2023).

iii. ***The Peer Emulation Theory of Sustainable Finance***

The peer emulation theory of sustainable finance posits that the actions of industry peers can influence financial decision-making and behavior. This theory suggests that firms may adopt sustainable practices in response to pressure or inspiration from competitors or peers within their sector (Ozili, 2022). By observing the success and reputational benefits gained by early adopters of sustainable finance, firms may emulate similar practices to enhance their own competitiveness and market positioning. Peer emulation can thus serve as a powerful mechanism for diffusing sustainable finance practices across industries and driving collective action towards sustainability goals (Contreras et al., 2019).

iv. ***The Life Span Theory of Sustainable Finance***

The life span theory of sustainable finance posits that the longevity and resilience of financial systems depend on their ability to adapt to changing environmental and societal conditions. This theory emphasizes the need for financial institutions and markets to embrace sustainability principles to ensure their continued relevance and viability over time (Ozili, 2022). By integrating sustainability considerations into their business models and investment strategies, financial entities can enhance their resilience to environmental shocks, regulatory changes, and societal demands. The life span theory underscores the imperative of sustainability as a strategic imperative for long-term financial stability and prosperity (van Zanten and van Tulder, 2021).

v. ***The Positive Signaling Theory of Sustainable Finance***

The positive signaling theory of sustainable finance suggests that firms can enhance their reputation and attract capital by signaling their commitment to sustainability. This theory posits that firms engaging in sustainable practices may enjoy favorable perceptions among investors, customers, and other stakeholders, leading to increased access to capital and enhanced market value (Ozili, 2022). By publicly disclosing ESG performance metrics and engaging in sustainability reporting, firms can signal their commitment to responsible business practices and differentiate themselves from competitors (Lee et al., 2022).

vi. ***The System Disruption Theory of Sustainable Finance***

The system disruption theory of sustainable finance proposes that transformative changes in financial systems are necessary to address systemic environmental and social challenges. This theory contends that incremental adjustments may not be sufficient to address the root causes of sustainability issues and that more radical interventions may be required to drive systemic change (Ozili, 2022). By challenging conventional financial paradigms and promoting alternative models of finance, the system disruption theory seeks to catalyze transformative shifts towards sustainability (Loorbach et al., 2017). This theory emphasizes the need for bold and innovative approaches to reshape financial systems and advance sustainable development goals.

In sum, the interplay of investor sentiments and the performance of ESG funds in emerging and developed markets gains deeper insight when viewed through the lens of theories of Sustainable Finance. For instance, the Priority Theory underscores the urgency of prioritizing sustainability in financial decision-making, while the Resource Theory emphasizes the efficient allocation of resources toward ESG objectives. Also, the Peer Emulation Theory suggests that social influence plays a pivotal role in shaping investor behavior towards sustainability, and the Life Span Theory emphasizes the long-term impacts of investments on environmental and social outcomes. Moreover, the Positive Signaling Theory highlights the importance of signaling sustainability commitments to attract conscientious investors. Finally, the System Disruption Theory underscores the potential for sustainable finance to catalyze systemic change toward a more resilient and equitable global financial system. Hence, integrating these theories offers a comprehensive understanding of how investor sentiments drive the performance of ESG funds, contributing to the advancement of sustainable finance principles worldwide.

2.3.4.4 Weaknesses and limiting factors to implementation of Sustainable Finance theory

The implementation of Sustainable Finance theory faces various challenges and limitations that warrant careful consideration. Migliorelli (2021) highlighted the several observable risks relating to the effective and transparent implementation of sustainable finance in practice. Amongst these weaknesses include rebranding without actual impact, as well as disordered adjustment in cost of capital spreads. Additionally, lack of standardized metrics for measuring environmental, social, and governance (ESG) factors, hindering consistent evaluation across diverse investment opportunities. Lastly, concerns about greenwashing and the accuracy of ESG data further complicate the effective implementation of sustainable finance principles. This section further discusses these possible risk concerns.

Rebranding without actual impact*:* The burgeoning growth of labelled sustainable finance instruments, such as green bonds, has been remarkable in recent years. This expansion, however, does not necessarily signify a proportional increase in investments flowing into genuinely sustainable sectors or activities. As noted by Migliorelli (2021), while the market for labelled sustainable finance products has soared, the actual allocation of funds toward sustainable endeavors may not mirror this growth. This discrepancy poses a significant risk known as "rebranding without additionality." It suggests that the proliferation of labelled sustainable finance may be more about a semantic shift rather than substantial contributions to environmental or social sustainability (Migliorelli, 2021).

***Greenwashing and Sustainable Washing**:* The rise of sustainable finance has also led to concerns regarding deceptive practices within the financial sector, commonly referred to as greenwashing and sustainable washing. These terms describe strategies employed by financial actors to portray their securities, products, or services as environmentally or socially responsible, regardless of their actual impact (Migliorelli, 2021). Originating in the consumer goods industry, these practices have now infiltrated the financial realm. Various forms of greenwashing and sustainable washing have been identified, ranging from superficial name changes to misleading marketing campaigns aimed at fostering a false perception of sustainability (Migliorelli, 2021). Moreover, the effectiveness of formal or informal labelling in driving market demand, even when claims are unsubstantiated, exacerbates the risk of consumers and investors being misled (Migliorelli, 2021).

***Disordered Adjustment in Cost of Capital Spreads**:* The impact of sustainable finance extends beyond mere semantic shifts and deceptive marketing to potentially altering the cost of capital and equity for non-sustainable sectors. As capital flows increasingly redirect toward sustainable industries, the cost of capital for non-sustainable sectors may rise. This phenomenon, driven by market demand and reinforced by sustainable finance frameworks, can lead to disordered adjustments in cost of capital spreads (Migliorelli, 2021). Empirical evidence, such as the observed differences in yields between green bonds and conventional bonds, suggests the emergence of a *"green bond premium" or "greenium"* (Migliorelli, 2021). Policy measures aimed at mainstreaming sustainable finance, such as lower capital requirements and fiscal incentives, could further amplify this dynamic, reshaping market preferences and investment strategies (Migliorelli, 2021).

***Differences between Jurisdictions in Labels and Operational Standards**:* While financial markets operate on a global scale, efforts to standardize sustainable finance practices remain fragmented at the national or regional level. This lack of international harmonization raises concerns about disparities in labelling standards and operational criteria. For instance, the eligibility criteria for green bonds may vary significantly between jurisdictions (Migliorelli, 2021). As exemplified by the differing approaches of Chinese and European taxonomies, discrepancies in permissible activities could undermine the credibility and effectiveness of sustainable finance initiatives on a global scale (Migliorelli, 2021). This risk underscores the need for enhanced collaboration and standardization efforts across jurisdictions to ensure the integrity and coherence of sustainable finance frameworks worldwide.

In summary, examining investor sentiments and the performance of ESG funds through the lens of Sustainable Finance Theory underscores the growing importance of sustainable investing in both emerging and developed markets. By incorporating ESG criteria into investment strategies, investors can contribute to positive social and environmental outcomes while pursuing financial returns.

2.4 Conclusion and chapter summary

As the second chapter of this dissertation, this critical episode of the study focused on the theoretical framework via succinctly providing a conceptual background on ESG funds and investing as well as applicable foundational theories underpinning the performance of ESG funds. The chapter commenced by exhaustively discussing ESG funds investing evolution, types, strategies, challenges as well as institutions committed to the promotion of ESG investing. Thereafter, the chapter further reviewed relevant foundational finance theories that underpins the subject matter of this research endeavor to test their core assumptions within the framework of investor sentiments and performance of ESG funds across market conditions and characterizations. For instance, the Efficient Markets Hypothesis (EMH) contends that in both emerging and developed markets, investor sentiment and the performance of ESG funds across bull and bear markets are primarily governed by the efficient assimilation of all available information into asset prices. This implies that any potential outperformance of ESG funds is transient and challenging to sustain, as market prices swiftly adjust to reflect new information related to ESG factors. Conversely, Behavioral Finance Theory recognizes that investor sentiment and cognitive biases can lead to deviations from rational decision-making, influencing the pricing of ESG funds, particularly during periods of market exuberance or pessimism. Investors' emotions and behavioral tendencies may result in overvaluation or undervaluation of ESG assets, creating opportunities for mispricing that could impact the performance of ESG funds across different market conditions.

On the other hand, Adaptive Market Hypothesis (AMH) amalgamates these perspectives by acknowledging that markets are not always perfectly efficient but can adapt over time as market participants learn and adjust their behaviors. In the context of ESG funds, AMH suggests that the performance of these funds may reflect the evolving sentiment and behavior of investors towards sustainability issues. Market participants continuously reassess and incorporate new information, regulatory changes, and societal trends related to ESG factors, leading to dynamic shifts in the performance of ESG funds across bull and bear market cycles. Furthermore, Sustainable Finance Theory underscores the long-term value creation potential of ESG principles, positing that ESG factors can enhance financial performance and risk management over time. This theory suggests that during periods of market turbulence, investors may increasingly prioritize ESG considerations, potentially leading to better performance of ESG funds compared to traditional funds, especially in both emerging and developed markets where sustainability issues are gaining prominence. Thus, the subsequent core chapters of this research study test the empirical validity of the axioms, postulations and fundamental beliefs of the highlighted theories within the domain of investor sentiment and ESG funds across market conditions and characterizations.

The next chapter of this dissertation is the chapter three and the foremost core chapter of the study. Being the first extended article on the first set of objectives, this chapter focuses on investor sentiments and ESG performance in different market regimes (bull vs bear) and market blocs (emerging markets vs developed markets).

CHAPTER THREE: INVESTOR SENTIMENT AND ESG INDEX RETURNS IN EMERGING AND DEVELOPED MARKETS UNDER CHANGING CONDITIONS

3.1 Introduction

In recent years, ESG (Environmental, Social, and Governance) investment has seen a significant increase in popularity which has been propelled by a plethora of reasons. Notably, the rise of ESG investing can be attributed to factors, including the increasing global awareness of sustainability issues, the changing preferences of investors, regulatory initiatives that promote sustainability, as well as the growing recognition of the benefits of responsible practices among corporations (Eccles et al., 2014; Clark et al., 2015; Geczy et al., 2021). More so, the cruciality of ESG investing can be seen in its potential to initiate favorable social and environmental impacts, offering investors an opportunity to harmonize their portfolios with ethical principles and advance sustainable business strategies. These factors have become essential in influencing risk-reward opportunities for investors, as they significantly direct corporate behavior towards responsible practices (Kotsantonis and Serafeim, 2019). In fact, multiple studies have consistently shown a favorable relationship between positive ESG performance and long-term financial resilience (Flammer, 2015; Friede et al., 2015). This further attenuates the nuances of ESG investments as a pathway to both financial gains and societal impact.

From a theoretical standpoint, the performance of ESG funds can be seen from the lens of fundamental theories of finance. Foremostly, the Efficient Market Hypothesis (EMH) asserts that asset prices completely reflect all available market information, implying that any superior performance associated with ESG factors will be rapidly integrated into pricing. Likewise, the Behavioral finance theory argues that investor sentiment and cognitive biases may cause market inefficiencies, which may result in consistent abnormal ESG returns. Also, the Adaptive Market Hypothesis (AMH) combines both viewpoints, recognizing that markets undergo changes over time, and achieving profitable investments necessitates adapting to these changing circumstances, which includes integrating ESG factors. As a form of style investing, which is characterized by the systematic adherence to certain investment methods, having ESG screening factors can largely impact returns and volatility.

As with conventional markets, ESG returns and volatility performance may vary across different market regimes, denoted by bull and bear market states. During bull markets, which are marked by increasing stock prices and favorable investor mood, ESG investments may provide strong returns due to the growing demand for socially responsible assets (Giese, Lee, Melas, Nagy, & Nishikawa, 2019). Also, the optimistic sentiment seen during periods of rising stock markets may enhance the attractiveness of firms that possess strong sustainability credentials. Conversely, during bear markets as characterized by falling stock prices and increased aversion to risk, ESG investments may exhibit resilience as ESG features may be perceived as markers of risk management and long-term sustainability (Eccles et al., 2014). Giese et al. (2019b) noted that ESG indices demonstrate reduced downside risk in bear markets. Understanding ESG performance in varying market regimes is relevant for investors who seek to align their financial optimization goal with sustainability impact regardless of market conditions.

Also, there is a possibility that ESG performance might vary across various market blocs, especially between emerging and developed markets due to their infrastructural and economic characterizations. This is because ESG investments in developing nations may encounter distinct difficulties and possibilities due to the presence of elevated uncertainties stemming from economic and political concerns. Giese et al. (2019a), in an examination of the effectiveness of ESG indices in emerging and developed markets, argued that although there may be variations, integrating ESG factors into investment strategies can still enhance risk-adjusted returns. Moreover, the integration of ESG aspects in emerging markets might possibly enhance long-term stability and performance, considering their varied regulatory frameworks and sustainability issues (Sherwood and Pollard, 2018). Therefore, it is pertinent for investors navigating the interplay between ESG investing and different market blocs to consider the specific contexts, noting the challenges and potentials thereof. An apt understanding of market contexts can inform sustainable investment strategies requisite for navigating changing market conditions in different landscapes.

Whilst understanding market conditions and contexts are imperative for making profound investing choices, it remains lacking in sufficiency without having a grasp of plausible sentiments that influence these markets. This is because investor sentiments generally play a pivotal role in shaping the returns and volatility of investments (including ESG styled investments), and their impact can vary across different market blocs, market regimes, and economic conditions. During periods of bullish market conditions, positive sentiments may lead to increased interest in ESG assets, which may result in higher returns as investors actively pursue socially responsible investment options (Liu et al., 2022). In contrast, in periods of market decline (bearish market condition), the perceived reliability and scrutiny linked to ESG investments may appeal to investors, thus reducing the possibility for losses (Ashwin Kumar et al., 2016). Also, the impact of investor sentiments on ESG performance becomes more nuanced when examining several market blocs. For instance in emerging markets, due to their distinctive economic and regulatory environments, may encounter different consequences in comparison to developed markets (Odell and Ali, 2016). These peculiarities may stem from sentiments emanating from the macroeconomic environment which may have significant, yet varying reactions influence on the returns and volatility of ESG in emerging and developed markets. Hence, comprehending these dynamics is crucial for investors who are traversing the delicate lines of investor sentiments and ESG performance under various market conditions and contexts.

Thus, this chapter of the research study critically examines the impact of investor sentiments on the performance of ESG funds under different market conditions (bull and bear) and market blocs (emerging and developed markets). To effectively achieve this, the chapter pursued the first set of the research objectives, which were: (1) to determine ESG performance under different market regimes of bull and bear; (2) to determine ESG performance under different market blocs of emerging markets and developed markets; and (3) to determine how investor sentiments impact ESG performance in different market regimes (bull vs bear) and market blocs (emerging markets vs developed markets). Using Markov-Regime Switching models, the study employed ESG index data and selected economic data over a sample period ranging 2011:01 to 2022:12. The rest of the chapter is sequenced thus: Section 3.2, succinctly considers empirical studies and findings on the nature of market conditions and market blocs, investor sentiments and ESG performance. Section 3.3 provides in-depth clarifications and justifications on the methodology and estimation procedures adopted. Section 3.4 covers the results for the preliminary tests, data analysis as well as complementary discussions. Section 3.5, concludes the chapter, proffers recommendations, and offers suggestions for future studies, amongst which are considered in the subsequent chapters.

3.2 Literature review

The discussed theories have indicated that the stock returns and volatility may vary across developed and emerging markets and are prone to the market conditions and behavioral biases such investor sentiment. It is therefore necessary to view the empirical studies that evaluated these dynamics in emerging and developed markets. Consequently, this section of the research study presents empirical findings on Investor sentiments and ESG performance across market conditions and blocs. Firstly, the section commences with a review of underpinning theories applicable to the nature of market conditions. Then, the empirical study on a bull and bear nature of markets are presented. Thereafter, the section critically examines empirical studies on the nature of emerging and developed markets. Lastly, a review of relevant empirical studies on investor sentiments and ESG performance are further presented

3.2.1 Empirical studies on bull and bear nature of markets

To commence the discourse of this empirical literature review, it is of noteworthy to emphasize that landmark financial theories have attempted to conceptualize the bull and bear nature of financial markets. The Efficient Market Hypothesis (EMH) is a cornerstone theory in the field of finance that examines the bull and bear nature of financial markets. According to EMH, financial markets are highly efficient, meaning that prices at any given time fully reflect all available information (Fama, 1970). This implies that it is extremely difficult for investors to consistently achieve superior returns by outsmarting the market, as all relevant data, whether public or private, is already incorporated into asset prices. In bull markets, which are characterized by rising asset prices, EMH suggests that this upswing is typically driven by new information or changes in investor sentiment, making it challenging to systematically predict when and why these upswings occur (Malkiel, 2003; Woo et al., 2020). Conversely, during bear markets, where asset prices decline, EMH implies that negative information or a change in sentiment is at play, resulting in downward trends that can be equally difficult to predict (Bouattour and Martinez, 2019).

Likewise, the Behavioral Finance Theory plays a pivotal role in explaining the bull and bear nature of financial markets, offering valuable insights into market trends driven by human psychology and behavior. Kahneman and Tversky (2013) delves into cognitive biases, showing that individuals often make irrational choices based on emotions and heuristics, rather than solely rational decisions. This psychological framework helps elucidate why market participants might exhibit herding behavior during bull markets, contributing to unsustainable price surges as investors follow the crowd. Similarly, the phenomenon of excessive pessimism and panic during bear markets can be attributed to these psychological biases. Furthermore, Thaler (1987) work in "Anomalies: The January Effect" underscores how investor overreactions and underreactions to new information can result in market inefficiencies and create the bearish and bullish market dynamics. The irrational exuberance that characterizes bull markets may reflect the disposition effect, where investors are reluctant to realize losses, driving asset prices beyond their fundamental values (Shiller, 2000). In contrast, bear markets can be marked by panic selling, fueled by loss aversion, which is a central concept in behavioral finance, highlighting the emotional aversion to losses more than the pursuit of gains.

More so, the Adaptive Market Hypothesis (AMH) is a modern and comprehensive theory that sheds light on the dynamics of the bull and bear nature of financial markets. Proposed by Andrew W. Lo, AMH acknowledges the validity of certain aspects of the Efficient Market Hypothesis (EMH) while recognizing the impact of investor behavior and psychological factors. Lo's work, particularly "The Adaptive Markets Hypothesis," offers a fresh perspective that considers market efficiency as context dependent. According to AMH, financial markets are not always completely efficient, as suggested by EMH, but they can adapt and shift between periods of efficiency and inefficiency, depending on various factors such as economic conditions, information availability, and market participants' behavior. This adaptability explains the emergence of both bull and bear markets. During bull markets, AMH suggests that the environment is characterized by high risk tolerance and optimism, leading to higher asset prices as investors engage in risk-seeking behavior. Conversely, bear markets often arise from periods of heightened uncertainty, economic distress, or significant shocks, causing investors to become more risk-averse and leading to asset price declines.

From an empirical standpoint, Zegadło (2022) “bull market” and “bear market” are traditional terms used for periods of rising and falling asset prices, respectively. The terms ‘bull’ and ‘bear’ and their derivatives are frequently used during market commentary. When applied to entire markets, they are generally taken to mean extended intervals of time over which prices have broadly increased or broadly decreased respectively (Chauvet and Potter, 2000). Such intervals are bounded by peaks and troughs, and naturally form alternating phases.

Hanna (2018) highlighted three distinct techniques for determining bull and bear market conditions as the Pagan and Sossounov (PS), Lunde and Timmermann (LT) and the Markov Switching (MS). The Pagan and Sossounov (2003) otherwise referred to as the PS approach, is a rules-based approach that borrows heavily from the algorithm developed in the seminal work of Bry and Boschan (1971) to determine turning points in the business cycle (Zegadło, 2022). Herein, the algorithm entails picking local maxima and minima in smoothed data series within a pre-specified time window, that utilizes moving averages as smoothing filters for the input data. The alternation of peaks and troughs is enforced by selecting the highest of multiple consecutive peaks not separated by troughs (or the lowest of multiple consecutive troughs), with assumptions regarding minimum duration of each phase and of the full cycle (consisting of two phases).
Likewise, the Lunde and Timmermann (2004) otherwise referred to as the LT approach, proposed an algorithm concentrated on the magnitude of the returns in each market phase. It assumes that the regime had changed at turning point P if the rate of return λ since point P exceeded a pre-specified amount. The trigger return rate is treated as a parameter and allowed to differ between bull (λ_1) and bear (λ_2) regimes. Kole and Van Dijk (2017) notes that Unlike the PS method, whose rules combine requirements for duration and price changes, the LT algorithm, consist of requirements for the price changes only. Hamilton (1989) offered an alternative method for identifying bull and bear market condition using Markov chains. Under these models, the state of the market is treated as an unobserved discrete variable upon which stock return dynamics depend. One simple such model is where the stock return r_t (i.e. change in log price) follows a different regime depending on the unobserved market state s_t. This approach which adopted a Markov regime switching econometric model have been subsequently adopted in multiple landmark studies of Turner et al. (1989), and Maheu and McCurdy (2000), who incorporate duration dependence, Kim et al. (2004) who incorporate volatility feedback, and Guidolin and Timmermann (2005) who find evidence for a 3-state model. Specifically, Assoe (1998) finds evidence of regime-switching in emerging markets that could be interpreted in relation to bull and bear markets. Maheu and McCurdy (2000) define bull and bear markets as high return, stable states and low return, volatile

states, respectively. The study further observed persistent bullish periods in the American stock market to be driven by stock fundamentals as well as irrational investment behaviors.

In addition to this, while rule-based approaches are subject to arbitrary parameterizations, the results of a MS approach depend upon the validity of the underlying statistical model (Harding and Pagan, 2003) . Rule based models are generally easy to understand and implement but suffer from delayed state identification due to the information lag. By contrast MS models are perhaps less intuitive, but produce immediate results (Berge, 2015). These models provide a complete, parametric characterization of the distribution of stock returns in the different regimes. As a consequence, Kole and Van Dijk (2017) observed that while the PS and LT rule-based models essentially rely on mean returns and regime duration, Markov switching models may also take the variance (and higher-order moments) of returns into account. In addition, identification, and forecasting result from a single step. Markov switching models can also accommodate more than two regimes (Guidolin and Timmermann, 2006; Maheu et al., 2012), and the transition probabilities of the Markov chain can be made time-varying as a function of predictor variables (Diebold et al., 1993). In sum, this review highlights the different approaches of determining the nature of bull and bear markets as established from existing empirical studies.

3.2.1.2 Empirical evidence on the impact of market conditions on returns and volatility

On the subject matter of how market conditions affect returns and volatility, Maheu and McCurdy (2000) found that bull markets have declining hazard functions and the best market gains occur at the start of a bull market. Their study also observed that volatility increases with duration in bear markets. Likewise, investigating changes in stock price and trading volume in bull and bear markets, Han et al. (2009) found that stock returns are lower when trading volume is lower for small-cap stocks during bear markets, indicating the influence of loss aversion. Further affirming this, Ap Gwilym et al. (2012) suggests that investment strategies based on characteristics like size, value, and momentum can be influenced by the market state, with value performing better during negative periods and momentum providing positive excess returns across both market states. Whereas the study of Li and Zakamulin (2020) noted that the predictability of stock market volatility varies across bull and bear market states. The study further revealed that volatility forecast horizon is longer in bear markets, and forecast accuracy is higher during bear market states. However, Ntantamis and Zhou (2015) found little evidence of a relationship between bull and bear markets in commodity prices and stock prices of firms engaged in commodity production.

Having succinctly discussed the concept of market conditions of bull and bear within the sphere of the finance profession and theories, this research inquiry hypothesizes that ESG performance may vary based on market conditions of bull and bear. Hence, the state/regime of an ESG market at a given time could have a significant impact on its return and volatility performance.

3.2.2 Empirical studies on Nature of emerging and developed markets

Several studies have shed insights on the nature of emerging and developed markets. For instance, Herbert (1996) discusses the structural characteristics and commonalities of emerging markets, including varying degrees of economic and political under-development, financial market inefficiencies, and high levels of political risk. As of 2003, the popular Goldman Sachs identified Brazil, Russia, India, and China (BRIC) as the emerging markets. In 2010, this list was revised to include South Africa, making BRICS (Drysdale, 2011). Ioana-Cristina and Gheorghe (2014) argued that the development potential of BRICS markets and the increased interest of investors in their financial markets. Strelchenko et al. (2022) highlights that emerging markets such as BRICS are countries with market markets that possess institutions and standards like developed countries such as G7, although not fully compliant. These markets demonstrate higher economic growth rates compared to developed markets.

This research investigation hypothesizes that ESG performance may vary based on market bloc characterization of emerging and developed markets. Hence, how a market is characterized could have a significant impact on the performance of ESG returns and volatility. Therefore, the study considers empirical literatures on ESG in both BRICS and G7 markets.

3.2.2.1 Empirical studies on the emerging market of Brazil

Investigating the performance of socially responsible equity indices in Brazil, Ortas et al. (2012) specifically the Brazilian Corporate Sustainability Index (BCSI) during different market conditions. The study found that ethical investments performed well, particularly during bullish market states, and did not underperform their benchmarks in terms of risk-adjusted returns. Several factors, including the appeal of sustainable businesses and corporate governance standards, contributed to this performance. The study suggests that ethical investments may enhance financial outcomes and offers advice to managers, investors, and policymakers looking to integrate sustainability into their practices. However, Arias Fogliano de Souza Cunha and Samanez (2013) noted that sustainable investments had certain appealing characteristics, but their financial performance was not significantly better than conventional investments. This was based on the analysis of returns performance and diversification benefits of the funds within the Brazilian Corporate Sustainability Index. The researchers further highlighted the necessity to examine the historical performance of sustainability indexes in emerging markets as well as the impact of regulation on sustainable investing.

Recent studies such as Henriques et al. (2021) argued that ESG trading strategies did not provide consistently high levels of alpha, highlighting the lack of an existing pricing model for ESG investing in the Brazilian market. The study underlines the need for further research into ESG pricing in the Brazilian market. Likewise, whilst investigating how ESG policies impact Brazilian stock returns during the COVID-19 pandemic, Carvalhal and Nakao Nakahodo (2022) found that companies compliant with ESG principles fared better during the pandemic. Emphasizing the cruciality of ESG compliance during crises, their study further suggests the need to advance ESG standards in Brazil, highlighting the significance of ESG practices. Exploring the relationship between market structure, ESG performance, and corporate efficiency in Brazilian publicly traded companies, Moskovics et al. (2023) found that although market concentration negatively affects company efficiency, ESG compliant companies exhibited impressive levels of efficiency. This implies that emerging markets such as Brazil could amplify the positive impact of ESG performance on efficiency. Plattek and Figueiredo (2023) found that regardless of market conditions, sustainable investments performed similarly to conventional investments in both returns and volatility terms. This was observed in a comparative analysis of sustainable and conventional investments in the Brazilian stock market. This implies that sustainability concerns do not necessarily hinder investment performance.

3.2.2.2 Empirical studies on the emerging market of India

Analyzing the performance of ESG portfolios relative to blue-chip companies and the market index in India, Goyal and Aggarwal (2014) examined data spanning from January 2008 to September 2013, using both nominal and risk adjusted measures such as Sharpe, Treynor, Jensen, and CAPM. The research revealed that portfolios consisting of stocks with a focus on environmental, social, and governance (ESG) factors had superior performance compared to both the overall market and portfolios comprised of well-established, financially stable companies. Furthermore, there was a notable positive relationship seen between ESG portfolios and both blue-chip portfolios and market portfolios. The monthly returns of ESG portfolios were greater in magnitude, however they could not demonstrate statistical significance. Additionally, ESG portfolios had elevated levels of systematic and total risk. The research findings indicate that ESG funds have the potential to surpass market performance in terms of returns, hence noting the significance of sustainable development in the Indian stock market. Similarly, Chelawat and Trivedi (2016) found a statistically significant correlation between higher ESG performance and improved financial performance of India corporations. This was done using the S&P ESG India Index to examine the relationship between ESG performance and financial performance as measured by metrics such as Tobin's Q and Return on Capital Employed (ROCE). The findings of the study further depict that sustainability matters are intertwined with corporate performance in India.

More recently, Singh and Maurya (2021) analyzed the historical growth and determinants of the Nifty 100 ESG index in India between April 2011 and December 2021. The research found a statistically significant upward trend in the ESG index, suggesting that long-term investments that include ESG aspects increased investor wealth. More so, the study noted a positive link between ESG factors and market index returns, even in periods of heightened market volatility. The study further highlighted the cruciality of incorporating and disclosing ESG principles into financial decision-making. Likewise, Sharma (2023) asserted that Indian ESG indexes such as NIFTY 100 Enhanced ESG and NIFTY 100 Sector Leaders, exhibited strong return performance even in turbulent markets, underscoring the importance of ESG aspects in company strategy. Observing the increasing adoption of ESG investing in India, Singh et al. (2023) assessed the efficacy of ESG-focused mutual fund schemes in the second largest emerging market in the world. The results of this deep-dive found that ESG integrated assets are specifically highly attractive in the Indian technology and financial services sectors.

ESG performance has the potential to protect investors during times of crisis and does not have a negative impact on investment performance during stable periods (Beloskar and Rao, 2023). This was noted from an investigation of investment performance of companies listed on the Bombay Stock Exchange that were assessed based on their environmental, social, and governance (ESG) practices during the COVID-19 pandemic. Likewise, focusing on risk indicators, annualized returns, and asset growth, Rohilla (2023) assert that ESG funds delivered superior performance compared to the market portfolio throughout the COVID-19 pandemic period. The study indicated the need of doing more investigations with more extensive sample sizes and extended time periods to comprehend the possibility for sustainable, long-lasting benefits from ESG investments.

However, whilst the plethora of studies have shown a positive sentiment towards ESG adoption in India, a few studies have depicted otherwise. For instance, Dhasmana et al. (2023) discovered that there is an asymmetrical correlation between investor sentiment and the ESG index, indicating a lack of investor enthusiasm towards ESG initiatives of Indian corporations. The researchers further emphasized the need for more efforts to incorporate sustainability into financial markets and stated that ESG investing had not yet been completely assimilated into the views of Indian investors. This perspective was also shared by Singh et al. (2023) who reiterated that though ESG investing is on the rise, a significant portion of the Indian populace are still unaware. In like perspective, Rao et al. (2023) observed that the ratings for the environmental and governance pillars consistently had an adverse effect on return on equity (ROE). This finding was based on an inquiry on the correlation between environmental, social, and governance (ESG) policies and the financial performance of Nifty 50 companies in India over the period from 2015 to 2022. The researchers further proposed that investors, corporate executives, and legislators should consider the balance between environmental and governance rules and profitability.

3.2.2.3 Empirical studies on the emerging market of China

In an early study on ESG in the state of China, Weber (2014) examined financial performance and ESG reporting among Chinese enterprises. The study found that ESG disclosure frequency was affected by stock market membership and ownership status. Whilst ESG reporting focused more on financial and environmental performance, it was observed that boosting the frequency and quality of ESG reporting was akin to being “responsible” in China. In a more recent study, Zhang et al. (2021c) conducted a study to examine the influence of green policies on green investments in China. The study compared the performance of ESG investments before and after the implementation of the "Guidelines for Establishing a Green Financial System" in 2016. Findings of the inquiry revealed that, after 2016, portfolios with high ESG ratings exhibited superior performance compared to portfolios with poor ESG ratings. Although this outcome cannot be attributed exclusively to the characteristics of the selected underlying companies, the significance of government policies in influencing investment patterns in China was duly highlighted.

Considering for the market crisis caused by the pandemic, Broadstock et al. (2021) examined ESG performance during financial crises, concentrating on the COVID-19 pandemic in China. They investigated whether investor views of ESG performance might predict stock performance or minimize risks. The research found that high-ESG portfolios outperformed low-ESG ones, especially during crises, underscoring the rising importance of ESG performance during challenging times. It was subsequently argued that sustainable investments are more resilient and have reduced downside risk due to ESG awareness, whereas poor ESG profiles increase tail risks as per the study. Similarly, Li et al. (2022) analyzed how ESG performance affected Chinese stock prices in 2022 during the COVID-19 crisis. Using an event-study model, the study found a positive correlation between ESG performance and cumulative anomalous returns for Chinese listed businesses during the downturn. This finding further implies that there is a significant and positive association between ESG performance and stock prices during crises, stressing the importance of ESG principles during bear market periods.

Questioning the influence of ESG ratings on performance, Amin and Tauseef (2022) examined the association between listed Chinese firms' financial performance and ESG ratings from 2010 to 2020. A non-monotonic relationship between a firm's ESG score and financial performance was found. Whilst it was observed that ESG disclosures moderate this association, the survey highlighted governance-based factors as a critical concern among foreign institutional investors of Chinese stocks. This implies that ESG practices can link corporations to society and promote investor trust, and long-term corporate survival. Also, the works of Zhang et al. (2022) found that ESG performance strongly impacts future profitability, equity capital cost, and firm value. This assertion was based on the examination of the Chinese capital market portfolio returns and ESG investments. Reiterating how ESG pillars and sectors affect stock performance, the study revealed that both high- and low-score level ESG portfolios had higher anomalous returns during financial crises. However, Chen et al. (2023) argued that Chinese equities with high ESG ratings outperformed those with poor ratings. This was based on a comparative analysis of ESG scores for all Chinese A-share equities of high-ESG corporations and low-ESG enterprises on the Chinese stock market. The research further noted a strong association between ESG scores and future business measures including return on assets and standardized unexpected earnings, demonstrating that ESG evaluations include a company's cash flow potential. These results contradict the idea that ESG performance is a risk factor since they were not caused by pricing. In a study on ESG performance and stock returns of listed companies in Eastern China, Yin et al. (2023) found that ESG performance improved stock returns, especially for non-state-owned businesses. Showing a nonlinear relationship, the study revealed that ESG performance boosts stock returns, particularly for specific industries and sectors in emerging nations such as China.

3.2.2.4 Empirical studies on the emerging market of South Africa

In South Africa, Johnson et al. (2019) studied ESG factors and Corporate Financial Performance (CFP) measures. Amongst several findings, it was found that whilst composite ESG measurements did not correlate with CFP indicators, breaking down the ESG measure showed significant connections. Also, it was observed that environmental practices negatively correlated with earnings per share (EPS), with corporations with better environmental scores having lower EPS. The study further stressed the necessity for organizations to customize their strategies to their operational ESG elements. A competent board is crucial to moderate the relationship between corporate controversies and ESG activity in corporate South Africa (Al-Hiyari et al., 2022). This is based on the empirical notion that managers may utilize ESG performance measurements as a "greenwashing mechanism" to favorably impact business disagreements. Although, it was noted that ESG-savvy board members can reduce managers' opportunistic use of ESG policies, the need for rigorous ESG analysis and techniques to eradicate irresponsible conducts was stressed. To actualize this, the study argued for the appointment of skilled board members in controlling ESG policies in South Africa. More recently, Nyakurukwa and Seetharam (2023) examined how stock performance of Johannesburg Stock Exchange (JSE) listed companies affect ESG news sentiment.

Using an event study analysis, the results showed that positive ESG news sentiment affected stock returns more than negative sentiment. In addition to this, the research showed that investors may profit from positive ESG news sentiment as it was observed that ESG news mood has a higher influence on stock returns and may affect asset allocation methods. This suggests that establishing an ESG regulatory entity and studying market reaction could offer investors in South Africa a pathway towards sustainable growth.

3.2.2.5 Empirical studies on the developed market of Canada

Considering ESG matters in Canada, Bush et al. (2020) explored how ESG determinants impact regional stock market risk and return, via evaluating ESG assets using MSCI ESG Leaders. It was found that MSCI ESG Leaders alphas were uncorrelated and perform differently across geographies. The study further observed that size and value risk premia did not explain alpha, as this was mostly affected by governance. More specifically, it was noted that Canadian ESG assets have strong alpha or returns in comparison to other regions. This implies that regional risk and return variations and presents an ESG investment analysis approach. During COVID-19 market crisis, Folger-Laronde et al. (2022) studied the relationship between ESG ratings and financial performance of exchange-traded funds in Canada. The findings suggest that increased sustainability performance of ETFs does not provide protection against financial losses in a significant market decline. Whilst the study findings was consistent with the earlier studies of Weber et al. (2011), this finding was inconsistent with a more recent study that noted that during the 2008 Global Financial Crisis, mutual funds with higher ESG ratings provided better protection against financial losses compared to mutual funds with lower ESG ratings (Das et al., 2018).

Inquiring on smart beta ESG disclosure within the Canadian context, Yasmine and Kooli (2022) evaluated 2014–2019 smart beta indexes with ESG elements. It was revealed that fundamental indexation works in Canada, and smart beta strategies with ESG components outperformed market capitalization-weighted portfolios. This finding was consistent across all performance measures, market dynamics, and interest rate regimes, evidencing that smart beta ESG indexes can weathered bull and bear market conditions. Despite increased volatility, López Vargas (2022) found that dual-sorted momentum strategy using ESG ratings outperformed the S&P/TSX Canadian benchmark in average returns, albeit not statistically significant. This was found in a thesis project that considered data of dual and single factor portfolio strategies from 2008 – 2020. The study noted that regardless of market condition in the considered period, the ESG integrated portfolio performed better in both returns and volatility than the market portfolio. This further corroborates findings of the prior studies.

3.2.2.6 Empirical studies on the developed market of Japan

Whilst there are limited empirical studies on ESG in Japan, a recent investigation by Chen et al. (2022) propose an ESG momentum approach for Japanese and Taiwanese stock markets employing momentum and ESG ratings. This unique method analyzes momentum impacts, ESG scores, and market performance in these two markets. It was found that the ESG momentum worked well in both markets, the strategy worked better in the Taiwanese market than the Japanese market. Furthermore, the study noted that market-specific factors are important in ESG momentum strategy, and a contrarian strategy based on ESG ratings may work better in Japan. Findings of the study implies that it is best for investors to tailor their tactics to market characteristics.

3.2.2.7 Empirical studies on the developed market of The United Kingdom

Some critical studies in the United Kingdom have inquired on ESG issues in the UK. Firstly, Sahut and Pasquini-Descomps (2015) investigated whether news-based ESG ratings influenced monthly stock market returns in Switzerland, the US, and the UK from 2007 to 2011. The research found that the overall ESG score was significant only in the UK, while changes in ESG subcategory ratings had a modest and transient effect on stock performance in particular sectors or time periods, with differences between nations. In addition to this, whilst analyzing monthly returns using a multifactor model which included ESG scores, it was further observed that although the US and Switzerland had little fluctuation in overall ESG scores, the UK had a considerable negative variance. The study argued that socially responsible investment (SRI) investing has become increasingly popular in the UK post 2007 financial crisis. Hence, as ESG news-based judgments affect market prices, the study suggests that integrating ESG criteria into UK portfolios can improve returns and volatility. Investigating the impact of ESG fund score on UK SRI and traditional pension portfolios, Alda (2020) found that SRI funds outperforms the pension funds, further revealing that most pension funds are increasingly giving consideration to ESG factors.

Also, the study observed that increasing the level of ESG screening leads to better investment returns and capital inflows, despite both conventional and SRI funds being influenced by a common set of factors. In contrast to the afore reviewed studies, Luo (2022) argued that UK companies with lower ESG ratings exhibit better investment returns. This was based on a study that considered the relationship between UK stock returns and Environment, Social, and Governance (ESG) ratings. Additionally, the research found that the environmental and social ESG premiums are more notable than the total ESG premium. A plausible reason for this could be that ESG premium is higher for low-liquidity assets than high-liquidity equities, suggesting a relationship between ESG and stock liquidity. This further implies that high-ESG shares may improve liquidity and lower a firm's cost of capital for managers and investors.

3.2.2.8 Empirical studies on the developed market of France

Several recent French studies have expounded on the subject matter of ESG in France. Investigating the growth of ESG investing in the French market, Crifo et al. (2019a) identified three key factors that have helped adopt sustainable business practices to include; investor influence, clear definitions and intermediaries, and government regulation. The study revealed that institutional investors are crucial to company sustainability reforms, stressing the significance of intermediaries like ratings agencies who offer guidance to investors on socially responsible investments. Another study by the authors examined corporate governance, sustainability, and board members and investors relations officer functions (Crifo et al., 2019b). Analyzing top French firms, the study reported a complex relationship between corporate governance and sustainability, noting that corporate sustainability issues are approached differently by the different directors of the firms. The report further emphasized the necessity to train French board of directors on how to handle corporate sustainability issues.

Commenting on the issue of chief executive officer (CEO) incentive compensation and corporate social responsibility (CSR) affect equity capital costs in 154 French ESG firms from 2015 to 2020, Chouaibi et al. (2021) found that CSR initiatives cut equity capital costs, benefit shareholders, and influence investment and financing decisions. This implies that investors and stakeholders might learn from the research that CSR activities lower equity capital costs. From a capital markets perspective, Öcal and Kamil (2021) evaluated how risk indicators including the volatility index

(VIX), credit default swap (CDS), and foreign exchange (FX) volatility index affect broad-based and sustainability (ESG) indices. The study analyzed daily data from November 2014 to December 2019 using eight price indexes and numerous tests. Findings from the analysis noted that ESG-indexed firms like France ESG-X, Germany ESG-X, and SRI-KEHATI are more shock-resistant than their broad-based index counterparts. Whilst it found that VIX, a measure of market volatility, has a greater effect on ESG indices, the report also revealed that organizations with stronger ESG exposure have reduced risk. Similarly, Gavrilakis and Floros (2023) found that investing in high-ESG firms doesn't always reduce returns in most European nations, including France. This was based on an investigation of the relationship between large-cap European stock returns, financial performance measures, aggregate ESG ratings, and stock returns. Their results further showed that although Greek and French enterprises with higher sizes may yield poor returns, smaller companies with greater price-to-book and Sharpe ratios tend to offer investors with better profits. The study concludes that corporate sustainability, governance, and investor behavior in Europe remains complex and in a dire need of more research investigations.

3.2.2.9 Empirical studies on the developed market of Italy

A limited number of Italian studies has considered the issue of ESG. For instance, Doni et al. (2020) evaluated the effects of EU Directive on ESG reporting, which required non-financial information disclosures. The research studied how Italian enterprises' voluntary disclosure of non-financial information before the directive affected their compliance subsequently.it was revealed that experience and competence in non-financial reporting substantially influence business model disclosures, indicating that organizations with previous exposure were more compliant. Also, it was found that companies have improved compliance, but the report suggests non-financial disclosure quality may be improved. Clementino and Perkins (2021) examined how Italian organizations react to sustainability rating agency inspections of their ESG compliance. The research found four business reactions to these evaluations, showing that organizations behave differently, as it disproves the idea that ESG ratings homogenize firms by showing their diverse reactions. More so, the study showed how management views of ESG ratings' benefits and alignment with firm strategy could affect corporate responses to the ratings. The study suggests that ESG ratings may not always enhance sustainability performance of Italian firms, as it poses empirical, theoretical, and ethical problems that need additional investigation. However, in the study of Menicucci and Paolucci (2022) on Italian bank ESG performance, Board diversity characteristics including size, age, gender diversity, independence, and CSR/sustainability committees affected ESG performance positively. The results showed that board size, independence, and a CSR/sustainability committee improve a bank's ESG performance, with female directors having a non-linear effect, further implying that gender balance on boards is helpful. This research illuminates how corporate governance features improve ESG performance in the Italian banking business, benefiting managers and investors. It improves corporate governance-ESG knowledge. In a more recent inquiry, Menicucci and Paolucci (2023) examined how environmental performance, social responsibility, and corporate governance (ESG) affect Italian bank performance (BP). Their results show that ESG criteria negatively impacts banks operational and market success. This shows Italian banks may not have developed strong sustainability strategies. While the links between ESG components are unclear, it was found that lowering emissions and waste improves financial and operational performance.

3.2.2.10 Empirical studies on the developed market of Germany

Several German studies have inquired on ESG matters in Germany. For instance, Velte (2017) found that environmental, social, and governance performance (ESGP) increases Return on Assets (ROA), highlighting the relevance of good corporate governance in financial performance. ESGP, especially governance performance, was shown to boost ROA for organizations, stressing the necessity of incorporating ESG factors into corporate plans and decision-making. Further investigation by Velte (2019), found a negative correlation between ESG performance and accruals-based earnings management. The study asserted that ESG-performing enterprises were less prone to manipulate profitability, notably via accruals-based procedures. The research further illuminated how ESG performance affects organizations' ethical and sustainable business operations, guiding investors and regulators. However, the conclusions may only apply to the German Prime Standard and not to other businesses or countries. Validating these links across industries and marketplaces may need further study.

The study of Korinth and Lueg (2022) investigated how ESG ratings affect German stock market risk categories. While the findings suggest that the risk and business sustainability of German firms have a U-shaped relationship, noting that ecological and social investments initially reduce risk but might raise it if overinvested. In addition to this, the research also stressed the significance of breaking down ESG scores to improve explanatory power of ESG models. Similarly, Banke et al. (2022) examined how German DAX40 corporations provide ESG ratings and how sharing them affects stakeholders.it was found that even contradictory ESG evaluations increased stock prices and business reputations. The research also emphasized on the need to add ESG rating data in company reporting and making it available to stakeholders in Germany. The results highlight the importance of ESG ratings in reporting techniques, which precipitates improved corporate reputation and stock prices. More recently, Shakulashvili and Talic (2023) evaluated stock return performance and the ESG framework in Germany and Switzerland, emphasizing the relevance of sustainability aspects. better ESG ratings indicate that sustainable organizations have better risk-adjusted returns, according to the research. The study also showed how financial crises and pandemics affect the sustainability-stock return relationship, showing its dynamic character.

3.2.2.11 Empirical studies on the developed market of the United States of America

Considering Socially Responsible Investments (SRI) in America, Schueth (2003) reviewed American financial services SRI funds extensively, with the goal was to present a broad review of SRI, its theoretical basis, current investment philosophies, and US growth drivers. The research found that SRI in the United States remains a fast-growing financial sector, which controls over $2 trillion in assets, that allows investors to make socially and environmentally responsible investments without losing earnings. Regardless, the authors noted that the U.S. SRI market is young and evolving, with room for development and possibilities. Likewise, Blankenberg and Gottschalk (2018) examined the rise of socially responsible investing (SRI) in the U.S. and Europe, focusing on sustainable stock-based portfolios. Evaluating the risk-adjusted portfolio competitiveness, the results of the inquiry showed that sustainable portfolios fared comparably to conventional ones, indicating that sustainable criteria did not reduce profitability in the United States. It was further observed that over the last two decades, the U.S. SRI market has risen from less than a trillion dollars to 8.72 trillion dollars, illustrating its worldwide relevance.

LaBella et al. (2019) sought to determine whether responsible investing, which includes ESG variables, affects risk and returns in the American market. Whilst stating that ESG definitions and measures are unstandardized and difficult to address, it was revealed that ESG data was gradually incorporated into assets under management, with over $30 trillion. However, the study stressed the need to assess whether ethical investments generated value or were only perceived. Further analysis showed that rating agencies' ESG ratings vary widely, which might put investors at risk. It advised sector-specific ESG to boost portfolio performance. In contradiction, the study of Jain et al. (2019) compared investment performance of sustainable indexes in established and developing regions such as the United States to traditional benchmarks using global indices. The findings of the study suggest that the sustainable indexes fared similarly to conventional ones, suggesting that sustainable investing did not always provide different results. The researcher further advised mixing standard and sustainable indexes in portfolios to diversify risk and protect against market swings. Howbeit, the study showed that sustainable investing alternatives might match typical index returns, enabling people and organizations to invest ethically without compromising profits. Focusing on ESG reporting issues in the US, Hoang (2022) analyzed business ESG disclosure, carbon risk, and political corruption. The research investigated how political corruption influenced voluntary ESG disclosure by listed U.S. corporations. It was found that political corruption greatly affected ESG disclosure processes, as companies with higher pollution levels were less likely to voluntarily publish their ESG performance, perhaps owing to their dishonest activities and desire to avoid inspection. Also, the report stressed the need for tougher environmental laws and enforcement to hold ESG performance accountable, especially in polluting industries. The study highlighted the influence of political corruption on ESG disclosure for high-pollution corporations and the importance of anti-corruption measures in promoting sustainable and ethical business practices.

3.2.3 Empirical studies on investor sentiments and ESG performance

On the issue of investor sentiments in relation to ESG performance, this research study hypothesizes that there is a possibility that ESG market performance are influenced by investor sentiments in different market conditions and characterizations. Hence, ESG performance (return and volatility) are subject to certain investor sentiments regardless of market conditions and characterizations.

Considering the study of Baker and Wurgler (2007b) which explored the influence of investor sentiment on stock prices, it was noted that although investor sentiment impacts stock prices, the quantification of the impact is unclear. The study further advised a "top-down" approach to investor sentiments owing to its exogenous nature and empirical effects. The authors stated that the top-down method explained how sentiment affects stocks using behavioral finance concepts like sentiment and arbitrage barriers, further noting that stocks that are difficult to arbitrage or value are more influenced by investor sentiment. Exploring the connection between investor sentiment and stock performance in 18 developed countries, Schmeling (2009) revealed that investor sentiment negatively predicted global stock market performance, indicating that strong sentiment was associated with lower future stock returns and vice versa. The study which used consumer confidence as a proxy for individual investor sentiment, further found that countries with less market integrity are more susceptible to herd behavior and overreactions, which has a strong influence of sentiment on stock returns. Zouaoui et al. (2011) investigated how investor sentiment contributes to stock market crises. The research concluded that investor sentiment makes stock market crises more likely within a year, with a more pronounced effect in countries with limited institutional participation which is prone to herd behavior and overreactions. They also suggested that while investor sentiment is a valuable tool for predicting stock market crises, it is not a reliable indicator for market rebounds. This research emphasized the role of psychological factors in financial markets and the limitations of traditional financial models in understanding stock market crises.

Dong and Yoon (2019) examined how global economic factors influenced the performance of emerging Asian stock markets using a dynamic model averaging methodology to evaluate the impact of various global variables, including established stock and exchange rate markets, economic fundamentals, financial and commodities markets, and investor sentiment. Findings of the study revealed that global factors, particularly established stock, and exchange rate markets, had a significant influence on emerging Asian stock markets due to the interconnectedness of financial markets. Also, economic fundamentals were found to have the best out-of-sample forecasting ability, indicating that stock markets effectively reflected economic activity. The research also highlighted the importance of considering various global factors during different periods, such as the Asian Financial Crisis of 1997–1998 and the Global Financial Crisis of 2007–2009, and the effect of global factors in volatile market conditions. Focusing on the relationship between public opinion and the financial impact of Environmental, Social, and Governance (ESG) factors, Serafeim (2020) found a correlation between company's ESG performance and its market value, which was more pronounced for companies experiencing increased positive public perception. Interestingly, the study also revealed that in times of negative sentiment, the market may undervalue strong ESG performance, while positive sentiment may lead to overvaluation. These findings highlighted the importance of market perceptions of sustainability initiatives adopted by companies as a valuable tool.

Likewise, Turkson (2021) research examined the link between stock performance, ESG ratings, and investor sentiment, focusing on how market apprehension affects this relationship. The study found that higher ESG ratings result in profitable stock returns during times of high market apprehension. Conversely, equities with higher ESG ratings have negative returns when market concern is low. This underscores the impact of investor sentiment on the connection between ESG ratings and stock performance, and further highlights the importance of considering investor sentiment in evaluating how ESG factors affect financial success, especially during times of heightened market panic. In yet another study, Wang et al. (2021) investigated the relationship between investor sentiment and upcoming stock returns in international markets, using the consumer confidence index (CCI) as a proxy. The study found a global inverse relationship between sentiment and stock returns, with emerging markets showing a more noticeable and enduring effect of sentiment. Similarly, the study of Vuong and Suzuki (2021) indicated that whilst firm-specific sentiment had a reduced impact on ESG performance for Japanese companies, market sentiment had less influence on corporate social conduct during economic downturns. This was based on the analysis of ESG scores of 367 companies from 2005 to 2019, which found that unfavorable feedback from the previous year could trigger a company's commitment to its ESG initiatives, especially for highly sensitive ESG companies. The findings imply that investor sentiment played a role in driving CSR initiatives in Japanese companies.

Also, Loang (2022) examined the influence of investor sentiment and market sentiment on overreaction in the US and European markets before and during the COVID-19 pandemic. It found that prior to COVID-19, investor sentiment was correlated with market returns, with realized volatility being a significant variable during the pandemic. However, an overreaction was observed during the pandemic in both the European and US markets, with the US market exhibiting a stronger tendency for overreaction. More recently, Dhasmana et al. (2023) explored the relationship between investor sentiment and the Environmental, Social, and Governance (ESG) index in India. The findings revealed an asymmetric and volatile connection between the ESG index and investor sentiment. Further noting that while investor sentiment deteriorated as the ESG index improved, it improved when the ESG index performed poorly. Interestingly, investor sentiment did not influence the ESG index, indicating that investors had limited interest in the ESG activities of businesses. These findings underscore the need for greater awareness and understanding of ESG criteria in India and the integration of ESG investing into the Indian market.

3.2.3.1 Empirical studies on investor sentiment factors and ESG performance

The reviewed studies encompass a wide array of topics related to investor sentiment, market dynamics, economic development, and environmental, social, and governance (ESG) factors. Each study aims to investigate specific aspects of these complex interactions, and their findings, implications, and limitations are summarized below.

With reference to the link between investor sentiments and global commodities, Ding et al. (2017) explored the impact of global crude oil price fluctuations on investor sentiment in the Chinese stock market. The exploration revealed a significant impact of crude oil price changes on investor sentiment, which had an 8-month lag. This study accentuates the need for monitoring the relationship between oil prices and investor sentiment to better manage stock market fluctuations. Similarly, He et al. (2019) studied the bidirectional relationship between crude oil prices and individual investor sentiment. It was found that oil prices have a generally negative impact on investor sentiment, with a time-varying relationship. Further findings noted that investor sentiment has a positive impact prior to the global financial crisis, negligible impact during the crisis, and even a negative impact after the crisis. Also, it was observed that crude oil has significant and asymmetric impacts on individual investor sentiment in both the long-term and short-term. Demirer et al. (2020) examined the effects of oil price shocks on sovereign bond markets and their interconnectedness with stock markets. The study found that oil price shocks impact bond markets in addition to stock market returns, emphasizing the complex interplay between these markets and the economic features of countries. The research depicts oil as a key factor in understanding the interconnectedness of global capital markets behaviors. Focusing on precious metals, Lei et al.

(2023) investigated the role of palladium and gold as havens for international ESG indices during the COVID-19 crisis. The researchers found that while palladium acts as a strong short-term haven during times of crisis in developed ESG markets, gold does not consistently serve as a safe asset. It was further suggested that adding gold and palladium to ESG portfolios could enhance investment returns and reduce negative risks in volatile market conditions.

Earlier research studies by Fisher and Statman (2003) explored the relationships between investor sentiment, stock returns, and consumer confidence. Herein, it was found that poor stock returns are often followed by strong consumer confidence, highlighting the intricate dynamics between these factors. Likewise, the research by Çevik et al. (2012) examined the link between stock returns and business confidence in the USA. They found that business activity in both manufacturing and non-manufacturing sectors had varying impacts on stock market regimes, highlighting the role of business confidence as a determinant of stock market behavior. On the other hand, Ferrer et al. (2016) compared consumer confidence indices and stock market crashes in European and US markets. Their research findings indicated negative correlations between consumer confidence indices and stock market movements, emphasizing the complex interplay between consumer sentiment and stock market behavior. However, Teresiene et al. (2021) investigated the effects of the COVID-19 pandemic on consumer and business confidence measures in the Eurozone, the US, and China. The study evidenced a short-term impact of COVID-19 on both consumer and business confidence, with variations across regions. This empirical revelation underscores the need to assess how businesses and consumers perceive the COVID-19 pandemic's effects. Most recently, Olkiewicz (2022) also questioned how the COVID-19 pandemic impacted business confidence in relation to economic indicators. The findings suggested that business confidence was negatively affected during the early stages of the pandemic, with increasing COVID-19 infections causing insecurity in business activity. The study further highlights the cruciality of monitoring corporate confidence during times of crisis to inform decision-making and adaptation.

On the connection between investor sentiments and macro-economic factors, Hassani and Bahini (2022) evaluated the connection between ESG disclosure and economic development. The research suggested that existing ESG disclosure rules might not be the best approach and that a more tailored approach based on the size and growth capacity of companies and national sustainable development might be more effective. Likewise, Diaye et al. (2022) investigated the association between ESG performance and GDP per capita in OECD nations. Empirical findings suggested a positive long-term association between ESG and GDP per capita, emphasizing the importance of ESG factors for long-term economic development. Considering for unprecedented events such as a pandemic, Trisnowati et al. (2022) examined the impact of ESG scores, financial performance, and macroeconomic factors on stock returns during the COVID-19 pandemic in Indonesia. The study revealed that investors in ESG index equities placed a greater emphasis on macroeconomic factors than on financial statement indicators. Of recent, Leogrande and Costantiello (2023) probed the relationship between GDP growth and ESG factors. Their research noted a positive association between GDP growth and good governance and social and political factors, emphasizing the importance of technology advancement for environmental sustainability.

3.2.4 Gaps in the existing empirical literatures

Based on the above review of empirical literatures, it is evident that related studies on market conditions, contexts, sentiments and ESG performance have widely considered the subject matter from varying dimensions, focus areas, sample periods, and models. However, this study highlights gaps in four major critical perspectives:

Firstly, on the subject matter of market condition, whilst some studies have considered performance of stock markets in bull and bear market conditions, there is no clear study that has considered performance of ESG markets under varying market conditions as a specific focus area within the sample period using the adopted models. Secondly, on the subject matter of market blocs, whilst majority of studies have considered performance of stock markets and other financial markets, in emerging and developed contexts, a limited number of studies has contemplated ESG market offering different findings based on different approaches. Yet there is no study that have offered empirical findings using the sample period and models adopted by this study. Thirdly, on the impact of investor sentiment on ESG market, there is no clear evidence in this niche area, as most popular studies such as Baker and Wurgler (2007b) and Rupande et al. (2019) have focused on stock markets. Lastly, on ESG related studies, most current studies have considered ESG from the perspective of ratings, scores, and reporting metrics across different market contexts. Hence, there is no clear study on ESG performance from a market perspective especially with consideration to market conditions and contexts.

3.3 Methodology and Estimation Procedure for Investor sentiments and ESG returns

This section focuses on identifying the most appropriate methodological technique for analyzing the response of the ESG funds to investor sentiment under different market conditions. Given the high frequency fluctuation dynamics of the variable of interest, we give credence to a methodological technique that can accommodate simultaneously the probable conditional mean and conditional variance features of the ESG fund return and across different market conditions. Essentially, the research study favors a Markov Switching Model (MSM) as the most appropriate in the context of this study, as it allows us to investigate the return and volatility dynamics of the ESG across different market conditions defined as the bear and bull periods. However, rather than arbitrary presumptions that the MSM is the most accurate, we employ some of the preliminary econometric tests that have been prominent in the literature when modelling high frequency to ascertain the appropriateness of our preference for the MSM. We however begin with the description of the data in term of their measurement and source.

3.3.1 Variables Description

3.3.1.1 Data for the ESG returns

The study selected MSCI ESG indices for countries within the BRICS and G-7 markets. Therefore, for Brazil, Russia, India, China, and South Africa; the MSCI ESG Leaders Index for Brazil, Russia, India, China, and South Africa were chosen as the ESG indices for BRICS, respectively. Of noteworthy, due to the war in Ukraine at the time of this study, MSCI ESG data for Russia has been removed from all databases, as it’s been perceived as a breach to the ESG principle.

Likewise, for Japan, France, Italy, Germany, Canada, the UK, and USA; MSCI Japan ESG Leaders Index, MSCI ESG Leaders Index for Japan, France, Italy, Germany, Canada, the UK, and USA were chosen as the ESG indices for G7, respectively.

In addition to the MSCI ESG Indices for each member country and individual market under consideration, we further included the MSCI ESG Emerging Market Index and the MSCI ESG Developed Market Index as benchmark indices for broad reference and comparative purposes. The MSCI ESG Leaders Indexes target companies that have the highest environmental, social and governance (ESG) rated performance in each sector of the parent index. For each selected country, an index comprises of a 50% sector representation per the parent index, with inclusion of companies that have the highest MSCI ESG rating in each sector (MSCI, 2023).

The daily ESG indices utilised in this study span between January 31st, 2011 and January 2nd, 2023, for Brazil, India, China, South Africa, and emerging market index. Whereas the start for which the indices were obtained for the G7 member countries, and the developed market index varies for the individual members of the group, the end date of January 2, 2023, remains the same for the different countries and markets considered. Following the standard practice in the literature, the ESG is expressed in returns for the sake of the empirical analysis; therefore, it is measured as the log of the first difference of the ESG indices that is utilised in this study to express the ESG indices in returns.

3.3.1.2 Data for investor sentiment

Some studies collected information on investor behaviour from media stories, events, and other publicly available materials, while others performed polls among investors. Other academics have created sentiment indexes using market-based variables such as price changes and trading activity. In the case of the latter in particular, the literature has theoretically and empirically confirmed a wide range of economic and financial market factors as indicators of investor sentiment. Some of these fundamentals representing the current investor sentiment indirectly have been described to include initial public offerings (IPOs), dividend premiums, share turnover, closed-end fund discounts, the Bloomberg commodity index, the volatility index (VIX), the S&P 500 index, the MSCI emerging markets index, the price of oil, the price of spot gold, and the equity issue ratio (Uygur and Taş, 2014; Han and Li, 2017; Pandey and Sehgal, 2019). However, these factors are not without their shortcoming as most of them are endogenous to the market and economic activity, thus fueling concern regarding their accuracy as a measure of investors sentiment. There is also the concern that there is no clear general conception of investor sentiment. To address some of these shortcomings, the approach has been to combine them into one composite index to reflect sentiment from different channels and by extension minimize loss of information.

Interestingly, there has been increasing evidence validating the fact that indices formed from various factors in measuring sentiment are more accurate than expressing them individually (see, for example, Baker and Wurgler (2006b); Liao et al. (2011); Finter et al. (2012); Beer and Zouaoui (2013); Chen et al. (2014); Rupande et al. (2019); Reis and Pinho (2020a); Muguto et al. (2022)) The composite index, as described herein, is often arrived at by employing the technique of principle component analysis (PCA). The PCA has the potential to minimise data dimensionality and to eradicate irrelevant features to improve the dataset's measurement of a common component, which in this case is sentiment. Essentially, the seven individual indicators of investor sentiment from which we formed the composite investor sentiment (CIS) are as follows:

a) Business confidence index (BCI)

This indicator provides insight on anticipated business developments based on opinion surveys on production, orders, and completed goods stocks in the industry sector. It can be used to track output growth and predict economic turning moments (OECD, 2023). The reliance on this indicator is based on the notion that business confidence is a significant driver of economic and financial instabilities due to its influence on economic driving forces. While the index largely measures company sentiment, it can be used to infer investor sentiment (Rahman and Shamsuddin, 2019). A score above 100 denotes a higher level of confidence in near-term company success, while a score below 100 denotes a lower level of optimism (OECD, 2023). The factor has been effectively applied to gauge sentiment on numerous occasions (see for example, Baker and Wurgler (2007a), Schmeling (2009), Zouaoui et al. (2011), Liston and Huerta (2012); Bildirici and Badur (2018); Rahman and Shamsuddin (2019); Nartea et al. (2020)). For the purpose of this study, the BCI data was gotten from the OECD website and interpolated into daily data frequency.

b) Consumer confidence index (CCI)

The CCI, like the BCI, represents corporate sentiment, but from the perspective of consumer behaviour. The Conference Board (2021) administers the CCI, which provides an indicator of future trends in household spending and saving based on their predicted financial status, sentiment about the general economic situation, unemployment, and saves potential. Despite the fact that consumers are not surveyed on their views on stock prices, the index has been proven to be highly associated with a variety of market indexes (Rahman and Shamsuddin, 2019). A higher score indicates increased consumer confidence in the future economic condition, which leads to less savings and a greater willingness to spend money on significant goods. Lower values, on the other hand, suggest a negative outlook on future economic developments, which may result in greater savings and less spending (OECD, 2023). The CCI has been used as a measure of investment sentiment in a number of research (see Wendeberg (2015); Chau et al. (2016); Koy and Akkaya (2017); Hamurcu (2021)). For the purpose of this study, the CCI data was gotten from the OECD website and interpolated into daily data frequency.

c) Volatility index (VIX)

The VIX is widely recognised as one of the most reliable indicators of market mood. The Chicago Board Options Exchange produced a real-time volatility index that quantifies market volatility expectations (CBOE, 2023). However, because it is a forward-looking index, it only indicates the implied volatility of the S&P 500 for the next 30 days. In addition to being a valuable instrument for risk assessment, the VIX offers the possibility to profit from volatility, typically through VIX-linked futures and options. The price of these instruments is seen to be a fair gauge of volatility because when anything happens in the market, traders and investors tend to buy them, causing prices to soar. Because VIX-linked instruments have a strong negative correlation with the financial market and are therefore often used by investors for hedging and diversification as well as pure speculation, the VIX is also known as the fear index because it measures the intensity of market fear and stress. Some recent studies that have used the VIX as a sentiment measure include Smales (2017) and Mbanga et al. (2019). For the purpose of this study, the VIX data was gotten from the Bloomberg database in a daily data frequency format.

d) Gold (GLD) prices

Among many types of precious metals, gold remains the leading and foremost form of alternative investment option globally (Aboluwodi et al., 2022). Gold's reputation as a sanctuary from market losses is the basis for its selection as a gauge of investor sentiment. Following a shock in the asset market, investors frequently reallocate their investment portfolio by adding gold as a safety asset. To put it another way, gold can participate in the phenomena of the flight to quality, where investors alter their asset allocations to include safer assets to hedge against probable losses. As a result, prices on the gold and financial markets always fluctuate at the same time, especially after a market crash (Hossenidoust et al., 2013; Mensi et al., 2013). Despite these qualities, very few studies have used gold's price and price movements as proxies to gauge investor sentiment throughout the market. The study by Padungsaksawasdi (2020) which used the gold investor sentiment index to examine the connection between investor sentiment and financial market return and volatility in Thailand, stands out among the few existing studies on the subject. Additionally, Muguto et al. (2022) examined the impact of investor sentiment on sectoral returns and volatility on the South African stock market and used the worldwide price of gold as one of their sentiment proxy measures when developing their sentiment index. For the purpose of this study, the price of Gold was gotten from the Quandl database in a daily data frequency format.

e) Oil prices

Oil remains a critical part of the global economy, as global activities on both demand and supply sides are influenced by the global oil price (Dong et al., 2019). Due to the cruciality of oil as a form of energy commodity (Aboluwodi et al., 2022), studies have shown that oil price fluctuations impact both spending and savings of households (Goulder et al., 2019). Likewise, studies have shown that anticipated increases in oil prices affect costs of production and stock prices. As a result of these, several empirical studies such as Deeney et al. (2015), Ding et al. (2017), Qadan and Nama (2018), and Ye et al. (2020) have considered global oil prices as a suitable proxy of measuring global investors sentiments. The choice of oil price as a possible indicator of investor sentiment is based on the finding that economic activity, which is heavily reliant on energy, has an impact on both oil prices and financial markets. Additionally, there has been a surge in the financialization of the oil futures markets (Du and Zhao, 2017), which, according to Fattouh et al. (2013), has allowed retail investor speculation to play a significant role in setting the price of oil on the spot market. For the purpose of this study, the price of Brent Crude Oil was used as a proxy sentiment and was gotten from the Quandl database in a daily data frequency format.

f) US dollar (DLR) index

Also known as the USDX, The US Dollar Index is a measure of the US Dollar value against a weighted basket of currencies that are being used by top US trading partners. The index compares the value of the US dollar against other currencies of the top US trading partners such as the Euro, Pound Sterling, Swedish Krona, Swiss Franc, Canadian Dollar, and Japanese Yen. Empirically, several studies such as Nor et al. (2013), Almansour (2015), Rupande et al. (2019), and Bouteska et al. (2022) have adopted the use of different exchange rates as a proxy measure for investors sentiments. The index was chosen based on its expanding relevance in the wake of the financial markets' openness due to financial market liberalisation legislation. These regulations have made it possible for investors seeking chances for portfolio diversification and higher returns to boost their cross-border investments (Roy and Shijin, 2020; Gupta, 2021). Cross-listing of businesses on other markets to gain exposure to more investors has also become more common (Baloch et al., 2018). Cross-listings and cross-investments, however, have effects on foreign exchange. As a result, a change in the currency rates is probably going to worry investors (Mahapatra and Bhaduri, 2019) and affect their emotion or sentiment. For the purpose of this study, the US Dollar Index was used as a global exchange rate proxy measure for investors sentiments. Furthermore, the data for the US Dollar Index was gotten from the Quandl database in a daily data frequency format.

g) Advance/decline ratio (ADR) index

A market-breadth measure called the advances and declines ratio (ADR) examines the ratio of advancing shares to decreasing shares. The market's upward (or downward) tendency is supported by the rising (or falling) patterns in the ADR (Brown and Cliff, 2005). Due to the market's activity being driven by investor sentiment, the ADR ratio is typically anticipated to be positive. As a result, the ADR ratio aids in identifying the current trend and serves as a gauge of market performance. By comparing the number of advancing stocks to the number of sinking stocks, the advance-decline ratio today provides vital insight into overall market sentiment and direction. Like with previous empirical studies such as Sehgal et al. (2010), Brown and Cliff (2004), Reis and Pinho (2020b) and Gong et al. (2022), this study utilised the ADR index as a sentiment measure to evaluate the attractiveness of ESG funds under changing market conditions. In the context of this study, the price and volume data necessary to compute the ADR for both BRICS and G7 economies were obtained from the Bloomberg database. Like with previous empirical studies such as Sehgal et al. (2010), Brown and Cliff (2004), Reis and Pinho (2020b) and Gong et al. (2022), this study utilised the ADR index as a sentiment measure to evaluate the attractiveness of ESG funds under changing market conditions. In the context of this study, the price and volume data necessary to compute the ADR for both BRICS and G7 economies were obtained from the Bloomberg database.

h) Bloomberg commodity (BCOM) index

According to Bloomberg Professional Services (2021), the way the BCOM is constructed makes it attractive as a sentiment proxy as it is calculated on an excess return basis and reflects commodity futures price movements. The BCOM tracks prices of futures contracts on physical commodities on the commodity markets. The index is designed to minimize concentration in any one commodity or sector. It currently has 23 commodity futures in six sectors. As a well-diversified index with low correlation to the global equity and fixed income market, the BCOM price fluctuations can serve as a suitable sentiment proxy for evaluating the attractiveness of equity market during changing market conditions. With the increasing cointegration of financial markets and commodity markets and the financialization of the latter, this index has enjoyed increased attention from investors (Kang et al., 2023). This means that its price movements, just as in the case of gold and oil, can reveal the expectations and sentiments of investors on financial markets. Empirically, several studies such as Izadi (2015) and Muguto and Muzindutsi (2021) have also utilised the index as a proxy for measuring investors sentiments in stock markets.

3.3.1.3 Constructing the composite investor sentiment (CIS) index

Using a single variable may not be sufficient to explain investor sentiments, as there is no standardized measure of assessing investor sentiments as there are various measures/proxies to consider influential to investor sentiments. Therefore,, many time series studies have widely considered the use of a composite index to evaluate investor sentiment based on a broad set of measures individually (see, for example, Baker and Wurgler (2006b); Liao et al. (2011); Finter et al. (2012); Beer and Zouaoui (2013); Chen et al. (2014); Rupande et al. (2019); Reis and Pinho (2020a); Muguto et al. (2022)).

A Composite Investor Sentiment Index (CISI) is a measure of the overall sentiment of investors in a particular market or security (Wang, 2022). Due to the unavailability of a holistically relevant measure of investor sentiment, it is pertinent to construct a composite measure of investor sentiment using relevant daily data of a variety of measures of investor sentiments as noted from previous studies (Zhou, 2018; Rupande et al., 2019). These measures include: Business Confidence Index (BCI), Consumer Confidence Index (CCI), Volatility Index (VIX), Oil, Bloomberg commodity index (BCOM), US Dollar index, and the Advance to Decline Ratio Index (ADR). Also, the choice of sentiment proxies was based on relevance, usage in existing studies and data availability.

Furthermore, using the Principal Component Analysis (PCA) technique, the study constructed a Composite Investor Sentiment Index (CISI) using the proxies of the highlighted sentiment measures. The choice for PCA was motivated by the ability of the technique to identify patterns in a dataset by reducing dimensionality without any information loss whist determining whether a broad set of sentiment measures influences ESG returns, volatility and interdependencies (Rupande et al., 2019). As a linear technique, PCA utilizes orthogonal transformation to search for linear combinations of the original variables that explain the most variance in a dataset (Muguto et al., 2022).

To maximize the variance of each factor loading of sentiment proxies, the Varimax rotation was used to rotate the PCA matrix as done in similar studies (Salem and Hussein, 2019; Rupande et al., 2019). Due to the observation that some sentiments proxies take more time to reveal sentiment changes than others, both contemporaneous and lagged proxies will be considered (Brooks, 2019). Of noteworthy, the EViews 13 software was utilized for the computation, and where necessary, data in annual frequency form were spliced and converted into daily data for the purpose of the study. Thus, the Composite Investor Sentiment index (CISI) was defined as the first principal component of the correlation matrix of the sentiment measures- the lagged vs current value of each sentiment proxy, as depicted by the value with a greater correlation, specified as:

$$Composite\ Investor\ Sentiment\ Index_t = \theta_1 Business\ Confidence\ Index_{t-\frac{1}{t}} +$$

$$\theta_2 \text{Consumer Confidence Index}_{t-\frac{1}{t}} + \theta_3 Volatility\ Index_{t-\frac{1}{t}} + \theta_4 Gold\ Price_{t-\frac{1}{t}} +$$

$$\theta_5 Oil\ Price_{t-\frac{1}{t}} + \theta_6 Commodity\ index_{t-\frac{1}{t}} + \theta_7 Dollar\ index_{t-\frac{1}{t}} +$$
$$\theta_8 Advance\ to\ Decline\ Ratio\ Index_{t-1/t} \tag{1}$$

Where:

θ_i are factor loadings on the first principal components of the proxies.

3.3.1.4 Control Variables

We control for economic growth and inflation measures as the log of the first difference of GDP and composite leading indicator (CLI), respectively. Others control variable considered in the study are short-term interest rates (STI) and long-term interest rates (LTI). The control variables are captured as common in the Markov switching model.

3.3.2 Preliminary Tests

The preliminary tests considered in this study are categorised into informal and formal pre-tests. The former is mainly in terms of descriptive statistics, where the mean, the standard deviation, skewness, kurtosis and the Jarque-Bera test are the statistic of interest. With respect to the latter, the Lagrange Multiplier (LM) test developed by Engle (1982) is utilized to test for the presence of ARCH effect in a variable, while Ljung-Box test is employed to detect the possibility of the presence of autocorrelation in the variables. We also pre –test the hypothesis of unit root using the Augmented Dickey-Fuller (ADF) unit root test with or without structural breaks, respectively. Finally, the BDS test statistic. Finally, we employ the Brock, Dechart, and Scheinkman (BDS) test to determine whether the ESG returns is suitable for the nonlinear feature of the Markov switching model (Brock et al., 1996). The BDS statistic is defined as follows:

$$BDS_{q.Q}(r) = \sqrt{Q}\,\frac{C_m(r) - C_1^r(r)}{\sigma_{q.Q}(r)}$$

where the Q term is bounded points of the area with q dimension, r represents radius of the sphere centered on X_i, C denotes constant while $\sigma_{q.Q}$ denotes standard deviation of $\sqrt{Q}C_m(r) - C_1^r(r)$. Hence, the null hypothesis to be tested in the BDS test is that the series are linearly dependent.

3.3.2.1 The Specification of Markov Switching Model

The innovation here is to capture both the conditional mean and conditional variance dynamics of the ESG returns. Also, germane to this study is to understand the extent to which investor sentiment matters in the ESG return and volatility. The goal is to capture all of these for the individual markets under consideration and between the emerging and developed markets, as well as across the bear and bull periods. In view of this, among other things, we favour the GARCH-based Markov switching model as the most suitable to capture all that is mentioned and of interest to this study. In other words, it is imperative to evaluate the volatility of the ESG returns using a regime-switching model that caters to switching parameters (changing market conditions), where the ESG volatility for each market $\left(\sigma_t^2\right)$ follows a process that is determined by an unobservable state variable $\left(S_t\right)$. The occurrence of a regime was divided into N states in period t when $S_t = N$, where N = 1,2,3…., N. The Markov switching model of the conditional mean permitted each regime with an alternate regression model, therefore, such a sentiment-
augmented model that contained a switching intercept, error variance and control variables is specified thus:

$$y_t = \mu_{s,t} + \sigma_t\left(S_{1,t}\right)\eta_t \tag{3.1}$$

$$\sigma_t^2\left(S_{1,t}\right) = \omega_{s,t} + \alpha_{s,t}\varepsilon_{t-1}^2\left(S_{t-1}\right) + \beta_c\sigma_{t-1}^2\Delta ISI\left(S_{1,t-1}\right) + Z'\lambda + \varepsilon_{s,t} \tag{3.2}$$

$$\varepsilon_{t-1}\left(S_{t-1}\right) = y_{t-1} - \mu_{s,t-1} \tag{3.3}$$

where the vector $y_1, y_2, \ldots y_T$ are the observations to be modeled, for instance, ESG in the case of this study while $\eta_t, t = 1, \ldots, T$ are the independently and identically distributed normal innovations with zero mean and unit variance. At each point, the conditional mean of the observation y_t is

$\mu_{s,t} = E\left(y_t / S_t\right)$ and the conditional variance (ESG volatility for each market) is $\sigma_t^2\left(S_{1,t}\right) = \text{var}\left(y_t / y_{1,t-1}, S_{1,t}\right)$, where $y_{1,t-1}$ and $S_{1,t}$ are shorthand for the vectors $\left(y_1, y_2, \ldots y_{t-1}\right)$ and` $\left(S_1, \ldots, S_t\right)$ respectively. The term $\omega_{s,t}$ is the state-dependent intercept (volatility), while $\sigma_{c,t}^2$ is the regime-dependent variance of the returns and $\left(S_{1,t}\right) = 1, 2$: illustrated two regimes, namely regime 1 and regime 2, with the primary independent variable represented by the state-dependent coefficient, such as $\Delta CISI$ denoting investor sentiment index (ISI).

3.3.2.2 Determination of bull and bear market conditions

In other words, a regime switching model, as described above, separates the time series into distinct phases and identifies a distinct underlying stochastic process for each phase. States or regimes are other names for the stages. A category in which an event can happen at any time is called a regime or state, and such is often explored to determine if a market is in a bearish or bullish state or condition.

According to Benschopa and López Cabreraa (2014), a bear market is characterised by a downward shift in the market and generally high volatility, while a bull market is characterised by a time frame in which there is very little volatility and an average increase in market value. In the context of this study, therefore, the regime with the least value of conditional variance or least volatility will be treated as the regime with a bearish market condition and otherwise as the alternative regime. This approach has been further adopted by several studies such as Segnon and Thomas (2015), Berk et al. (2017), and Kula and Baykut (2017).

Moving forward, the term Z_t is a vector representing the control variable, namely, economic growth, inflation, long-term interest rate and short-term interest rate all of which were captured as the non-switching regressors in the Markov switching model. The process $\{S_t\}$ is an unobserved ergodic time homogeneous Markov chain with N-dimensional discrete state space (i.e. S_t can take any integer from 1 to N). The $N * N$ transition matrix of the Markov chain is defined by the transition probabilities $\left\{P_{i,j} = P\left(S_t = j \mid S_{t-1} = i\right)\right\}_{i,j=1}^{N}$. The vector $\theta = \left(\left\{\mu_i, \omega_i, \alpha_i, \beta_i\right\}_{i,j=1}^{N}\right)$ denotes the parameters of the model. To ensure positivity of the variance, the following constraints are required: $\omega_i > 0, \alpha_i \geq 0$ and the study will adopt the Markov Chain Expectation Maximization (MECM) for the maximum likelihood estimation of the Markov switching GARCH model.

3.4 Result Presentation and Discussion of Finding

The presentation of the empirical results and the discussion of findings are carried out under two broad sections, for instance, the preliminary analysis in sub-section 3.4.1 and the main empirical analysis in sub-section 3.4.2. The latter was further grouped into three sub-sections to include empirical results for the BICS countries in sub-section 3.4.2.1, and for the G7 countries in sub-section 3.4.2.2.

3.4.1 Preliminary Results of Investor sentiment and ESG returns

3.4.1.1 Descriptive statistics for ESG returns

Starting with mean statistic which is obtained by adding up the series and dividing the number of observations, a look at the Table 3.1 shows that on average, India followed by China are the countries with the highest ESG fund returns among the BICS markets. In another development, the mean statistic shows that USA with the mean value of 0.04% is on average the country with the highest ESG returns among the G7 member countries. Next to the USA is Italy while Germany is the only economy negative ESG returns. From the viewpoint of emerging market compared to the developed market, the mean statistic shows that the ESG fund returns is on average relatively higher for the developed market compared to emerging market. This seems to find support in the assertion that the wealthier the country, the more people require businesses to be more responsible and actively implement ESG initiatives.

Irrespective of whether a country belong to BICS or the G7, a look at the standard deviation statistic shows an overwhelming deviation of the ESG fund from its mean level in all the investigated markets which is an indication of the probable inherent volatility dynamics of the ESG funds. That said, the standard deviation statistic for the ESG fund in the BICS countries is higher for Brazil. With respect to the G7 member countries, the standard deviation statistic show that Italy is the country with the most volatile ESG market while Germany is the country in the G7 economy where the ESG market is relatively stable and less volatile. Finally, and quite surprising, despite the mean statistic reporting the emerging market having less ESG returns on average compared to the average return of the developed market, the standard deviation statistic on the other hand show that ESG fund is relatively more volatile in the emerging market compared to the developed market.

Table 3.1: Descriptive Statistics

ESG Returns for Emerging Markets						
	Mean (%)	***Std. Dev.***	***Skewness***	***Kurtosis***	***J-B test***	***No. Obs.***
Brazil	-0.01	2.06	-0.59	10.82	40.94***	3110
China	0.02	1.56	0.17	9.22	5043.4***	3110
India	0.03	1.25	-0.78	14.10	16293.7***	3110
South Africa	0.01	1.84	-0.38	5.99	1238.9***	3110
Emerging Market	0.01	1.23	-0.37	9.56	7237.33***	3110
ESG Returns for Developed Markets						
Canada	0.01	1.46	-0.88	16.49	30718.8***	3981
France	0.01	1.28	-0.47	11.31	10448.3***	3589
Germany	-0.01	1.21	-0.59	12.99	9995.3***	2371
Italy	0.02	1.53	-1.20	18.60	28688.7***	2762
Japan	0.01	1.33	-0.14	8.65	5312.46***	3981
UK	0.00	1.41	1.41	14.52	22140.2***	3981
USA	0.04	1.32	-0.79	16.99	11678.7***	1415
Developed Market	0.02	0.97	-0.79	16.06	10827.6***	1502
Investor Sentiment Index and Control Variables						
CIS	270.58	43.75	0.23	2.04	189.62***	3982
GDP	18515.90	3207.05	0.60	2.46	283.74***	3982
CPI	2.57	2.17	2.27	8.28	805.92***	3982
CLI	99.73	1.56	-2.86	14.81	286.51***	3982
LTI	2.20	1.51	0.16	1.56	361.60***	3982
STI	0.55	1.40	2.08	6.65	507.83***	3982

Note: *Std. Dev. represent the standard deviation and the coefficient of variation as a measure of spread, while ***, ** and * denotes significant at 1%, 5% and 10% levels of significance, respectively.*

Regarding the statistic of the distribution, we find the skewness statistic for the ESG returns negative in all the countries. Also, we find the kurtosis statistic of the ESG fund to be consistently leptokurtic both in emerging and the developed countries. Finally, the Jarque-Bera (JB) statistic that takes into consideration information from skewness and kurtosis to test for normality suggests non-normality of the ESG fund for all the BICS and G7 countries as well as their respective group as emerging and developed markets, respectively. However, since the composite investor sentiment index (CISI) and the macroeconomic indicators are global variables, then there is no basis for comparing their descriptive statistics on the CISI as we as those on the control variables across the individual BICS and G7 countries. That said, we find the Jarque-Bera test both for the CISI and the control variables to be statistically significant indication the rejection of the null hypothesis of normality in the distribution of both the CISI and the individual macroeconomic series considered.

3.4.1.2 Unit Root Testing

One of the preconditions for modelling with time series is unit root testing. Employing both the standard Augmented Dickey-Fuller (ADF) unit root test and the unit root test with structural breaks, presented in Table 3.2, are the outcomes of the unit root testing for each of the variables of interest. It must be reiterated that for unit root testing, the variables are expressed in the exact form they are captured in the model. For instance, the return series of the ESG and the log of the first difference of the investor sentiment are utilized. The unit root tests are also performed on the log of the first difference of the GDP proxy for economic growth and the log of the first difference of the CPI proxy for inflation.

However, since the long-term and short-term interest rates are already measured in percent, the unit root test is performed on them without transforming them any further. Starting with the ESG return series, the null hypothesis of unit root is consistently rejected in all the countries and across the emerging and developed markets. What this implies is that the ESG return is a stationary series, and the robustness of this evidence holds for all the BICS and G7 member countries, irrespective of whether it is with or without a break, but mixed across the unit root with constant, with constant and trend, and without either constant or trend.

Presented in Table 3.2 are the unit root test results for the investor sentiment and the control variables. However, while the order of integration is I(1) for CISI when the unit root is without structural break, the null hypothesis of unit root is rejected at the 1% level of significance for the unit root with structural breaks. Regarding the control variables, the null hypothesis of the unit root is significantly rejected for growth, inflation, CLI, and CTI but otherwise for LTI. In all of this, the fact that the unit root result is consistent, particularly in the context of the ADF with structural breaks, gives credence to our preference for the regime switching model as the most appropriate to capture the break points in terms of alternative regimes such as bear and bull periods.

Table 3.2: Augmented Dickey-Fuller Unit Root Test Results

	Unit root without break			***Unit root with break***			
	Level	***First Difference***	***I(d)***	***Level***	***First Difference***	***I(d)***	***Break Date***
Unit root testing for ESG in Emerging Markets							
Brazil	-56.618^{a}***	-	1(0)	-57.716^{a}***	-	1(0)	10/30/2008
China	-53.346^{c}***	-	1(0)	-53.823^{c}***	-	1(0)	3/14/2022
India	-23.385^{a}***	-	1(0)	-56.188^{b}***	-	1(0)	3/01/2011
South Africa	-54.165^{a}***	-	1(0)	-54.656^{c}***	-	1(0)	12/11/2015
Emerging Market	-53.713^{a}***	-	1(0)	-54.499^{c}***	-	1(0)	10/30/2008
Unit root testing for ESG in Developed Markets							
Canada	-23.951^{b}***	-	1(0)	-62.493^{b}***	-	1(0)	10/05/2007
France	-59.938^{a}***	-	1(0)	-61.037^{b}***	-	1(0)	3/12/2020
Germany	-48.586^{a}***	-	1(0)	-50.020^{b}***	-	1(0)	3/12/2020
Italy	-54.460^{c}***	-	1(0)	-56.165^{c}***	-	1(0)	3/12/2020
Japan	-71.137^{a}***	-	1(0)	-71.851^{a}***	-	1(0)	3/15/2011
UK	-63.574^{a}***	-	1(0)	-64.414^{c}***	-	1(0)	10/29/2008
USA	-11.331^{c}***	-	1(0)	-44.723^{c}***	-	1(0)	8/10/2017
Developed Market	-33.547^{c}***	-	1(0)	-35.548^{c}***	-	1(0)	3/12/2020
Unit root testing for CISI and Control Variables							
CISI	-2.040^{b}	-64.678^{b}***	1(1)	-46.031^{b}***	-	1(0)	10/30/2007
Growth	-16.572^{c}***	-	1(1)	-57.573^{c}***	-	1(1)	10/30/2007
Inflation	-65.014^{c}***	-	1(0)	-103.58^{c}***	-	1(0)	6/01/2009
CLI	-13.190^{c}***	-	1(1)	-46.031^{c}***	-	1(1)	10/30/2007
LTI	-1.215^{a}	-13.621^{c}***	1(1)	-3.953^{c}	-45.967^{c}***	1(1)	10/30/2007
STI	-2.580^{a}***	-	1(1)	-9.458^{b}***	-	1(1)	10/01/2008

Note: *The superscript a, b & c indicates model with no constant and trend, model with constant, and model with constant and trend, respectively. The null-hypothesis hypothesis is that an observable time-series is not stationary (i.e. has unit root). Break points/date were also reported as well as the order of integration [I(d)], while ***, ** and * implies significant at 1%, 5% and 10% levels of significance, respectively.*

3.4.1.3 Serial Correlation and Heteroscedasticity Tests

We extend the preliminary analysis to test for the presence of autocorrelation and conditional heteroscedasticity in the variables. For the autocorrelation test, we employ the Ljung-Box test, while the Engle (1982) Autocorrelation Conditional Heteroscedasticity-Lagrange Multiplier (ARCH-LM) test is explored to determine the presence of conditional variance in the series. However, while both tests are residual-based, the statistics of interest are obtained both for residual and residual-squared in the case of the Ljung-Box but mainly in terms of residual-squared in the ARCH-LM test. As a result, while Q-stat. and Q^2-stat. are reported in the Table 3.3 in the case of the Ljung-Box test, only the F-stat. is reported in the case of the ARCH-LM. More importantly, each of the tests are performed and reported at different lag lengths such as k=5, k=10, and k=20.

i. Autocorrelation test results

Starting with the ESG return series, a look at Table 3.3 shows that the hypothesis of no autocorrelation is overwhelmingly rejected in all the BICS and G7 markets. Although there are few instances where the hypothesis of no autocorrelation or the absence of serial dependence holds, such as South Africa in the case of the BICS markets, others are France, Germany, and Italy in the case of the G7 markets. However, it is instructive that these few exceptional cases are only evident when the test is mainly about the residual of the series and not the squared residual and mainly when the hypothesis is tested at lags 5 and 10, respectively. As expected of a returns series, the null hypothesis of no autocorrelation is significantly rejected for the ESG return series when the test is performed on the squared of the residual.

We also find the rejection of the null hypothesis of no autocorrelation rejected for the investor sentiment series particularly when the test is performed of on the squared residual of the series. What this depicts is that the higher-order temporal dependencies are relatively more pronounced, as evident both for the ESG returns and the investor sentiment series. This in particular is in line with an empirical pattern that has been widely established when modelling with high-frequency financial time series (see Antoniou et al. (2005). On the other hand, however, the rejection of the null hypothesis of no autocorrelation with respect to the macroeconomic fundamentals being controlled for in this study is only evident when the temporal dependencies are in the first moment. This may not be unconnected to the fact that the control variables are originally low-frequency and only spliced to be expressed at the same frequency as other variables of interest.

Table 3.3: Serial Correlation and Conditional Heteroscedasticity

ESG in Emerging Markets									
	Q-Stat.			*Q^2-Stat.*			*ARCH LM Test*		
	K=5	*K=10*	*K=20*	*K=5*	*K=10*	*K=20*	*K=5*	*K=10*	*K=20*
BRA	6.838	25.12***	34.23**	129.3***	170.2***	188.5***	168.1***	88.40***	44.29***
IND	22.80***	64.28***	77.94***	766.9***	131.7***	178.9***	110.5***	69.05***	47.92***
CHN	15.63***	26.06***	45.33***	447.85***	577.66***	704.29***	64.63***	35.54***	19.30***
RSA	5.115	14.18	31.48**	643.2***	994.9***	124.5***	86.73***	53.44***	27.51***
EME	4.729	33.80***	58.47***	206.8***	351.5***	537.0***	269.1***	145.8***	81.52***
ESG in Developed Markets									
CAN	24.37***	77.08***	108.0***	203.3***	366.6***	532.1***	230.3***	135.7***	82.08***
FRA	4.670	16.41*	24.72	544.0***	103.1***	128.0***	83.86***	60.48***	32.02***
GRM	6.166	24.21***	34.64**	345.3***	715.6***	870.6***	63.11***	53.73***	30.15***
ITL	7.256	16.00	34.86**	147.9***	199.6***	216.2***	24.28***	15.40***	7.844***
JPN	9.599*	12.70	25.28	131.2***	219.4***	316.3***	170.5***	101.0***	53.63***
UK	27.19***	46.88***	69.98***	105.3***	186.0***	255.6***	128.2***	79.37***	41.36***
USA	12.75***	107.7***	143.6***	876.9***	147.2***	176.9***	116.9***	70.73***	37.26***
DME	4.299	18.95**	38.41***	136.9***	395.1***	465.8***	20.78***	29.27***	17.23***
CISI and the Control Variables									
CIS	4.196	16.95*	24.54	186.1***	311.3***	509.2***	29.67***	20.68***	13.91***
Growth	0.079	187.4***	328.3***	0.084	0.083	0.084	0.015	0.008	0.004
Inflation	5.848	47.67***	48.09***	0.006	0.183	0.185	0.001	0.018	0.009
CLI	369.7***	649.2***	843.0***	12.08**	12.29	19.24	2.36**	1.197	0.927
LTI	166.4***	268.1***	326.5***	0.157	1.078	9.640	0.031	0.104	0.471
STI	719.6***	135.0***	230.0***	73.85***	130.03***	252.2***	2.825***	8.627***	6.447***

*Note: BRA, IND, CHN and RSA are the acronyms for Brazil, India, China, and South Africa, while EME implies emerging market markets. Also, CAN, FRC, GRM, ITL, JPN, UK and U.S.A. are the acronyms for the G7 countries, namely, Canada, France, Germany, Italy, Japan, United Kingdom, and United States of America in that order, while DME is developed market. The reported values for the Ljung-Box –based autocorrelation test is Q- and Q^2 statistics and ARCH-LM test for the conditional heteroscedasticity is reported using F-statistics. Three different lag lengths (k) of 5, 10 and 20 are considered for robustness purpose. The null hypothesis for the autocorrelation test is that there is no serial correlation, while the null for the ARCH-LM test is that there is no conditional heteroscedasticity. ***, ** and * indicates significant at 1%, 5% and 10% respectively.*

ii. ARCH effects

The finding of significant evidence of serial correlation, particularly in the squared residual of the ESG returns and the investor sentiment series, suggesting that the series second moments are time-varying, is an indication of the probable presence of heteroscedasticity in the series. Confirming this is the overwhelming evidence of significant ARCH effects reported in Table 3.3 for ESG returns in all the markets as well as for the investor sentiment series. In fact, a look at the table shows that irrespective of the choice of the lag length that is under consideration, the null hypothesis of homoscedasticity or no ARCH effect was significantly rejected at the 1% level of significance for the ESG returns and the investor sentiment series that are originally of high frequency. In sum, this overwhelming evidence of autocorrelation and conditional variance, among others, further strengthens our motivation for a Markov switching model (MSM) that has the feature of enabling us to examine not only the conditional mean but also the conditional variance of the ESG across two different market conditions.

3.4.1.4 Nonlinearity Test

One of the motivations for using the Markov switching model in the literature is its ability to capture the probable nonlinear feature of the variable of interest. Therefore, before proceeding to estimate with a Markov switching model, one of the prerequisites is to determine its suitability for the data under consideration by testing for the presence of nonlinearity in the variable. The standard practice in the literature has been to perform a linearity test against nonlinearity before estimating with a complex nonlinear model such as the Markov switching model. As earlier established, the BDS nonlinear test is employed in this study, and the result of the test is presented in Table 3.4, where the values in parenthesis are the probability values associated with the BDS test statistic. The fact that the probability values are consistently less than 5% in all the investigated markets gives credence to the rejection of the null hypothesis. Saying it differently, the evidence of the overwhelming rejection of the null hypothesis of linear dependency in all the BICS and G7 markets is an indication of the feature of nonlinearity in the ESG returns series in both the emerging and developed markets.

Table 3.4: BDS Test Bootstrap Results for Nonlinearity in ESG Returns

Emerging Markets	***Dimension***				
	2	***3***	***4***	***5***	***6***
Brazil	0.0112*** (0.0015)	0.0241*** (0.0023)	0.0334*** (0.0028)	0.0388*** (0.0029)	0.0408*** (0.0028)
India	0.0123*** (0.0016)	0.0259*** (0.0025)	0.0358*** (0.0029)	0.0421*** (0.0031)	0.0421*** (0.0029)
China	0.0106*** (0.0016)	0.0231*** (0.0024)	0.0341*** (0.0029)	0.0403*** (0.0031)	0.0434*** (0.0029)
South Africa	0.0090*** (0.0014)	0.0205*** (0.0023)	0.0281*** (0.0027)	0.0329*** (0.0028)	0.0343*** (0.0027)
Emerging Market Index	0.0203*** (0.0014)	0.0414*** (0.0022)	0.0581*** (0.0027)	0.0672*** (0.002	0.0717*** (0.0027)

Developed Markets					
Canada	0.0249*** (0.0016)	0.0548*** (0.0025)	0.0767*** (0.0029)	0.0916*** (0.0031)	0.0994*** (0.0030)
France	0.0166*** (0.0016)	0.0385*** (0.0025)	0.0558*** (0.0030)	0.0673*** (0.0031)	0.0729*** (0.0030)
Germany	0.0162*** (0.0019)	0.0347*** (0.0030)	0.0506*** (0.0035)	0.0606*** (0.0037)	0.0656*** (0.0036)
Italy	0.0178*** (0.0017)	0.0332*** (0.0027)	0.0443*** (0.0032)	0.0511*** (0.0034)	0.0537*** (0.0033)
Japan	0.0204*** (0.0014)	0.0413*** (0.0022)	0.0548*** (0.0026)	0.0622*** (0.0027)	0.0639*** (0.0026)
United Kingdom (UK)	0.0254*** (0.0016)	0.0499*** (0.0025)	0.0689*** (0.0029)	0.0812*** (0.0031)	0.0864*** (0.0030)
United States of America (USA)	0.0305*** (0.0027)	0.0650*** (0.0044)	0.0922*** (0.0052)	0.1122*** (0.0054)	0.1240*** (0.0053)
Developed Market Index	0.0213*** (0.0025)	0.0468*** (0.0040)	0.0651*** (0.0047)	0.0753*** (0.0050)	0.0791*** (0.0047)

Note: *The values in parenthesis are the standard errors associated with BDS test statistic of the null hypothesis that the data is independently and identically distributed (iid) against an unspecified alternative. *** implies significant rejection of the null hypothesis of linearly dependent at 1% level of significance.*

3.4.2 Presentation and Discussion of Empirical Results

Having confirmed the various inherent statistical features of the variables of interest, such as unit root with structural break, presence of autocorrelation and conditional variance, and evidence of nonlinearity, all of which confirm the suitability of the Markov switching model as the most appropriate in the context of this study, the empirical results herein are presented and discussed under three main subsections. The first is sub-section 3.5.1, where the empirical estimates on the conditional mean and conditional variance of the ESG and the impact of the investor sentiment on the ESG returns are presented and discussed for the case of the BICS markets. The second is sub-section 3.5.2, where the empirical estimates are considered for the case of the G7 markets.

3.4.2.1 The impact of investor sentiment on ESG in the Emerging markets

The goal here is to understand whether the impact of the investor sentiment on the ESG return can be generalized for the individual BICS countries and across different market conditions. The empirical estimates as presented in Tables 3.5 include the mean of the ESG return, the volatility of the ESG returns, and the direct impact of the CISI on the ESG returns as well as those of the control variables.

The average return: conditional mean

The conditional mean parameter (μ) in equation (3.1) measures the average return in both regime 1 and regime 2, respectively. A look at Table 3.5 shows that the coefficients on the conditional mean are predominantly positive in the BICS economies except for Brazil in regime 1 and when the economies are measured as a group in regime 2. However, we find the ESG performance in terms of the mean returns to not be statistically significant in the BICS economies, both as individual countries and when the economies are measured as a group. The robustness of this finding is evident both in regime 1 and regime 2.

That said, while China is the country with the highest average returns in the ESG in bull market condition (regime 1), with mean values of 3.25%, Brazil is the country with the highest average returns on the ESG in bear period (regime 2), with mean values of 3.15%. In a similar development, South Africa, with a mean value of 1.19% in bull condition (regime 1) and 1.29% in bear condition (regime 2), is the country with the lowest average returns on ESG in both regimes. Also, from an intra-comparative perspective, it was observed that the ESG markets in India and China performed better in bull market condition than in their bear market condition. Conversely, it was observed that the Brazilian and South African ESG markets depicted a better performance in bearish market condition than in bullish market condition. More so, when the BICS economies are treated as a group in the form of emerging market economies (EME), we find the returns on the ESG to be positive and relative higher in bear (regime 1) with a mean value of 3.52% compared to the bull (regime 2), where they are negative and relatively lower with a mean value of 0.58%. Overall, we find the returns on the ESG in the emerging market economy (EME) with the potential of increasing in bear (regime 1) while the reverse is likely to be the case in bull (regime 2).

The volatility dynamics: Conditional variance

The volatility dynamics of the ESG are captured by the conditional variance parameter (σ^2) in equation 3.2. The goal here is to determine the extent to which the dynamics of volatility, both in terms of magnitude and sign (direction), vary for the different BICS countries being investigated and across the different regimes being considered. Consistent with the outcomes of the preliminary analysis earlier considered, the study found the coefficient on the conditional variance (σ^2) statistically significant in all the BICS countries. However, the magnitude of the conditional variance shows that the volatility of ESG returns is higher in regime 2 compared to regime 1. The fact that this finding holds for all the individual BICS countries except when measured as a group is a further indication that the ESG is mostly in bearish market conditions in regime 2 and bullish in regime 1. What this portends is that the ESG performance is characterized by a downward shift, with the conditional variance measuring the volatility of the ESG returns generally high for all the BICS indicating a bearish market condition in regime 2 and a bullish market condition in regime 1.

In a more specific sense, the study found Brazil to be the country with the most volatile ESG returns, with conditional variance values of 0.40 in bull market condition (regime 1) and 1.24 in bear market condition (regime 2), respectively. Whereas, the study found India to be the country with the least volatile ESG returns, as ESG volatility reduces by 0.09% in the bull market condition (regime 1) and increases in the bear market condition (regime 2) by 0.83%. Even when the volatility of ESG returns increases in both regime 1 and regime 2 in the cases of China and South Africa, it is instructive that the magnitude of the increase is 0.86% and 1.03% for both economies in regime 2 compared to 0.10% and 0.33% in regime 1, respectively.
From the EME index perspective, it was also observed that whilst volatility of the emerging markets as a group/unit reduces by 0.2 in the bull market condition (regime 2), it was observed that volatility increases in the bear period by 0.74. This, among other things, is a confirmation of the ESG returns being bearish in most of the BICS countries. Thus, it must be pointed out herein that the higher volatility associated with such a bearish market condition often leads to rapid price swings and creates challenges for investors.

The effect of investor sentiment on ESG performance

One of the main objectives of this study is to understand the impact of investor sentiment on ESG performance under different market conditions. Starting with regime 1, where the ESG is mostly bullish as it is characterized by a time frame in which there is very little volatility and an average increase in market value, we find the impact of the investor sentiments to be positive and statistically significant in each of the individual BICS countries and even when the economy is captured as a group. The only exception in this regard is the case of China, where the impact of investor sentiments on ESG is positive but not statistically significant. More importantly, we find the impact of the investor sentiments on the ESG to be higher in Brazil, while a 1% increase in the investor sentiment increases the ESG returns by 0.13%. In the cases of India and South Africa, a 1% increase in investor sentiment tends to increase the ESG returns by 0.04% and 0.12%, respectively. However, when the ESG is in bearish market conditions, we find the impact of investors' sentiment to have remained positive in all the BICS countries, but the effect is only statistically significant in China and South Africa. This is an indication that the extent to which the investor sentiments enhances the ESG returns may depend on the condition of the market, such as whether it is bearish or bullish.

The role of control variables

In addition to the investor sentiment whose direct impact on ESG performance is the focal point of this study, the study also controlled for some important variables namely, economic growth, inflation, composite leading indicator (CLI), and short-term interest rate (STI). These variables are alternative indicators of the macroeconomic conditions. However, while an increasing economic growth is expected to spur the ESG performance, higher inflation as well as short- interest rate is likely to affect the ESG performance adversely.

Starting with economic growth, for example, there are three ways that, according to Ho et al. (2019), economic growth is expected to affect ESG performance. First, an increase in the rate of growth implies an increase in the country's capacity to achieve and sustain high investment rates, leading to technological advancement that creates innovation. Second, rising levels of employment and income raise the funds from which effective ESG policies can be financed. Third, a better standard of living, generated by economic growth, may change lifestyles; people will give greater attention to environmental amenities, social challenges, and governance.

However, while our empirical finding, as reported in Table 3.5, tends to conform to the predicted positive impact of economic growth on ESG performance, the significance of the effect seems to be only statistically viable in the case of Brazil when the market is in bull condition and in the case of India when the market is in bear condition. This is again an indication that the extent to which the economic growth in the investigated BICS countries matters in the ESG performance may be sensitive to whether the market condition is bullish or bearish.

On the extent to which increasing inflation is likely to affect ESG performance, it is instructive that rising inflation typically means organisations must take on more costs, such as more expensive materials or labour, that may make achieving the ESG goals more challenging. However, irrespective of whether the market condition is bullish or bearish, our empirical findings reveal that the effect of inflation on the ESG performance is not statistically significant in many of the BICS countries investigated. The only notable exception in this regard is when the countries are captured as a group in the form of an emerging market and when the market is in bearish condition. In the said exceptional case, we find the ESG rather responding positively to increasing inflation. This is an indication that even if increased costs make achieving the original ESG-themed targets challenging, organisations can prioritise what's possible to minimise the adverse effect of increasing inflation on ESG performance.

As with inflation, the short-term interest rate is a cost of investment; therefore, increasing the interest rate, is likely to increase the cost of investing in ESG stocks and, by extension, affect their performance adversely. However, in what appears to be a confirmation of the hypothesis of the neutrality of the interest rate in the long run, our findings show that only the short-term interest rate has a significant impact on the ESG performance in the BICS countries. However, we find the validity of such a negative effect of the short-term interest rate on ESG performance to be statistically evident only when the market condition is bullish in India and China and when the BICS countries are captured as EME, and the market is in bearish condition.

Transition probabilities and expected duration probabilities

Having shown that the market for ESG in the BICS economies is mostly bearish in regime 2, with evidence of higher volatility likely to affect the expectations of investors, the way forward is to understand the probability of the market transiting to regime 1, which is bullish in nature. A further look at Table 3.5 shows that the transition probabilities of the ESG returns for a bull market condition (P11) and a bear market condition (P22) are persistent, hovering around 0.989 and 0.883. Except when the BICS economies are expressed as a group in the form of emerging market economies (EME), the transition probabilities show that the probability of the ESG returns being in the bull market condition is higher in all the individual BICS countries compared to the probability of the ESG returns being in the bearish market condition. These results are consistent with the constant expected duration. For example, while ESG returns in Brazil are likely to spend about 50 days in bull market conditions (T11), they are only 12 days in bear market conditions. In a similar trend, the ESG returns are likely to remain in the bull market condition for about 45 days in India, 66 days in China, and 55 days in South Africa. Whereas the probabilities of the duration the ESG returns are expected to remain in bear market conditions in these economies are about 8 days, 23 days, and 16 days, respectively.

Table 3.5: Empirical Estimates on ESG and Investor Sentiment in the Emerging Market

	Brazil	India	China	RSA	EME
Regime 1					
μ	-1.8233 (0.6085)	1.6781 (0.4498)	3.2527 (0.1001)	1.1911 (0.7589)	3.5187 (0.2756)
σ^2	0.4042*** (0.0000)	-0.0913*** (0.0008)	0.0973*** (0.0000)	0.3314*** (0.0000)	0.7379*** (0.0000)
CIS Index	0.1349*** (0.0000)	0.0352*** (0.0017)	0.0105 (0.4029)	0.1233*** (0.0000)	0.0942*** (0.0001)
Control variables					
Inflation	-0.0374 (0.2702)	0.0179 (0.3140)	-0.0003 (0.9887)	-0.0005 (0.9850)	-0.0114 (0.4868)
Growth	1.0442*** (0.0043)	0.1991 (0.3047)	0.4449 (0.1630)	0.3669 (0.2144)	0.7384 (0.1230)
CLI	0.0184 (0.6048)	-0.0161 (0.4673)	-0.0317 (0.1087)	-0.0113 (0.7693)	-0.0374 (0.2518)
STI	4.6463 (0.4741)	-7.4239* (0.0671)	-12.3273* (0.0800)	-8.0363 (0.1705)	-1.4746 (0.7516)
Regime 2					
μ	3.1476 (0.6118)	1.3793 (0.7678)	1.4720 (0.8334)	1.2934 (0.8057)	-0.5814 (0.8550)
σ^2	1.2369*** (0.0000)	0.8306*** (0.0000)	0.8674*** (0.0000)	1.0312*** (0.0000)	-0.1994*** (0.0000)
CIS Index	0.0012 (0.9797)	0.0523 (0.1058)	0.0947*** (0.0027)	0.1018*** (0.0079)	0.0600*** (0.0000)
Control variables					
Inflation	0.0588 (0.5353)	-0.0634 (0.5318)	0.0081 (0.9358)	0.0786 (0.3540)	0.0071** (0.0116)
Growth	0.9885 (0.2192)	1.4081* (0.0572)	0.2958 (0.6049)	0.6198 (0.4132)	0.2964 (0.1134)
CLI	-0.0339 (0.5881)	-0.0159 (0.7348)	-0.0167 (0.8115)	-0.0147 (0.7806)	0.0062 (0.8445)
STI	-25.1627 (0.3675)	8.3226 (0.7142)	9.1600 (0.5575)	21.9320 (0.2996)	-6.1266** (0.0374)
Transition Probabilities					
P_{11}	0.9803	0.9781	0.9848	0.9818	0.9583
P_{22}	0.9193	0.8827	0.9580	0.9384	0.9890
Expected Duration Probabilities					
T_{11}	50.8031	45.6707	66.0916	55.1433	23.9910
T_{22}	12.3976	8.5316	23.8389	16.2505	91.4837

Note: *The values in parenthesis are the p-values with ***, ** and * implies significant at 1%., 5% and 10% levels of significance, respectively.*

3.4.2.2 Impact of investor sentiment on the ESG performance in developed markets

As demonstrated in the case of the BICS economies, the focal point of this section is to provide evidence-based insights on the dynamics of the effect of investor sentiment on the performance of ESG in the G7 member countries under market conditions of bull and bear states. As with the emerging markets, market conditions of bull and bear were determined following Benschopa and López Cabreraa (2014), approach as discussed in the methodology section. Following this approach, it was observed that the except for North American countries including Canada and the United States of America, the regime 1 was observed to be the bull period for all individual and group ESG markets as represented by the G7 economies. This observation was based on the higher volatility in regime 2 and further confirmed by the expected duration. Thus, presented in Table 5.6 are the empirical estimates on the returns, volatility, and response of ESG in the G7 countries investor sentiments under different market conditions.

The average return: conditional mean

The conditional mean (μ) measuring the average returns on ESG shows that the return is only statistically significant in Germany when the market is in bull market condition (regime 1) and bear market condition (regime 2) and when the U.S.ESG market is in bull market condition (regime 2). When the G7 member countries are captured as a group and expressed as developed market economies (DME), we find the average returns to be statistically significant, but mainly when the market is in regime 1. The result also shows the average returns. On whether the average returns on the ESG stocks is increasing or decreasing, we find the coefficients on the conditional mean to be positive in at least five of the G7 countries both when the market is in regime 1 and in regime 2, respectively. Essentially, Japan and the U.S. are the countries with the negative ESG returns in regime 1, while Canada and Germany are the G7 countries with negative ESG returns when the market is in regime 2. In sum, the ESG return is on average predominantly positive in most of the G7 countries irrespective of whether the market is in regime 1 or regime 2.

Regarding the magnitude of the returns on the ESG, while Canada with mean values of 4.73% and Italy with the mean values of 2.12% are on average the countries with the highest on ESG when the market is in regime 1, while France and then still Italy follow by UK are the country with the highest average returns on the ESG in regime 2. In another development, Germany and then U.S. are the countries with the least average returns on ESG both in regime 1 regime 2, respectively. With respect to the G7 member countries expressed in their group form as developed market economy (DME), we find the mean values larger in regime 2 compared to regime 2. For instance, while there is the potential of returns on ESG increases on average by 0.06% when the DME is in regime, there is, however, the likelihood of the returns on ESG decreasing by 0.12% when the DME is in regime 1.

The volatility dynamics: Conditional variance

This section analyses the conditional variance of the ESG returns in the G7 countries to enable the understanding of the volatility dynamics of the ESG under different market conditions. Irrespective of whether it is regime 1 or regime 2, the study found the coefficient of the conditional variance (σ^2) statistically significant in all the developed markets except for the US market in regime 1. However, from the viewpoint of the magnitude of the conditional variance, the volatility of ESG returns appears to be predominantly higher in regime 2 compared to regime 1. The only two instances of an exception in this regard are in the cases of Canada and the USA, where the study found volatility of the ESG returns to be relatively higher in regime 1 compared to regime 2. To put it differently, the ESG performance is predominantly characterized by a downward shift, with the conditional variance measuring the volatility of the ESG returns generally high for about 5 of the G7 countries, thus implying that ESG in those 5 markets as well as the group DME index are in a bearish market condition in regime 2 and in a bullish market condition in regime 1.

Considering the magnitude of the volatility of the ESG returns from the individual point of view of the G7 countries, Canada followed by the USA and Italy are the countries with the most volatile ESG returns in regime 1, where the conditional variance is as high as 0.97, 0.66 and 0.03, respectively. Conversely, in regime 2, Italy and UK with variance conditions of 0.92 and 0.91 are the G7 countries with the most volatile ESG returns in regime 2.

The implication here is that, while Canada and USA have their ESG markets to be bearish in regime 1 and bullish in regime 2, it is, however, otherwise in the cases of Italy and UK. Other G7 countries whose ESG markets are in bearish conditions in the regime 2 are France, Germany, and Japan. Also, when the G7 economies is modelled as group under the coinage of developed market economy (DME), the market condition is bullish in regime 1 and bearish in regime 2.

The effect of investor sentiment on ESG performance

Starting with regime 1, the study found the impact of investor sentiments on the ESG performance to be statistically significant in all of the developed markets (G7 countries), with the USA economy the only notable exception. However, compared to regime 1, the significant impact of the investor sentiments in the ESG performance in regime 2 is only statistically evident in 3 of the G7 countries. Canada, Japan and then UK are the G7 countries where the effect of investor sentiments on ESG performance is statistically significant both in regime 1 and regime 2. More importantly, we find the impact of the investor sentiments on the ESG to be higher in Canada irrespective of whether the ESG market is in regime 1 or regime 2. However, while a 1% increase in the investor sentiments will increases the ESG returns in Canada by 0.13% in regime 1 it is by 0.12% in regime 2. Another interesting finding is the fact that regardless of whether the ESG market is bearish or bullish, the investors sentiment has no significant effect on the ESG performance in the USA market given the statistically insignificant of the effect of the investor sentiments on the country's ESG returns both in regime 1 and regime 2. From the viewpoint of the G7 countries represented as the developed market economy (DME), the effect of the investor sentiments on the ESG performance is though positive in both regimes, but the magnitude of the effects appears to be relatively higher in regime 2 compared to regime 1.

In sum, the extent to which the investor sentiments enhance the ESG returns in the G7 countries, and the developed economy as a whole may depend to an extent whether the market condition is bearish or bullish.

The role of control variables

As earlier demonstrated, we extend the nexus between ESG returns and investor sentiment to control for some important macroeconomic fundamentals namely, economic growth, inflation, composite leading indicator (CLI), short-term interest rates (STI) and long-term interest rates (LTI). However, a look at the estimates on these control variables show that, while a higher growth rate is expected to spur the ESG performance, the significance of this position appears to be only statistically viable in the case of Canada when the ESG market is in regime 1 and in the case of

UK when the ESG market is in regime 2. Also, while higher inflation and contractionary interest rates both in the forms of short-term and long-term interest rates expected to affect the ESG performance adversely, we only find little evidence to support these positions statistically. For instance, not only is the effect of the inflation on the ESG performance statistically significant when the ESG market is in regime 1, but mainly in the case of the French economy and the direction of the impact tends to contradict the theoretical prediction of negative effect of inflation on ESG performance. As with inflation, we find little or no significant impact of both short-term interest rate and the long-term interest rate on the ESG performance. The only notable exception is in regime 2 where the ESG returns in Germany respond significantly to changes in the short-term interest rates with the direction of the impact correctly signed. For instance, a 1% increase in the short-term interest rates reduces   returns on the ESG in Germany by about 18%.

Expected duration of ESG returns in bull and bear market conditions in emerging and developed markets

Given that the ESG performance in the G7 economies is mostly bearish when the market is in regime 2 with evidence of higher volatility likely to alter the expectations of the investors, the goal in this section is therefor to understand the probability of the market transiting to regime 1, which is on the other hand bullish in nature. However, the transition probabilities presented in Table 3.6 shows that the transition probabilities of the ESG returns for a bull market condition (P11) and a bear market condition (P22) are persistent, hovering around 0.987 and 0.915. With the exceptions of Canada and the USA, the transition probabilities show that the probability of the ESG returns being in the bull market condition is higher in about five of the G7 member countries compared to the probability of the ESG returns being in the bearish market condition. The fact that the probability of the ESG returns being in the bullish market condition for the majority of the G7 countries also hold when the G7 is expressed in group as developed market economy (DME). Interestingly, we find these results to be robust and consistent with the constant expected duration. For example, when the G7 is expressed in group as DME, there is the probability of the ESG returns to be retain in the bull market conditions (T11) for about 33 days compared to the 13 days in the bear market conditions.

Table 3.6: Empirical Estimates on ESG and Investor Sentiment in the Developed Markets

	Canada	France	Germany	Italy	Japan	UK	USA	DME Index
Regime 1								
μ	4.7311 (0.2208)	1.8116 (0.4188)	0.0601*** (0.0084)	2.1267 (0.4763)	-0.6347 (0.7224)	1.1574 (0.5855)	-0.1663 (0.1551)	0.0639*** (0.0016)
σ^2	0.9693*** (0.0000)	-0.2828*** (0.0000)	-0.2732*** (0.0000)	0.0290*** (0.4015)	-0.1161*** (0.0000)	-0.1706*** (0.0000)	0.6647*** (0.0000)	-0.5918*** (0.0000)
CIS Index	0.1391*** (0.0000)	-0.0274** (0.0129)	-0.0712*** (0.0000)	0.0399*** (0.0038)	0.0965** (0.0000)	0.0530*** (0.0000)	0.0268 (0.3949)	0.0452*** (0.0011)
Control variables								
Inflation	0.0027 (0.6705)	-0.0010 (0.8847)	0.0150 (0.4311)	-0.0273 (0.2280)	-0.0003 (0.9879)	-0.0067 (0.1907)	-0.1456 (0.5248)	-0.0145 (0.5584)
Growth	1.0805* (0.0771)	-0.0627 (0.7045)	-0.2043 (0.5813)	0.0547 (0.8067)	-0.0976 (0.6022)	0.2216 (0.2087)	0.8728 (0.6451)	-0.0031 (0.9837)
CLI	-0.0499 (0.2029)	-0.0173 (0.4381)	0.1454 (0.7760)	-0.0205 (0.4921)	0.0068 (0.7018)	-0.0111 (0.5974)	1.1805 (0.3231)	0.4664 (0.1915)
STI	0.2737 (0.9624)	-0.2629 (0.9719)	-18.3753* (0.0600)	-11.46947 (0.1778)	-2.1829 (0.4901)	-5.1949 (0.1377)	3.5340 (0.7254)	-27.6010*** (0.0000)
Regime 2								
μ	-1.6015 (0.5040)	3.3138 (0.2491)	-0.1606** (0.0330)	2.4304 (0.5855)	2.3190 (0.5314)	2.4204 (0.5019)	0.1275*** (0.0000)	-0.1185 (0.1781)
σ^2	-0.1913*** (0.0000)	0.6332*** (0.0000)	0.5975*** (0.0000)	0.9192*** (0.0000)	0.7707*** (0.0000)	0.9102*** (0.0000)	-0.5455*** (0.0000)	0.4126*** (0.0000)
CIS Index	0.12921*** (0.0000)	0.0264 (0.2021)	0.0145 (0.6031)	0.0339 (0.3841)	0.1151*** (0.0000)	0.0650** (0.0207)	0.0103 (0.4058)	0.0915*** (0.0004)
Control variables								
Inflation	0.0075 (0.1668)	0.0078* (0.0801)	-0.0153 (0.7484)	0.0697 (0.3684)	-0.0157 (0.6690)	0.0042 (0.4920)	0.0349 (0.1784)	0.0227 (0.7341)
Growth	0.2013 (0.2402)	0.7191 (0.1378)	0.2492 (0.4960)	0.7058 (0.2988)	0.7795 (0.1342)	1.1308** (0.0489)	0.1497 (0.3263)	0.4026 (0.3236)
CLI	0.0165 (0.4903)	-0.0345 (0.2336)	0.9544 (0.2140)	-0.0257 (0.5675)	-0.0249 (0.5043)	-0.0259 (0.4769)	-0.2623 (0.5466)	0.7446 (0.3123)
STI	-3.4269 (0.1990)	-9.9934 (0.2432)	2.4924 (0.7756)	-1.5454 (0.9125)	0.4624 (0.9266)	4.7089 (0.4098)	-7.9131 (0.4481)	16.7331 (0.1908)
Transition Probabilities								
P_{11}	0.9510	0.9730	0.9777	0.9735	0.9794	0.9819	0.9603	0.9704
P_{22}	0.9870	0.9503	0.9511	0.9153	0.9325	0.9384	0.9740	0.9281
Expected Duration Probabilities								
T_{11}	20.4178	37.0611	45.0280	37.8405	48.6202	55.4111	25.2072	33.8329
T_{22}	77.4559	20.1457	20.4792	11.8191	14.8326	16.2392	38.5864	13.9231

***Note:** The values in parenthesis are the p-values with ***, ** and * implies significant at 1%., 5% and 10% levels of significance, respectively.*

3.4.3 Discussion of the results on investor sentiment and ESG returns in emerging and developed markets

Consistent with the approach of Benschopa and López Cabreraa (2014), it was found that the Regime 1 was the bull period for all the individual BICS markets as denoted by the period of low volatility and higher expected duration period. Conversely, the MSM depicts that for the emerging markets index (EME) representing all emerging markets as a single index/unit, the regime 1 was observed to be the bear period as indicated by the higher volatility and confirmed by the shorter expected duration in the regime.

On this backdrop, the study investigated the ESG returns performance, ESG volatility performance as well as the impact of investor sentiments on ESG performance. These investigations were conducted across market conditions of bull and bear as well as across market blocs of emerging and developed markets. Thus, this section of the dissertation provides a discussion on the findings of the study using a thematic approach.

3.4.3.1 Discussions on the impact of investor sentiment on ESG returns performance in emerging markets

Commencing with the first objective of this chapter, the discussions of the findings will be conducted from the standpoint of ESG emerging markets. Therefore, the section considers the ESG returns performance, volatility and the impact of investor sentiment on ESG performance in emerging markets as defined as the BIC markets.

With reference to the ESG returns performance in the emerging markets bloc, findings of the study revealed that in the bull market condition, the Chinese ESG market remains the top performing ESG market, whilst the Brazilian market was found to be the least performing ESG market. Conversely, in the bearish market condition, the Brazilian ESG market was noted as the top performing ESG market, whilst the South African market was determined as the least performing ESG market. This observation suggests that the ESG return performance in the emerging markets bloc varies amongst the markets based on market conditions. Also, the pairwise nature of the variations could further imply that there is a tendency that some emerging markets have shared commonalities than with others. This is particularly observed in the pairs of the Brazil-South Africa markets and the India-China markets. The pairwise structure could further depict that the level of advancement and infrastructural development in some emerging markets such as China and India, could have an impact on the attractiveness of investment, especially in their ESG markets. As seen with China and India being the top two leading markets in a bull-run period, this reiterates that investors find ESG funds attractive positive markets during positive market conditions.

The findings of the study are consistent with relevant studies on returns of emerging markets focusing on the BRICS market bloc This alignment is depicted in the findings of Rupande et al. (2019), Deng and Cheng (2019) and Xaba et al. (2019). For instance, Rupande et al. (2019) observed that BRICS markets are heterogeneous in nature, with returns performance varying among the individual markets. Likewise, Deng and Cheng (2019) also found a positive correlation between ESG indices and stock market performance in China, with a greater impact on non-state-owned enterprises and the secondary industry. However, Xaba et al. (2019) found that South African stock returns performed best among the BRICS markets across the bull and bear market conditions.

A range of studies have explored the relationship between ESG performance and stock market returns in emerging markets. In South Africa, Johnson et al. (2019) studied ESG factors and Corporate Financial Performance (CFP) measures. Amongst several findings, it was found that whilst composite ESG measurements did not correlate with CFP indicators, breaking down the ESG measure showed significant connections. Also, it was observed that environmental practices negatively correlated with earnings per share (EPS), with corporations with better environmental scores having lower EPS. The study further stressed the necessity for organizations to customize their strategies to their operational ESG elements. Similarly, Li et al. (2022) analyzed how ESG performance affected Chinese stock prices in 2022 during the COVID-19 crisis. Using an event-study model, the study found a positive correlation between ESG performance and cumulative anomalous returns for Chinese listed businesses during the downturn. Also, the works of Zhang et al. (2022) found that ESG performance strongly impacts future profitability, equity capital cost, and firm value. This assertion was based on the examination of the Chinese capital market portfolio returns and ESG investments. Likewise, Sharma (2023) asserted that Indian ESG indexes such as NIFTY 100 Enhanced ESG and NIFTY 100 Sector Leaders, exhibited strong return performance even in turbulent markets, underscoring the importance of ESG aspects in company strategy. More recently, Plattek and Figueiredo (2023) found that regardless of market conditions, sustainable investments in Brazil performed similarly to conventional investments in both returns and volatility terms.

Furthermore, with reference to the ESG volatility performance in emerging markets bloc, findings of the study revealed that in the bull market condition, the Brazilian ESG market remains the most volatile ESG market, whilst the Indian market was found to be the least volatile ESG market. Conversely, in the bearish market condition, the Brazilian ESG market was noted as the most volatile ESG market, whilst the Indian market was determined as the least performing ESG market. Regardless, from the standpoint of volatility the findings further confirm the observation of a pairwise relationship among the emerging markets. This is evident in the relational observation of Brazil-South Africa being the most volatile ESG markets in both bull and bear market conditions. Conversely, it is also discerned that India-China ESG markets have the least volatility across the market conditions of bull and bear. This implies that the ESG markets of India and China are more risk resilient than the ESG markets of Brazil-South Africa. A plausible reason for this could be that the advancements in the technology, infrastructure, and general economy of these markets improves their investment attractiveness, even in terms of ESG investments.

However, regardless of the intra-bloc analysis among the ESG markets, the study observed that the ESG emerging markets as a group unit as represented by the EME index, evidenced an overall lower volatility level across bull and bear market conditions than all the individual ESG markets. This implies that emerging markets as a group are more risk resilient than their individual markets. A plausible reason for this could be attributed to the beneficial inherent synergies and efficiency that could arise as a result of diversification.

The findings of the study are consistent with relevant studies on volatility of emerging markets focusing on the BRICS market bloc. Such studies include de Paula et al. (2018), Rupande et al. (2019), Patel (2019), Anyikwa and Phiri (2023), and Rohilla (2023). For instance, the doctoral study of Rupande et al. (2019) found that the nature of volatility in BRICS stock markets are heterogeneous, with the conditional variance varying among the individual markets. Likewise, Patel (2019), whilst exploring volatility within emerging markets of BRICS in the pre and post global financial crisis (GFC) periods, noted that stock volatility of Brazil was higher than the volatility of the other markets within the bloc. Conversely, the study observed that the Indian stock market exhibited stability and comparatively lower volatility. This is also in agreement with the recent revelation of Anyikwa and Phiri (2023) that observed that other than Russia, the Brazilian stock market exhibited the highest volatility as compared to other BRICS markets. However, the study of de Paula et al. (2018) found that the Brazilian stock market exhibit low volatility in bull and bear market regimes. It is necessary to stress that this study was not a comparative study.

Regardless, within the context of ESG, Sherwood and Pollard (2018) found that integrating ESG strategies into emerging market equities can lead to higher returns and lower downside risk. However, the performance of ESG markets in different countries varies. In bull markets, the Chinese ESG market outperforms, while in bearish markets, the Brazilian ESG market performs better. This was supported by Broadstock et al. (2021) who found that high-ESG portfolios generally outperform low-ESG portfolios, with ESG performance mitigating financial risk during crises. More so, the study of Carvalhal and Nakao Nakahodo (2022) found that Brazilian companies compliant with ESG principles fared better during the pandemic. Similarly, in the Indian ESG market, Rohilla (2023) assert that ESG funds delivered superior risk performance compared to the market portfolio throughout the COVID-19 pandemic period.

Lastly, with reference to the impact of investor sentiments on ESG performance in emerging markets bloc, findings of the study revealed the South African ESG market as the only ESG market to be statistically significant in both the bull and bear market condition. Conversely, the study observed whilst the influence of investor sentiments on the performance of the Brazilian and Indian ESG markets to be statistically significant in only bullish market condition. On the other hand, the influence of investor sentiments on the performance of the Chinese ESG market was only found to be statistically significant in the bearish market condition.

The observation from the emerging markets suggests that in general, except for the Chinese market, investor sentiment significantly influences the ESG returns of all individual markets and the group during a bull market condition. More precisely, the study observed the Brazilian and South African ESG markets to be most sensitive to the influence of investor sentiments in the bull market condition as a 1% increase in the investor sentiment increases the ESG returns by 0.13%. and 0.12% in these markets respectively. On the other hand, general observations from the bear market condition implies that only China, South Africa and the emerging markets group are significantly susceptible to the influences of investor sentiments during a market downturn. Furthermore, the statistical significance of investor sentiments on the South African ESG market in both the bull and bear market condition, implies that amongst all the individual markets in the emerging markets bloc, the South African market remains the only market that has a constant investor sentiment toward ESG investing. This consistent sentiment towards long term sustainability is depicted in both positive and negative market trends. In addition to this, the study also found a consistently significant influence of investor sentiments on performance of ESG funds across bull and bear market conditions in the emerging markets economies (EME) index.

The findings of the study are consistent with relevant studies on the impact of investor sentiments in emerging markets focusing on the G7 market bloc. Such studies include Dong and Yoon (2019), Dhasmana et al. (2023) and Nyakurukwa and Seetharam (2023). For instance, Dong and Yoon (2019) examined how global economic factors influenced the performance of emerging Asian stock markets using a dynamic model averaging methodology to evaluate the impact of various global variables, including established stock and exchange rate markets, economic fundamentals, financial and commodities markets, and investor sentiment. Findings of the study revealed that global factors, particularly established stock, and exchange rate markets, had a significant influence on emerging Asian stock markets due to the interconnectedness of financial markets. Also, economic fundamentals were found to have the best out-of-sample forecasting ability, indicating that stock markets effectively reflected economic activity. The research also highlighted the importance of considering various global factors during different periods, such as the Asian Financial Crisis of 1997–1998 and the Global Financial Crisis of 2007–2009, and the effect of global factors in volatile market conditions. Also, Dhasmana et al. (2023) discovered that there is an asymmetrical correlation between investor sentiment and the ESG index, indicating a lack of investor enthusiasm towards ESG initiatives of Indian corporations. The researchers further emphasized the need for more efforts to incorporate sustainability into financial markets and stated that ESG investing had not yet been completely assimilated into the views of Indian investors.

More recently, Nyakurukwa and Seetharam (2023) examined how stock performance of Johannesburg Stock Exchange (JSE) listed companies affect ESG news sentiment. Using an event study analysis, the results showed that positive ESG news sentiment affected stock returns more than negative sentiment. In addition to this, the research showed that investors may profit from positive ESG news sentiment as it was observed that ESG news mood has a higher influence on stock returns and may affect asset allocation methods. This suggests that establishing an ESG regulatory entity and studying market reaction could offer investors in South Africa a pathway towards sustainable growth.

3.4.3.2 Discussions on the impact of investor sentiment on ESG returns performance in developed markets

Commencing with the second objective of this chapter, the discussions of the findings will be conducted from the standpoint of ESG developed markets. Thus, the section considers the ESG returns performance, volatility and the impact of investor sentiment on ESG performance in emerging markets as defined as the G7 markets.

With reference to the ESG returns performance in the developed markets bloc, findings of the study revealed that in the bull market condition, the ESG market such as Italy, France, the UK, Germany, and the USA ranks as the top positively performing ESG markets in order of sequence, whilst the Canadian and Japanese markets were found to be the least negatively performing ESG markets. Conversely, in the bearish market condition, the ESG market such as Canada, France, Italy, the UK and Japan were noted as the top positively performing ESG markets, whilst the ESG markets including the USA and Germany were noted as the least negatively performing ESG markets.

In the context of this study, the statistical significance implies that in general, market conditions impact the returns of ESG funds in these specific markets. Furthermore, from a specific individual perspective, these findings imply that the Japanese and Canadian ESG markets exhibited negative returns under a bullish market condition, whilst the German and American ESG markets exhibited negative returns in the bearish market condition. In addition to this, given that Canada and the US are exempted from the definition of regime 1 as the bull market condition (as discussed earlier) based on the bull and bear determination by Benschopa and López Cabreraa (2014), therefore the highest ranking ESG market per average returns in the bull period is Italy. Whilst this position is followed by France, the US and the UK ESG markets, the least ranking ESG markets were found to be Canada and Japan with negative returns. More so, this also implies that except for Germany, the ESG markets in major European markets and the US are found to be attractive by investors.

The findings of the study are consistent with relevant studies on returns of developed markets focusing on the G7 market bloc. Such studies include Chiang and Zheng (2015), Rupande et al. (2019), and Muguto and Muzindutsi (2022). For instance, the doctoral study of Rupande et al. (2019) found that the nature of returns in G7 stock markets are heterogeneous, with the average mean varying among the individual markets. In addition to this, Chiang and Zheng (2015) found that Canadian and the USA markets to be best returns performing stocks between 1990 -2009, whilst Japan and Italy reported the least returns in the same period. Likewise, Muguto and Muzindutsi (2022) found that Germany and the USA had the highest returns among the G7 markets whilst the least returns were recorded by Italy and France.

Also, some relevant ESG focused studies such as Sahut and Pasquini-Descomps (2015) have noted that integrating ESG criteria into UK portfolios can improve returns and volatility. Likewise, in Germany, Velte (2017) found that environmental, social, and governance performance (ESGP) increases return on assets (ROA), further stressing the necessity of incorporating ESG factors into corporate plans and decision-making. Evaluating the risk-adjusted portfolio, Blankenberg and Gottschalk (2018) discovered that sustainable portfolios fared comparably to conventional ones, indicating that sustainable criteria did not reduce profitability in the United States. Moreover, in Italy, Doni et al. (2020) found that the effects of EU Directive on ESG reporting which required non-financial information disclosures, has substantially influenced Italian business model disclosures. More recently, Gavrilakis and Floros (2023) found that investing in high-ESG firms does not always reduce returns in most European nations, including France. However, during COVID-19 market crisis, Folger-Laronde et al. (2022) studied the relationship between ESG ratings and financial performance of exchange-traded funds in Canada. The findings suggest that increased sustainability performance of ETFs does not provide protection against financial losses in a significant market decline.

Furthermore, with reference to the ESG volatility performance in developed markets bloc, it could be asserted that from the purview of volatility as measured by the conditional variance, Italy, the UK and Japan, are the most volatile ESG markets in the bull period, whilst the US, Canada, Germany and France can be seen as the least volatile during a bullish market condition. Likewise, from the standpoint of bearish market condition, the study observed that the most volatile markets during a market downturn are Canada, Italy, and the UK, whilst the least volatile during bearish market are Germany, France, the US, and Japan.

Therefore, given the context of bull and bear market condition, it could be asserted that from the purview of volatility as measured by the conditional variance, Italy, the UK and Japan, are the most volatile ESG markets in the bull period, whilst the US, Canada, Germany and France can be seen as the least volatile during a bullish market condition. Likewise, from the standpoint of bearish market condition, the study observed that the most volatile markets during a market downturn are Canada, Italy, and the UK, whilst the least volatile during bearish market are Germany, France, the US, and Japan.

The findings of the study are consistent with relevant studies on the nature of volatility of developed markets focusing on the G7 market bloc. Such studies include Li and Yen (2011), Chiang and Zheng (2015); Rupande et al. (2019) and Muguto and Muzindutsi (2022). For instance, the doctoral study of Rupande et al. (2019) found that the nature of volatility in G7 stock markets are heterogeneous, with the conditional variance varying among the individual markets. Considering the nature of volatility among G7 stock markets, Li and Yen (2011) identified higher covariance risk in extremely bullish or bearish market states, particularly in the Italian, U.S., and U.K. markets, as compared to Japanese market significantly lower beta estimate. Similarly, the study Chiang and Zheng (2015) observed that the Italian market was the most volatile as compared to the UK market which evident the least amount of volatility amongst the G7 developed markets bloc in the period between 1990 -2009. Furthermore, Muguto and Muzindutsi (2022) whilst exploring the nature of volatility in BRICS and G7 markets found that Italy and Japan had the highest volatility while Canada and the UK had the least volatility.

In addition to these, some relevant ESG focused studies have also offered empirical evidence on ESG volatility within the context of developed markets. The study of Öcal and Kamil (2021) noted that ESG-indexed firms like France ESG-X, Germany ESG-X, and SRI-KEHATI are more shock-resistant than their broad-based index counterparts. Likewise, Korinth and Lueg (2022) investigated how ESG ratings affect German stock market risk categories. While the findings suggest that the risk and business sustainability of German firms have a U-shaped relationship, noting that ecological and social investments initially reduce risk but might raise it if overinvested. Furthermore, inquiring on smart beta ESG disclosure within the Canadian context, Yasmine and Kooli (2022) evaluated 2014–2019 smart beta indexes with ESG elements. It was revealed that fundamental indexation works in Canada, and smart beta strategies with ESG components outperformed market capitalization-weighted portfolios. This finding was consistent across all performance measures, market dynamics, and interest rate regimes, evidencing that smart beta ESG indexes can weathered bull and bear market conditions. A recent investigation by Chen et al. (2022) found that the ESG momentum worked well in both markets, the strategy worked better in the Taiwanese market than the Japanese market.

Lastly, with reference to the impact of investor sentiments on ESG performance in developed markets bloc, findings of the study revealed that in general, regardless of market conditions investor sentiments have a crucial influence on the returns of ESG funds across all markets within the developed markets bloc as well as the developed market index. More specifically, the study noted that this influence was more consistent across all markets in the bull period as represented by regime 1 in most cases. However, the study further observed inconsistencies in the significance of investor sentiments influence in the bear market conditions. These inconsistencies were explicated via the empirical evidence of insignificance in ESG markets such as France, Germany, Italy and the USA. Whilst this depict that investor sentiments is not a panacea for ESG investing in these markets during market downturns, a plausible reason could be that these markets remain open to the idea of ESG investments during a positive market trend and do not see ESG funds to be resilient during bearish market periods. On the other hand, the study noted that ESG markets such as Canada, Japan and the UK are vastly and significant influenced by investor sentiments in both bull and bear market periods. This implies that regardless of market conditions, there is a strong sentiment towards ESG investments in these highlighted countries amongst the developed markets bloc.

The findings of the study are consistent with relevant studies on the impact of investor sentiments in developed markets focusing on the G7 market bloc. Such studies include Wang et al. (2021), Vuong and Suzuki (2021), Loang (2022) and Wang et al. (2022). For instance, Wang et al. (2021) investigated the relationship between investor sentiment and upcoming stock returns in international markets, using the consumer confidence index (CCI) as a proxy. The study found a global inverse relationship between sentiment and stock returns, with emerging markets showing a more noticeable and enduring effect of sentiment. Similarly, the study of Vuong and Suzuki (2021) indicated that whilst firm-specific sentiment had a reduced impact on ESG performance for Japanese companies, market sentiment had less influence on corporate social conduct during economic downturns. This was based on the analysis of ESG scores of 367 companies from 2005 to 2019, which found that unfavorable feedback from the previous year could trigger a company's commitment to its ESG initiatives, especially for highly sensitive ESG companies. The findings imply that investor sentiment played a role in driving CSR initiatives in Japanese companies. Also, Loang (2022) examined the influence of investor sentiment and market sentiment on overreaction in the US and European markets before and during the COVID-19 pandemic. It found that prior to COVID-19, investor sentiment was correlated with market returns, with realized volatility being a significant variable during the pandemic. However, an overreaction was observed during the pandemic in both the European and US markets, with the US market exhibiting a stronger tendency for overreaction. More recently, Wang et al. (2022) using turnover ratio as the sentiment proxy and applying GARCH- type models, confirmed a conditional impact of investor sentiment on stock returns via bull regime- optimistic (pessimistic) shifts in investor sentiment would increase (decrease) stock returns, while in bear regime- optimistic (pessimistic) shifts would decrease (increase) stock returns.

3.4.3.3 Comparative discussions on the ESG-Investor Sentiment Nexus between emerging and developed markets

Returns performance

From a comparative standpoint, the findings of the study assert that in terms of ESG returns performance under bull market condition in general, the emerging market economies (EME) index as represented by the BIC markets as a group unit performed better than the developed market economies (DME) index as represented by the G7 markets. More specifically, it was found that among the markets in total, the Chinese market – an emerging market performs best as compared to the Italian market which was the topmost performing market in the developed markets economic bloc. Conversely, the overall least performer across both market blocs was found to be the Canadian market. this compares with the Brazilian market, which was found to be the least performer in the emerging market bloc.

From a comparative standpoint, the findings of the study assert that in terms of ESG returns performance under bear market condition in general, the developed market economies (DME) index as represented by the G7 markets performed better than the emerging market economies (EME) index as represented by the BIC markets as a group unit. More specifically, it was found that among the markets in total, the Canadian market – a developed market performs best as compared to the Brazilian market which was the topmost performing market in the emerging markets economic bloc. Conversely, the overall least performer across both market blocs was found to be the USA market. this compares with the South African market, which was found to be the least performer in the emerging market bloc.

Volatility performance

From a comparative standpoint, the findings of the study assert that in terms of ESG volatility performance under bull market condition in general, the developed market economies (DME) index as represented by the G7 markets exhibited a higher volatility than the emerging market economies (EME) index as represented by the BIC markets as a group unit. More specifically, it was found that among the markets in total, the Brazilian market – an emerging market exhibited a higher volatility as compared to the Italian market which was the most volatile market in the developed markets economic bloc. Conversely, the overall least performer across both market blocs was found to be the USA market. this compares with the Indian market, which was found to be the least performer in the emerging market bloc.

From a comparative standpoint, the findings of the study assert that in terms of ESG volatility performance under bear market condition in general, the emerging market economies (EME) index as represented by the BIC markets as a group unit exhibited a higher volatility than the developed market economies (DME) index as represented by the G7 markets. More specifically, it was found that among the markets in total, the Brazilian market – an emerging market exhibited a higher volatility as compared to the Canadian market which was the most volatile market in the developed markets economic bloc. Conversely, the overall least performer across both market blocs was found to be the German market. this compares with the Indian market, which was found to be the least performer in the emerging market bloc.

Investor sentiment

From a comparative standpoint, the findings of the study assert that in terms of the impact of investor sentiments on ESG performance under bull market condition, the study noted that ESG performance in emerging market economies (EME) index as represented by the BIC markets as a group unit was significantly influenced by investor sentiments in statistical terms, as compared to the developed market economies (DME) index as represented by the G7 markets. More specifically, it was found that the Brazilian market in general was the most susceptible to the impact of investor sentiments under a bull market condition as compared to the Canadian market in the developed markets bloc.

From a comparative standpoint, the findings of the study assert that in terms of the impact of investor sentiments on ESG performance under bear market condition, the study noted that ESG performance in emerging market economies (EME) index as represented by the BIC markets as a group unit was slightly more significantly influenced by investor sentiments in statistical terms, as compared to the developed market economies (DME) index as represented by the G7 markets. More specifically, it was found that the Canadian market in general was the most susceptible market in a bear market trend, as compared to the South African market in the emerging markets bloc.

3.5 Conclusions on Investor sentiment and ESG performance across market conditions and blocs

The chapter three of this dissertation investigated the impact of investor sentiment on ESG return and volatility performance across market conditions of bull and bear regimes, as well as market characterizations of emerging and developed markets. In this concluding section of the chapter, the research objectives vis-à-vis corresponding findings on the impact of investor sentiments on the return and volatility performance of ESG funds across bull and bear market conditions in emerging and developed markets was reviewed. Thereafter, suggestions for future studies are highlighted.

3.5.1 Review of study objectives and findings

Given the recent interest in the ESG consciousness of investors, this study examines whether investor sentiment towards ESG investment is firm, and unconditionally consistent regardless of market conditions. Essentially, this study employs a Markov regime switching model to test whether the impact of investor sentiment on ESG performance can be generalized under different market conditions. Taking cognizance of the varying degrees of developmental status in developed and emerging markets, this chapter of the study expounded on the subject matter from three pivotal dimensions of inquiry: (1) to determine ESG performance under different market regimes of bull and bear; (2) to determine ESG performance under different market blocs of emerging markets and developed markets; and (3) to determine how investor sentiments impact ESG performance in different market regimes (bull vs bear) and market blocs (emerging markets vs developed markets).

Regarding the return performance of ESG under different market conditions in different markets blocs of emerging and developed markets, the findings of the study in general established mixed outcomes. For instance, in bull market condition, the finding established that the emerging markets index outperformed the developed markets index. However, in a bearish market trend, the findings established that developed markets index performed better than the emerging markets index. This suggest that markets conditions and market characterizations play a pivotal role when considering the return performance of ESG markets. Conversely, regarding the volatility performance of ESG under different market conditions in different markets blocs of emerging and developed markets, the findings of the study in general established mixed outcomes. The findings of the study confirmed that in bull market condition, the developed market index as exhibited a higher volatility than the emerging market index. however, in bear market condition, it was established that the emerging market index exhibited higher volatility than the developed market index. whilst this further validates the effects of market conditions and characterizations, it is however interesting to note that despite the returns of emerging markets outperforming developed markets in the bull regime, the relative volatility was lower in the same regime compared to the developed markets.

Despite these findings, it is not clear the extent to whether the investor sentiment spur or moderate the persistence of volatility in the ESG returns. To address this concern, we employ a more robust conditional variance modelling approach in the following Chapter of this study to specifically determine the volatility dynamics of the ESG returns both from symmetric and asymmetric perspectives.

CHAPTER FOUR: EFFECT OF INVESTOR SENTIMENT ON VOLATILITY DYNAMICS OF THE ESG RETURNS IN EMERGING AND DEVELOPED MARKETS

4.1 Introduction

Stock returns volatility is a crucial facet within the realm of financial markets, embodying the degree of variation or dispersion of a security's price over a specific time period. Like stock returns, volatility represents an integral aspect in the understanding of asset performance. Volatility, which is typically measured by statistical metrics such as standard deviation or variance, reflects the assessment of potential risk and uncertainty. As underscored by numerous studies see (Black, 1976; Engle, 1982), understanding and effectively managing volatility is paramount for investors, portfolio managers, and policymakers alike. Notably, volatility serves as a key input in financial models and risk management strategies (Bollerslev, 1986), enabling market participants to gauge the potential variability in investment returns. Investors keen on maximizing returns while mitigating risk must navigate the intricate relationship between risk and reward, as elucidated by the Capital Asset Pricing Model (CAPM) and the Efficient Market Hypothesis (EMH) (Sharpe, 1964; Fama, 1970). Furthermore, the seminal work of Black and Scholes (1973) on option pricing has accentuated the integral role of volatility in financial derivatives markets. In this context, volatility performance becomes a critical determinant of investment success, influencing asset allocation decisions, hedging strategies, and overall portfolio optimization. The importance of volatility in investment decisions is further emphasized in empirical studies exploring its impact on asset prices, market dynamics, and investor behavior (Schwert, 1989; Andersen et al., 2003). These studies have further stressed that an in-depth comprehension of the nature of stock returns volatility in different market blocs is essential for market participants seeking to make informed and optimal investment decisions in an ever-evolving financial landscape.

The nature of volatility manifests distinct characteristics across diverse market blocs, with a discernible dichotomy between emerging and developed markets. Whilst emerging markets, characterized by evolving economic structures, varying levels of institutional development, and higher degrees of information asymmetry, often exhibit heightened levels of volatility compared to their developed counterparts (Erb and Harvey, 2006; Bekaert and Harvey, 1997). The inherent nature of risk in emerging markets stems from plausible factors such as political instability, currency fluctuations, and uneven regulatory frameworks, amplifying the potential for abrupt and pronounced market movements (Mohanty, 2013). On the other hand, it has been argued that developed markets, often benefitting from mature institutional infrastructures and greater regulatory stability, tend to experience lower levels of volatility. The divergence in volatility nature between these market blocs is integral for the discernment of investors, as it shapes the risk-return profiles of investment portfolios. Also, understanding the intricacies of volatility in different markets is imperative for crafting effective investment strategies, particularly in the context of globalized portfolios (Karolyi et al., 2012). This is because investors and other relevant stakeholders are required to navigate the nuances of volatility across various market regions, to optimize asset allocation, implement risk management strategies, and attain diversification benefits (Baker et al., 2020). Consequently, in the pursuit of optimizing investment decisions, it is none the wise to be aware of evolving investment styles such as ESG investments, and their unique nature of volatility in both emerging and developed markets, which may impact the risk-reward position of portfolios.

The burgeoning domain of Environmental, Social, and Governance (ESG) investing represents a paradigm shift in the investment landscape, with a growing emphasis on sustainable and socially responsible practices (Rau and Yu, 2023). As investors increasingly integrate ESG criteria into their decision-making processes, it becomes imperative to scrutinize the nature of volatility within the ESG market. The volatility in ESG markets exhibits subtle patterns, with distinctions observable between emerging and developed markets. In emerging markets, where regulatory frameworks and disclosure practices may be less robust, ESG volatility is often influenced by a confluence of factors, including political instability, social tensions, and environmental risks (Manaswi et al., 2023). Conversely, in developed markets, where ESG integration has become more institutionalized, volatility tends to be driven by factors such as corporate governance practices, regulatory changes, and shifts in consumer sentiment (Hong and Kacperczyk, 2009; Luo, 2022). Understanding the nature of ESG volatility in different markets is pivotal for investors and stakeholders seeking to align their portfolios with sustainable principles. This is because research suggests that companies with strong ESG performance demonstrate not only lower volatility but also enhanced long-term financial performance (Friede, 2019). Moreover, recognizing the varied dynamics of ESG volatility across markets enables investors and stakeholders to tailor their strategies, capitalize on potential opportunities, and contribute to the promotion of sustainable business practices globally. This strategic prowess could be further enhanced with an apt understanding of how investor sentiment shapes the nature of ESG volatility across these market blocs.

Thus, this chapter of the research study critically examines the nature of ESG funds volatility within and between different markets blocs of emerging and developed markets. Furthermore, this chapter of the study investigates the impact of investor sentiments on ESG volatility in emerging and developed ESG markets blocs. To effectively achieve this, the chapter sought to actualize the second set of research objectives highlighted in the chapter one of this dissertation, which were: (1) to determine and compare the nature of ESG volatility in emerging and developed markets considering for volatility stylized facts such as asymmetry, mean reversion, and persistence, (2) to determine and compare the impact of investor sentiments on ESG volatility in emerging and developed ESG markets. Using a variety of Generalized Autoregressive conditional Heteroskedasticity (GARCH) models, the study employed ESG index data and selected economic data over a sample period ranging 2011:01 to 2022:12. The rest of the chapter is outlined thus: Section 4.2, succinctly considers empirical studies and findings on the stylized volatility facts, the nature of volatility in emerging and developed markets as well as the link between volatility and investor sentiment. Additionally, relevant relative studies on the influence of ESG on volatility in several perspectives were explored. Section 4.3 provides in-depth clarifications and justifications on the methodology and estimation procedures adopted. Section 4.4, covers the results for the preliminary tests, data analysis as well as complementary discussions. Section 4.5, concludes the chapter, proffers recommendations and offers suggestions for future studies, amongst which are considered in the subsequent chapters.

4.2 Empirical studies on nature of ESG volatility

This section provides an overview of the potential reasons for the observed volatility patterns, as well as a review of the existing empirical research on the nature of volatility. Additionally, the section covers a comprehensive examination of studies conducted in both emerging and developed markets, with significant emphasis placed on the markets under investigation, methodologies adopted, duration of the research, as well as the findings and implications. Further exploring the possible link between volatility and investor sentiment, the study also considers relevant relative studies on the influence of ESG on volatility under various dimensions.

4.2.1 Stylized facts of volatility

Stylized facts refer to empirical findings or patterns in data that are often seen in diverse financial and economic time series. These factual statements encapsulate fundamental attributes of financial markets and economic events, hence serving as significant benchmarks or reference points for scholars and practitioners. Although stylized facts may not always embody universal truths, they provide useful insights into the behavior of financial and economic variables. In order to effectively represent and include the observed patterns in financial markets, Engle and Patton (2001) a robust volatility model should possess the capability to capture and accurately reflect these stylized realities.

i. Evidence of volatility persistence

Volatility persistence pertains to the tendency of financial market volatility to demonstrate clustering or persistence across a certain period (Onyele and Nwadike, 2021). In essence, it can be seen that periods characterized by elevated levels of volatility are often followed by subsequent times of heightened volatility, while periods characterized by diminished levels of volatility tend to be succeeded by subsequent periods of reduced volatility (Enow, 2023). The phenomenon of long memory, also known as long-range reliance, is often seen in financial time series. This suggests that shocks or events that occurred in the far past might have a persistent influence on asset values, resulting in a gradual decline in autocorrelations (Muguto and Muzindutsi, 2022).

The phenomena in question has been regularly recorded in academic literature. Engle and Bollerslev (1986) conducted a study that developed the ARCH (Autoregressive Conditional Heteroskedasticity) model, which subsequently emerged as a fundamental instrument for capturing and quantifying the phenomenon of volatility persistence. Bollerslev and Mikkelsen (1996) conducted a study which yielded findings indicating the presence of long memory in volatility. This implies that shocks to volatility possess the ability to persist over time. In a study conducted by Glosten et al. (1993), it was shown that historical data had a substantial influence on future volatility, suggesting the existence of a persistent pattern. The significance of incorporating volatility persistence models into risk management was underscored by Poon and Granger (2003). Andersen and Bollerslev (1998) conducted a study that provided more evidence on the enduring nature of volatility in financial data at high frequencies. Furthermore, the research conducted by Ding et al. (1993) developed the notion of GARCH models, which have since emerged as a pivotal instrument for comprehending and elucidating the persistence of volatility. Additional studies conducted by Christoffersen and Diebold (2006) have delved deeper into the dynamic characteristics of volatility persistence and its implications for the field of financial risk management. The aforementioned important research jointly emphasizes the persistent characteristic of volatility in financial markets, emphasizing its pivotal significance in evaluating risk, determining option prices, and managing portfolios.

ii. Evidence on shocks/innovations and volatility asymmetry

The phenomenon of volatility asymmetry, characterized by differing responses of volatility to positive and negative shocks, has been generally acknowledged as a possible outcome resulting from shocks or innovations in financial markets (Bhowmik and Wang, 2020). In the equities market, volatility asymmetry, leverage effect, and risk premium are interconnected phenomena that intensify during market stress. Volatility asymmetry, seen as a skew or smile in implied volatility, reflects the market's perception of heightened downside risk compared to upside potential. The leverage effect, which demonstrates the negative correlation between stock returns and subsequent changes in volatility, becomes more pronounced during market downturns, exacerbating risk perceptions (Kayral et al., 2020). This occurs when there is a decrease in the price of an asset, it is observed that the volatility of its returns tends to exhibit a greater increase compared to instances when the price of the asset increases (Onyele and Nwadike, 2021). Consequently, investors demand a higher risk (volatility) premium as compensation for holding equities, particularly during turbulent periods, whereby the implied volatility, which represents market expectations of future volatility, tends to be greater than the realized volatility, which reflects the actual historical volatility (Enow, 2023). This implies that investors often exhibit a willingness to pay a higher price in order to get protection from unfavorable price fluctuations.

This view is substantiated by a significant body of scholarly research. In their study, Giot and Laurent (2003) analyze commodities markets and observe that unanticipated shocks, especially those of a negative nature, have a tendency to elicit more significant escalations in volatility. In his seminal work, Nelson (1991) presents the GARCH model, which offers a framework for examining the heterogeneous reactions of volatility to diverse shocks, so establishing a fundamental basis for comprehending volatility asymmetry. In their seminal work, Ding et al. (1993) undertake an investigation into the phenomenon of long memory within the context of stock market returns. Their study sheds light on the role of unequal responses to shocks in shaping the observed patterns of volatility. The study conducted by Christensen and Prabhala (1998) examines the connection between implied and realized volatility, shedding light on how option markets might exhibit volatility asymmetry in reaction to different shocks. Bollerslev and Todorov (2011) examine the relationship between anxiety, risk premia, and their impact on financial markets. They demonstrate that these factors may result in uneven responses to shocks, particularly at the extreme ends of the return distribution. The scholarly references gathered together emphasize the empirical data and theoretical frameworks that substantiate the existence of volatility asymmetry as a reaction to shocks and innovations in financial markets.

iii. Evidence on volatility and mean reversion

The notion of mean reversion in finance posits that the prices or values of assets tend to converge towards their historical average or mean level as time progresses. In essence, this suggests that when the price or value of an asset strays much from its historical mean, there is a proclivity for it to return to that mean in subsequent periods. The phenomenon of mean reversion is often seen across many financial markets, with significant implications for trading techniques, risk management, and financial modeling. The mean-reverting characteristic of volatility in financial markets has been widely studied and is well-supported by academic research. The reversion of volatility to its historical mean has been empirically demonstrated by various research. For example, Bollerslev and Todorov (2011) observe a notable presence of mean reversion in volatility across diverse asset classes. This finding suggests that periods characterized by high volatility tend to be followed by periods of decreased volatility, and conversely. Bollerslev and Wooldridge (1992) provide empirical evidence that supports the concept of volatility mean reversion within the realm of financial asset returns. They emphasize the significance of previous levels of volatility in forecasting future volatility. In their study, Christensen and Prabhala (1998) investigate the correlation between implied and realized volatility. Their findings indicate that implied volatility tends to return to its historical average as time progresses, hence supporting the principle of mean reversion. Furthermore, the authors Cont and Da Fonseca (2002) examine the concept of mean reversion in implied volatility surfaces and highlight its economic importance in the context of option pricing. In this study, Alizadeh et al. (2002) examine the phenomenon of mean reversion of volatility in foreign currency markets, providing empirical data that is specifically relevant to this particular financial area. The scholarly sources provided collectively emphasize the often-observed tendency of volatility to return to its mean, and the significant implications this has for the management of risk and the pricing of derivatives.

iv. Evidence of volatility susceptible to external factors

Exogenous variables, as external determinants of financial market behavior, have a well-established influence on market volatility. Academic research has extensively explored the impact of various exogenous factors on volatility. For instance, economic indicators such as GDP growth, inflation, and interest rates have been linked to changes in market volatility (Engle and Ng, 1993; Andersen et al., 2003) . Geopolitical events, such as elections and conflicts, have demonstrated significant effects on volatility (Bekaert and Hoerova, 2014). Studies have also highlighted the role of corporate earnings announcements in influencing volatility (Ederington, 1979). Monetary policy decisions by central banks, including interest rate changes, have been shown to impact market volatility (Gürkaynak et al., 2007). Additionally, market sentiment, often driven by news and social media, can swiftly alter volatility levels (Da et al., 2011). These academic references underscore the diverse range of exogenous variables and their significant influence on financial market volatility.

The impact of exogenous variables, which refer to external events or shocks, on volatility in financial markets has been extensively acknowledged and substantiated by a substantial body of scholarly literature. Bekaert and Hodrick (1993) conducted a study to investigate the influence of macroeconomic variables, namely interest rates and inflation, on stock market volatility as exogenous factors. The significance of incorporating exogenous factors, such as economic indicators and news events, into volatility forecasting and management was underscored by (Poon and Granger, 2003). The study conducted by Caporin and McAleer (2012) examined the impact of exogenous factors on volatility forecasting models, with a specific focus on their relevance in estimating Value-at-Risk (VaR). In addition, the study conducted by Ross (1989) examined the impact of foreign currency interventions carried out by central banks as external occurrences that have an effect on the volatility of exchange rates. Tse and Tsui (2002) conducted a study to examine the role of exogenous variables, such as economic shocks and political events, on volatility in Asian stock markets. Their research emphasized the significant impact of these factors on market volatility. The academic literature emphasizes the crucial impact of exogenous factors on financial market volatility and highlights the need of integrating them into modeling and risk management methodologies.

V. Evidence of volatility is characterized by fat tails

The presence of fat-tailed behavior is commonly seen in financial markets, whereby volatility exhibits a tendency to experience severe occurrences at a higher frequency than what would be anticipated under a normal distribution. It is often observed that asset returns typically have fat-tailed distributions, indicating a higher occurrence of extreme events, both positive and negative, compared to what would be anticipated under a normal distribution. This observation suggests that infrequent but substantial market collapses or big price spikes occur with more frequency than anticipated by conventional models. The empirical phenomena in question has been regularly established in academic study. Mandelbrot and Mandelbrot (1997) established the notion of fractal geometry as a means to characterize price fluctuations and emphasized the existence of fat tails in financial time series. Lux (1996) presented empirical findings that support the existence of fat tails in stock returns and proposed that this phenomenon is an inherent characteristic of financial markets. Moreover, Cont (2001) investigated the distribution of returns on financial assets and discovered substantial evidence in favor of fat tails, therefore highlighting the significance of these findings for the fields of risk management and modeling. Morone (2008) asserts that both the amount and quality of information have an influence on the occurrence of volatility clustering and the establishment of fat tail returns. In their study, McNeil and Frey (2000) examined the importance of fat tails in the modeling of extreme events, particularly in relation to the calculation of value-at-risk (VaR). this was corroborated by Kirchler and Huber (2009), who observed that instances of heightened volatility are seen subsequent to the introduction of novel information, and those without pertinent knowledge have a greater contribution to the occurrence of extreme market events compared to individuals possessing educated insights.

Discernible differences exist in the fat tail distributions of emerging and developing markets. According to Ibragimov and Khamidov (2010), developing foreign currency markets have lower tail indices in comparison to industrialized nations, suggesting a heightened vulnerability to severe shocks. The discovery is confirmed by Stoyanov et al. (2017), who demonstrates that both established and developing equities market indexes have exponential tails. In the study conducted by Straetmans and Candelon (2013), it was shown that there is no substantial difference in the tail behavior of developing stock markets compared to established markets. However, it was observed that emerging currencies are more susceptible to experiencing fluctuations in tail behavior.

4.2.2 Empirical evidence on volatility in emerging markets

Over the years several studies have been intrigued and have sought to understand the nature of volatility in emerging markets. This section of the research study offers an exhaustive review of some critical studies that have empirically contributed to the current knowledge on volatility in emerging markets. A timeline approach of this studies is provided thus:

4.2.2.1 The 1990s empirical evidence on volatility in emerging markets

Commencing with studies carried out in the 1990s, an early study conducted in the 1990s by Choudhry (1996) examined the volatility, risk premia, and persistence of volatility in six emerging stock markets, pre and post the 1987 stock market crash. Focusing on gaining insights from the impact of the meltdown on the selected markets, the study analysed monthly data of Argentina, Greece, India, Mexico, Thailand, and Zimbabwe from January 1976 to August 1994 using the GARCH in the mean model (GARCH-M). Findings indicate significant variations in the ARCH parameter, risk premia, and volatility persistence during the 1987 crisis. Further expanding on this investigation, Bekaert and Harvey (1997) highlighted the need of comprehending volatility in emerging markets in order to ascertain the cost of capital and provide guidance for investment choices. Their work presented a method that evaluates the changing significance of global and local information in predicting future returns and conditional volatility. The results suggested that whilst capital market liberalizations often increase the link between local and global market returns, they do not inevitably amplify emerging market volatility. De Santis (1997) investigated the relationship between anticipated stock returns and volatility in emerging financial markets including Brazil, India and China. The research revealed the presence of clustering, predictability, and persistence in conditional volatility, similar to that seen in developed markets. However, unlike developed markets, it was further observed that emerging markets, exhibited elevated conditional volatility and an increased likelihood of significant price fluctuations. In addition to this, it was noted that exposure to country-specific risk was not rewarded with commensurate returns. Offering more intricacies on the characteristics of volatility in developing markets such as Brazil and India, Aggarwal et al. (1999) discovered that high volatility is not a continuous occurrence, but rather characterized by different and sudden disruptions. Noting a correlation between the volatility of individual market returns and the dollar adjusted returns, the researchers also found that the conditional variance differs among countries within the emerging markets bloc.

4.2.2.2 The 2000s empirical evidence on volatility in emerging markets

Considering for research works in the 2000s, we commence with Rashid Sabri (2004)'s exploration of stock return volatility in emerging economies across South Africa, Mexico, Korea, Turkey, and Malaysia, which provided a foundation for understanding market dynamics during crisis periods. Using monthly data, the research identified key predictors of increased price volatility, with stock trading volume and currency exchange rates emerging as pivotal variables. In a parallel study, Shin (2005) delved into the intricate relationship between risk and return within emerging markets, employing both parametric and semiparametric GARCH-M models. The revelations of the study further reinforced the existing body of literature, highlighting the persistence of a positive relationship. This is in consistency with prior research, including works by Baillie and DeGennaro (1990), Choudhry (1996), and De Santis (1997), reaffirmed the existence of a relatively weak link between risk and return within these markets.

Using multivariate GARCH models that incorporates volatility asymmetry, persistence, and time-varying conditions, Ho (2006) evaluated the volatility dynamics of Shanghai A- and B-shares, Shenzhen A- and B-shares, Taiwan, and Hong Kong stock markets in greater China. Notably, findings of the study observed that whilst there is strong evidence of volatility persistence across all the markets, the B-share markets did not exhibit the significant asymmetric volatility, also known as the "leverage effect." Likewise, by challenging the time-varying risk premium theory in most markets Karmakar (2007) highlighted the importance of considering asymmetry and time-varying volatility dynamics in developed and emerging stock markets. The study which adopted both symmetric and asymmetric GARCH models, uncovered a high degree of persistence in conditional variance across all markets, indicating a robust characteristic of return-generating processes. Additionally, the presence of an asymmetric relationship between past innovation and volatility, also suggested the presence of leverage effect. The study of Daal et al. (2007) considered the use of asymmetric GARCH-Jump models to effectively capture unique features of return dynamics in emerging markets such as Brazil and India. Whilst it was noted that these models were more suitable for exploring equity return dynamics, the models observed that the emerging markets exhibited increased volatility persistence, fatter tails, reduced asymmetries and significant effects from the jump component. Arora et al. (2009) asserts that emerging markets showcased higher mean return-to-volatility ratio compared to developed markets. This was found in a comparative study conducted between emerging and developed stock markets across different frequency measures from daily to annual between January 1, 2002, and December 31, 2006. However, further findings revealed that the return distributions in the emerging markets defied normality, revealing clustering of return volatility. Also, whilst the GARCH (1, 1) specification proved sufficient in most cases, the presence of the leverage effect in volatility behavior was inconsistent, depending on the measure of frequency of stock return data. Delving into the sudden changes of volatility in the stock markets of the BRIC countries, Kasman (2009) utilized the iterated cumulative sums of squares algorithm to examine the impacts of these changes on the persistence of volatility. Notably, accounting for endogenously determined sudden shifts in variance in the GARCH model significantly reduced the estimated persistence in return volatility. This nuanced insight challenges previous findings, suggesting a potential overestimation of the degree of volatility persistence in financial time series

4.2.2.3 The 2010s empirical evidence on volatility in emerging markets

Considering for studies in the 2010s, Samer A. M. Al-Rjoub (2010) conducted a study on emerging Arab markets to understand the complex connection between stock market returns and volatility. Using the GARCH in mean, Exponential GARCH, and GARCH/E-GARCH models, the research covered the period from 1990 to 2002. Findings revealed a strong and positive relationship between current returns and volatilities in majority of the markets. In addition to this, volatility persistence and sudden changes in volatility were found across the markets. In a similar vein, Trivedi (2013) asserted that asymmetric GARCH models provided enhanced explanations for returns and volatility clustering in BRIC emerging markets as compared to simple GARCH models. This assertion was further backed by the study of Tripathy and Garg (2013), who observed a significant rise in the volatility of Brazilian market after negative shocks. Testing several GARCH models such as ARCH, GARCH, GARCH-M, EGARCH, and TGARCH, the authors found that asymmetric GARCH models have shown strong evidence of asymmetry in stock returns, suggesting the existence of a leverage impact. Moreover, an examination on the stock prices of BRICS markets by Romero and Kasibhatla (2013) highlighted that the volatility term structure if emerging markets exhibited a consistent mean-reverting behavior across several markets, indicating a common trait. Consistent with the findings of Samer A. M. Al-Rjoub (2010) and Trivedi (2013), Coffie and Chukwulobelu (2014) also found a consistent presence of volatility in emerging African markets, highlighting the presence of risk associated with volatility.

Furthering the investigation on volatility persistence, Muhammad and Shuguang (2015) examined how structural break points impact the persistence of variation in asymmetric GARCH models in seven emerging markets. Employing EGARCH and T-GARCH models, the study revealed a reduction in variance persistency when considering regime shifts, challenging traditional modeling assumptions. Whilst estimating asymmetric GARCH models with endogenous break dummies in selected emerging markets, Uyaebo et al. (2015) noted differences in volatility reactions to market shocks and the existence of the leverage effect across the different emerging markets. The study suggested that emerging stock markets could moderate their fast response to market fluctuations through improvements in market infrastructure, instrument quality, and regulatory practices. The uniqueness of individual markets was further stressed in the study of Morawakage (2015) which concluded that the relationship between volatility and risk premium was not significant according to the GARCH-M model, implying possible nuances in the risk-return dynamics of emerging markets. This is despite the presence of significant volatility clustering, leverage effects, and nonlinear effects in the markets.

Investigating the correlation between stock returns and volatility in South Africa and China, using a GARCH model, Cheteni (2016) found high volatility in both markets, with a persistent and similar movement in returns. The research findings confirm the trajectory of similarity in the movements of both markets. Testing short run and long run relationships from a broader dimension of BRICS markets, Tripathy (2017) uncovered asymmetric and leverage effects in all BRIC markets, emphasizing varying patterns of long-run and short-run volatility components. Focusing on just South African market. Rupande et al. (2019) examined volatility persistence and leverage effects in the "rainbow nation", specifically investigating the connection between investor sentiment and stock returns. The research emphasized that the GJR-GARCH-M model is most suitable for modeling volatility of the South African stock market. Using the sentiment-augmented GJR-GARCH-M model, the findings further asserted that there is a significant relationship between investor sentiment and stock returns.

4.2.2.4 The 2020s Empirical evidence on volatility in emerging markets

A review of relevant studies on volatility of emerging markets in the 2020s begins with the study of Mukhodobwane et al. (2020) which explored the volatility modeling of BRICs stock markets. Employing univariate GARCH models with different error distributions, the study found that each market's volatility is characterized by various distributions, highlighting the intricate nature of their dynamics. It was further that volatility persistence pattern in various markets differs according to different assumptions, highlighting the need of customized modeling methodologies. Extending the study of volatility of emerging markets with a peculiar reference to the impact of the 2008 global financial crisis, Kayral et al. (2020) revealed the prevalence of larger effects from negative shocks than positive ones, underscoring the asymmetry in emerging stock markets. Likewise the research investigation of Akkaya (2021) focuses on the analysis of volatility spread in emerging markets, using EGARCH models. The study identified a negative and statistically significant asymmetric effect across various countries, except China, highlights the prevalence of leverage effects. Further noting that volatility spread analysis among different markets, explains the interconnectedness of global markets. With a particular focus on the Indian stock market, Ali et al. (2022) specifically investigates volatility predictions using GARCH and FIGARCH models. The research reveals the presence of long-lasting volatility, highlighting the greater influence of negative news on stock market volatility. More recently, the study of Muguto and Muzindutsi (2022) conducted a comparative examination of developed (G7) markets and emerging (BRICS) markets understand the nature of stock return volatility. The analysis revealed evidence of volatility persistence, asymmetry, mean reversion, and a weak risk premium in both market blocs. It was further noted that the considerable disparities within each group undermine generalizations about the efficacy of developed versus emerging markets.

4.2.3 Volatility in developed markets

4.2.3.1 Essential studies on Volatility in developed markets before the 1990s

Early seminal works have collectively contributed to the understanding of volatility and its implications for stock dynamics in developed markets. Beginning with the study of Poterba and Summers (1984) which challenged the idea of persistent volatility, while French et al. (1987)

established connections between expected risk premiums and volatility. The study of Chou (1988) further adds depth to the discourse by estimating risk aversion whilst exploring changing equity premiums. The research conducted by Poterba and Summers (1984) examined the possible impact of changing volatility in stock market prices on the overall level of stock market prices. The results of the investigation questioned the notion of volatility persistence in developed markets, as it was observed that volatility has a weak serial correlated. Whilst this suggests that shocks to volatility do not persist over time, it was consequently noted that impact of these shocks on stock market prices is limited, given that changes in volatility affect expected required rates of return for relatively short intervals. Extending this discourse, French et al. (1987) explored the relationship between stock returns and stock volatility in developed markets. Investigating whether the expected market risk premium is related to the predictable volatility of stock returns, the findings reveal a positive correlation between the expected market risk premium and the predictable volatility of stock returns. Additionally, the study uncovers evidence suggesting that unexpected stock market returns are negatively related to the unexpected change in the volatility of stock returns. It was further observed that the negative association indirectly supports the idea of a positive connection between expected risk premiums and volatility. Contributing to the discussion on the persistence of volatility and the changing risk premium in the stock market by using the GARCH estimate approach, Chou (1988) investigated the presence of changing equity premiums in the United States between 1962 and 1985 via estimating the index of relative risk aversion. The outcome of the inquiry confirms the presence of changing equity premiums during the specified timeframe. More notably, the study emphasizes the high persistence of shocks to stock return volatility, leading to the conclusion that the data does not reject a non-stationary volatility process specification

4.2.3.2 Essential studies on volatility in developed markets during the 1990s

Taking in to account the studies carried out in the 1990s, in a critical assessment of the limitations of GARCH models in the context of asset pricing applications, Nelson (1991) highlights three major drawbacks of GARCH models, Firstly, these models contradict the results that suggest a negative relationship between present returns and future returns volatility. Secondly, the use of parameter restrictions in GARCH models often results in violated estimated coefficients, restricting the conditional variance process. Lastly, it is difficult to explain/interpret the persistence of shocks to conditional variance in GARCH models as typical indicators of persistence often provide contradictory outcomes. To mitigate against these drawbacks, the author proposed a new form of ARCH and employs it to estimate a model of the risk premium on the CRSP Value-Weighted Market Index from 1962 to 1987. Glosten et al. (1993) further contributed to the existing body of knowledge by examining the link between the anticipated monthly return based on certain conditions and the volatility of monthly return using a modified GARCH-M model. Herein, the authors explored seasonal fluctuations in volatility, distinct effects of positive and negative innovations on conditional volatility, as well as using nominal interest rates as predictors of conditional variance. Contrary to conventional notions, results of the inquiry observed a negative correlation between the projected monthly return and the variance. Additionally, the research highlights that monthly conditional volatility may not exhibit the same level of persistence as previously thought. This provides valuable insights into how volatility reacts to unexpected returns in a dynamic manner. The seminal study of Engle and Ng (1993) introduced the news impact curve, which provides valuable insights into the influence of new information on volatility estimations. This curve serves as a measure to assess how newly acquired information is considered when estimating volatility. Using daily Japanese stock return data, the research compared and estimated several ARCH models, including a largely nonparametric model. Further introducing diagnostic testing to detect the unevenness of volatility reactions to news, the study found that the model developed by Glosten, Jagannathan, and Runkle is the most superior parametric model. More so, it was observed that the EGARCH model effectively captures a substantial amount of the asymmetry. However, further evidence indicated an unnecessarily elevated level of variability in the conditional variance as predicted by the EGARCH model. In another ground breaking study, Hamilton and Susmel (1994) suggested a sophisticated approach to tackling the difficulties of attributing long-lasting effects to stock market volatility, considering the influence of severe unexpected events such as the October 1987 crisis. Presenting a new model that allows the parameters of an ARCH process to change in distinct states, with the transitions between states controlled by an unobserved Markov chain, this model investigates hidden innovations derived from Gaussian and Student t distributions. As a major contribution, this study offers a nuanced viewpoint on modeling volatility by recognizing that very big shocks may have different origins and effects on future volatility compared to tiny shocks. Hence, estimating regimes and transitions improves the capacity to comprehend the intricacies of financial market dynamics.

4.2.3.3 Essential studies on volatility in developed markets during the 2000s

Relevant studies in the 2000s have considered the dynamic spread of volatility throughout global stock markets (Polasek and Ren, 1999), the correlation between conditional covariance and market behavior Dean and Faff (2001), how crises impact patterns of asymmetry and persistence in the market (Patev, 2004), mean reversion of returns in short horizons (Nam et al., 2006) and nature of volatility in emerging and developed markets (Karmakar, 2007).

Addressing the increased transmission of volatility that was noticed in global stock markets after the Asia crisis of 1997, the research of Polasek and Ren (1999) analyzed the daily fluctuations in stock returns in the financial markets of New York, Germany, and Japan over a period of two years, starting from June 21st, 1996, and ending on June 22nd, 1998. Using a VAR-GARCH in mean model to examine the impact of multivariate volatility, the researchers sought to determine whether the volatility of stock returns influences the returns. The analysis, using Markov Chain Monte Carlo (MCMC) techniques, revealed a complex transmission pattern across the stock markets, characterized by dynamic fluctuations occurring both before and during the Asia crisis. Likewise, investigating the potential asymmetry in the conditional covariance between stock and market returns in reaction to positive and negative news, Dean and Faff (2001) examined the relationship between time-varying risk premiums and conditional covariance to provide a clear explanation for empirical facts such as the mean reversion of stock prices and asymmetric volatility. Whilst prior studies have mostly examined time-varying betas, the researchers argued that covariance asymmetry offers a more effective approach for understanding observed behavior of returns. Using a conditional covariance model which incorporated both the direction and size of changes in returns. The study discovered a considerable asymmetry in covariance, which might partially explain the tendency of stock prices to revert to their mean and the feedback effect on volatility.

Examining the nature of stock market volatility in Central Europe, Patev (2004) analyzed the Central European Stock Index from April 30, 1996 to May 31, 2002, in three distinct time periods - the period before the crisis, the period during the crisis, and the period after the crisis. Using a both symmetric and asymmetric GARCH models, for in-sample and out-of-sample forecasting purposes. Findings of the study suggests the presence of autocorrelation, with the autoregressive process being associated with both nonsynchronous trading and an asymmetric reaction to positive and negative news. Also, a significant leverage effect and persistence in volatility was found across all periods, with an increase in asymmetry during crises periods. Additionally, it was noted that during a financial crisis, the negative return shocks exhibit more volatility compared to positive return shocks, and an asymmetric GARCH model with non-normal residuals effectively captures the key volatility features of Central European stock markets, Nam et al. (2006) inquired on the presence of nonlinearity in short-term return patterns, which are characterized by an asymmetric mean-reverting tendency. Investigating on the behavior of market indexes and individual stocks over a span of forty years, the research identified a significant asymmetric mean reversion on a daily and weekly basis, whereby returns that are negative revert faster with a greater reverting magnitude than returns that are positive. Further expounding on the discourse of volatility, Karmakar (2007) observed that despite differences in market behaviors in emerging and developed countries, there remains a high level of conditional variance persistence in all markets regardless of blocs. This was found in an evaluation of stock volatility in emerging and developed countries based on daily data analyzed using both symmetric and asymmetric GARCH models.

4.2.3.4 Essential studies on volatility in developed markets during the 2010s

Looking into relevant studies done in 2010s, Chkili et al. (2012) contribute to the understanding of stock returns and exchange rates by employing univariate and multivariate GARCH-type models. Focusing on three European stock markets and two US dollar exchange rates, the study reveals evidence of asymmetry and long memory in conditional variances. In multivariate settings, the bilateral relationships between stock and foreign exchange markets are found to be highly significant for France and Germany. The study introduces the univariate FIAPARCH and bivariate CCC-FIAPARCH models, demonstrating their superior in-sample estimates and out-of-sample forecast accuracy. Additionally, the research supports the FIAPARCH model's suitability for forecasting portfolio market risk exposure and highlights diversification benefits between stock and foreign exchange markets. Likewise, the study of Hassan (2017) interrogated the changes in volatility patterns for DJIA, DAX, and FTSE between 2008 and 2015. The study which investigated the impact of external shocks on the persistence of volatility, utilized the Iterated Cumulative Sums of Squares (ICSS) algorithm to detect abrupt shifts in volatility, hence questioning the prevailing notion of enduring high volatility. The findings indicate that the combination of regime changes with a GARCH model effectively decreases the level of volatility persistence.

Assessing the daily volatility and persistence in European and US financial markets throughout the period from March 2013 to January 2017, Duță (2018) utilized the GARCH (1,1) and GARCH-M (1,1) models to evaluate the volatility performance of fourteen stock indices in Europe and the United States. Whilst the GARCH (1,1) model was found to be suitable in modeling the volatility of most markets, the GARCH-M (1,1) model evidenced a positive correlation between assumed risk and future returns in only American, British, Romanian and the Hungarian markets. Additionally, it was further noted that the US index (S&P500), has the most significant correlation with the Romanian stock indexes (BET and BET-BK). In an attempt to capture high volatility persistence, Borup and Jakobsen (2019) proposed a dynamic Realized Exponential GARCH model (REGARCH). As an extension which decomposed the conditional variance into short and long terms, the model was tested on an exchange traded fund which tracks the S&P500index and 20 stocks. The model evidenced an empirical fitness and suitability in capturing volatility dependencies.

4.2.3.5 Essential studies on volatility in developed markets during in the decade of 2020s

Reviewing studies conducted in the 2020s, Spulbar et al. (2020) undertook a comprehensive analysis to explore volatility spillover effects, past volatility impact on current market movements, and reactions to positive and negative news across various financial markets. Investigating both developed and emerging stock markets from different continents, the study employed symmetric and asymmetric GARCH models to capture the complexities of volatility clustering, interdependence, correlations, financial integration, and leptokurtosis. The findings revealed that all selected financial markets exhibit high volatility, indicating the presence of a leverage effect. Notably, the stock markets in Hungary, the USA, Germany, India, and Canada showed elevated positive volatility after the global financial crisis.

Focusing on Nasdaq-100 stocks, Aliyev et al. (2020) employed univariate asymmetric GARCH models, including EGARCH and GJR-GARCH to model and estimate the volatility of technology, innovative and non-financial stocks. The research study which spanned from January 2000 to March 2019, uncovered persistent volatility shocks with an asymmetric impact, where negative shocks have a greater influence on volatility than positive shocks of the same magnitude. The financial implication for investors is that the Nasdaq-100 index exhibits clustering volatility, enabling strategic positioning based on the nature of these stocks. The study of Thampanya and Pornpikul (2020) contributed to empirical evidence by evaluating volatility persistence and asymmetry in stock returns within the ASEAN-5 countries across different market phases. The study finds evidence of asymmetry in both bull and bear markets, with negative shocks inducing higher volatility than positive shocks. The results emphasize the importance of monitoring stock markets, especially during downturns, to mitigate risks and their impact on the financial system.

Further expanding the discourse, Onyele and Nwadike (2021) extend the exploration of stock returns volatility to the global level, focusing on the S&P Global 1200 index. Using GARCH techniques, the study identifies explosive volatility persistence and a strong asymmetric news effect, particularly during the COVID-19 crisis in 2020. The findings underscore the influence of news on global stock market volatility and its potential implications for risk management.

Likewise, Oredegbe and Abioye (2022) broaden the scope by investigating the volatility of stock market indices in both high-income and middle-income economies. Employing GARCH model, the research found evidence of long memory and mean reversion in volatility, suggesting its persistence but eventual return to a mean level. The study also reveals that both latest news and prior information about volatility influence volatility, with prior information exerting a greater influence. The research offers a deeper understanding of stock market volatility in different economic contexts.

The inquiry of Enow (2023) delves into the long-term behavior of stock markets, emphasizing the importance of volatility persistence in influencing security price valuations. Using GARCH and Markov switching models, the study predicts that volatility will persist in various markets, influencing expected returns over an extended period. This suggests a need for diversified and broader investment approaches to mitigate risk across different indexes

More recently, Osabuohien-Irabor (2023) also attempted to improve on traditional GARCH model by integrating the Iterated Cumulative Sums of Squares (ICSS) algorithm into the multivariate BEKKGARCH model, thereby effectively capturing changes in variance. Focusing on major European capital markets, findings of the study revealed that detected changes correspond to both global and domestic events. This further emphasizes the importance of considering sudden changes in variance and controlling for volatility changes to produce more accurate estimates of volatility persistence.

4.2.4 Empirical evidence on volatility and Investor sentiment

The financial markets are inextricably linked to several elements, and a limited amount of relevant research studies have empirically examined the relationship between ESG volatility and investor sentiment. Using an aggregate investor sentiment index, the study of Kumari and Mahakud (2015) employed VAR-GARCH models to test whether investor sentiment predicts volatility in the Indian stock market. The study found that investor sentiment significantly impacts volatility of emerging stock markets such as India. More particularly, the study evidenced a connection between negative investor sentiment and increased volatility, revealing the influence of sentiment as a possible cause of market instability. The study of Shahzad et al. (2017) examined the causal effect of investor sentiment and economic policy uncertainty on commodity markets volatility, using news -based measures as well as bullish and bearish investor sentiments. The findings of the study suggested that investor sentiment has a superior significant impact on commodity markets compared to economic uncertainty. Hanna et al. (2020) proposed that the emotion sent by the financial media, particularly Financial Times news, as measured by the tone of the news reporting, has an impact on the trading volume specifically during bullish market conditions. Results of the investigation supports the idea that noise traders have a significant impact on fueling speculative booms, hence affirm the presence of herd behaviors in stock markets. Using a Markov Switching Vector Autoregressive (MS-VAR) model, Sosa et al. (2022) comparatively analysed the impact of macro-economic sentiments such as oil and exchange rates on the volatility of sustainable index in Mexico under different market conditions. The research findings evidenced that whilst sustainable investments are not influenced by oil prices, a significant influence was uncovered by exchange rates and the US stock markets in bearish market period. Remarkably, the study of Dhasmana et al. (2023) found that ESG index is not affected by investor sentiment implying that investors show a certain level of apathy towards ESG initiatives adopted by companies. This was based on an investigation into the relationship between the ESG index and investor sentiment in India. Further finding uncovers an imbalanced link, demonstrating that the surge in the ESG index diminishes investor sentiment, whereas underperformance in the ESG index triggers sentiment. The research conducted by Sabbaghi (2023) assessed the effect of positive and negative news on volatility risk for ESG businesses with high ratings, using multivariate DCC-EGARCH modeling using the Morgan Stanley Capital International (MSCI) ESG Leader indexes. The results shed light on a complex situation, revealing that bad news has a greater effect on the volatility of high ESG-rated enterprises in developing markets compared to good news. This highlights a clear imbalance in the reaction to news events.

Rupande et al. (2019) delve into the intricate relationship between investor sentiment and stock return volatility, challenging the conventional assumption of rationality in financial markets. The study introduces the hypothesis that volatility, specifically linked to sentiment-driven noise trader activity, plays a significant role in altering the risk distribution of financial assets. This departure from traditional financial theory is examined through the construction of a daily sentiment composite index and the application of Generalized Autoregressive Conditional Heteroscedasticity (GARCH) models on the South African market. The findings unveil a significant connection between investor sentiment and stock return volatility, suggesting that behavioral finance can offer valuable insights into the behavior of stock returns on the Johannesburg Stock Exchange. Consequently, the study advocates for a reevaluation of prevailing asset pricing models, notably the Capital Asset Pricing Model, by incorporating sentiment as a relevant risk factor.

Muzindutsi et al. (2023) extend the exploration of the influence of investor sentiment, specifically focusing on the housing market. The study aims to fill a gap in the literature by investigating the time-varying effect of investor sentiment on housing prices, an aspect often overshadowed by macroeconomic and country risk considerations. Employing GARCH, GJR-GARCH, E-GARCH, and Markov-switching VAR models, the research uncovers significant findings regarding the influence of investor sentiment on housing properties' returns and conditional volatility under different market conditions. Notably, positive changes in investor sentiment lead to increased property returns and decreased conditional volatility. The study identifies investor sentiment as a crucial driver of the risk premium in property returns, with varying impacts across different segments of the housing market. This nuanced understanding suggests that investor sentiment can be a potent force in shaping real estate market dynamics, particularly influencing mass investor redemption actions during uncertain conditions.

4.2.5 Empirical evidence on the ESG factor and volatility

An increasing number of recent studies have investigated the volatility of ESG compliant companies. Commencing with the study of Ashwin Kumar et al. (2016), it was noted that ESG companies show lower volatility in their stock performances compared to their peers. Likewise, Jakobsson and Lundberg (2018) observed that there is a statistically significant negative relationship between high ESG/CSR performance and share price volatility. Similarly, the research finding of Xu (2023) asserts that corporate ESG performance can significantly reduce stock price volatility. In addition, with regards to ESG volatility during crises periods, studies such as Moalla and Dammak (2023) discovered that strong ESG performance reduces stock price volatility resulting from the COVID-19 shock and promotes resilience and stock price stability. In a like manner, Zhou and Zhou (2021) emphasized that good ESG performance helps reduce the increase in stock price volatility due to COVID-19 shock. However, the investigation of Sabbaghi (2022) suggests that bad news has a larger impact on the volatility of ESG firms compared to good news. This was also corroborated by the study of Sandu (2023) which found that companies with better ESG performance face higher stock return volatility. In parallel to this , Yu et al. (2022) revealed that ESG-related stocks cannot bring excess returns during crisis, despite exhibiting a better risk performance during a normal period.

Another cohort of recent studies have inquired on the relationship between ESG ratings and volatility. The research investigation of Czerwińska and Kaźmierkiewicz (2015) found that shares issued by companies with higher ESG rating were distinguished by an over-average return rate and lower return rate volatility. This was similar to the observations of de Marco and van Vuuren (2022) that companies with higher relative ESG combined scores exhibit lower levels of weekly volatility. The study conducted by Reber et al. (2022) focuses on IPOs and demonstrates that voluntary ESG disclosure reduces idiosyncratic volatility and downside tail risk, while higher ESG ratings are associated with lower firm-specific volatility and downside tail risk in the aftermarket. Also, the study of Zhang et al. (2021a) explored the connection between ESG ratings and implied tail risk, finding that higher ESG-rated companies tend to have lower implied volatility but exhibit more negative implied skewness and higher implied kurtosis, indicating higher negative tail risk..

Considering for market states, specifically in a bear market period, Engelhardt et al. (2021) noted that high ESG-rated firms in Europe had higher abnormal returns and lower stock volatility during the COVID-19 crisis, with the social score being the main driver of these results. Likewise, the study of Zarafat et al. (2022) suggested that higher ESG ratings are associated with reduced asymmetry behavior in volatility, but this relationship varied before and after the COVID-19 pandemic. This was further affirmed in another research inquiry conducted by Ford et al. (2022) which observed that firms with higher ESG ratings garner more optimistic sentiment due to their perceived "safety" and the potential increased optimism of analysts.

Howbeit, unlike the prior studies, the research of Eratalay and Cortés Ángel (2022) evidenced that although maintaining a high ESG ratings may reduce systemic risk contribution and exposure, this was found applicable to only firms with high ESG ratings of up to 7.3% less systemic risk compared to lower-rated firms. This was further confirmed in another study by Eratalay and Cortés Ángel (2022) which noted that higher ESG ratings are linked to lower systemic risk contribution and exposure among European blue-chip firms during the COVID-19 period. The study further found the social and governance factors to have significant impacts on systemic risk. Regardless, Lopez et al. (2020) propose the standardization of ESG factors as a solution to address discrepancies across rating providers.

Another cohort of recent studies have inquired on the performance of ESG portfolios from a risk perspective. In their analysis of ESG-styled portfolios, Moreira and Muir (2017) discover that portfolios that adapt risk levels according to market volatility result in substantial improvements in utility. This assertion is in agreement with the research assertions of Bennani et al. (2018), which found that ESG investing has been financially beneficial since 2014, with little effect on the volatility of investments and the management of losses. More evidently, Ouchen (2022) found that an ESG portfolio exhibits lower volatility in comparison to a market benchmark portfolio. This is consistent with the study of Bhattacharjee and De (2022) which discovered that ESG equities investments have higher systematic risk exposure in emerging markets.

From a more technical dimension, the study of Hanna (2020) suggests that imposing ESG industry restrictions on minimum-volatility portfolios does not significantly impact variance and Sharpe ratios. This was exemplified in the study of Lee et al. (2021) which emphasized that high-ESG-rated portfolios consistently provide superior outperformance, diversification efficiencies, and lower overall risk compared to low-ESG-rated portfolios. Further confirming this, Schmidt (2022) noted that portfolios with higher portfolio ESG value (PESGVs) yield more concentrated portfolios and lower Sharpe ratios.

With reference to the COVID-19 crisis, the study conducted by Singh et al. (2021b) reveals that the pandemic has not had a statistically significant impact on the return and volatility of the Bombay Stock Exchange ESG index. In fact, the research of Pisani and Russo (2021) revealed that funds with superior ESG ratings had superior performance relative to their counterparts within the COVID-19 crisis, showcasing enhanced resilience and reduced risk contagion. However, according to Jones (2022), the COVID-19 pandemic had a lesser effect on the ESG index compared to the conventional index. The finding showed that while both the ESG and conventional indices experienced increased volatility during the crisis, the impact on the ESG index was significantly less than that of the conventional index. This conclusion is in line with the research of Albuquerque et al. (2021), who emphasize that ESG funds traded in a manner that helped stabilize the market for ESG equities. Likewise, the research of Cerqueti et al. (2021) observed that high ESG rated funds incur less relative market value decline compared to low ESG ranked funds when volatility is low. This observation was later confirmed by Döttling and Kim (2022) who noted that high-ESG funds received higher than average fund flows during normal times during the crisis.

In summary, the aforementioned studies highlight the evolving research niche of environmental, social, and governance (ESG) factors and volatility, as it offers a detailed exposition of how ESG performance, ratings, and portfolio dynamics are interconnected. Whilst some existing empirical evidence suggest that ESG factors might help reduce volatility, others emphasize that this impact depends on other factors, such as market circumstances and the particular time period being analyzed.

4.2.6 Gaps in empirical studies on ESG volatility and investor sentiments

Hitherto, several existing studies on volatility have mainly focused on traditional stock market volatility, regardless of screenings for style investing- specifically sustainability screens. Whilst majority of the studies have noted that volatility in developed markets tend to be asymmetric and persistence, relative empirical knowledge on emerging markets is mixed. A plausible reason for this could be different time frames used by different studies. Howbeit, as it can be deduced from the review of literatures, there is a clear lacking in empirical evidence on the volatility of ESG markets. Furthermore, the nature of ESG volatility with market blocs of emerging (BICS) and developed (G7) markets is unknown. Whilst, there are a number of studies that have sought to model and understand the peculiarities of emerging and developed stock markets, it is unknown which volatility model is most suitable for understanding the peculiarities of ESG markets in developed and emerging market blocs. More so, there is no clear evidence if there is a distinction between ESG volatility persistence and asymmetry in developed (G7) and emerging (BICS) market blocs in aggregate. Although, few studies have offered comparative analysis on stock market volatility between emerging and developed markets, these studies have adopted varying definitions for market blocs. Lastly, the role of investment sentiment in ESG volatility dynamics remains unclear. Whilst recent empirical studies such as Rupande et al. (2019), have delved on the investor sentiments and stock market, Muzindutsi et al. (2023), have considered investor sentiment and property market. Evidence on investor sentiment and ESG market volatility remains lacking despite the global rise of ESG investing.

4.3 Research Methodology for ESG Volatility and Investor Sentiments

This section of the chapter provides succinct discussions and justifications on the research methods and estimation procedures as well as the result presentation and discussion of findings.

4.3.1 Methods and Estimation Procedures for ESG Volatility and Investor Sentiment

The novelty in this chapter is to ascertain whether the persistence of volatility differs for developed markets relative to emerging markets, considering our discovery in the previous chapter of overwhelming evidence of volatility in the dynamics of the ESG returns. The paradigm created by Engle (1982) is typically the starting point when the issue is not about the spillovers of volatility but rather its persistence, as shown in the study by Isah and Ekeocha (2023). Since the Engle (1982) seminar paper developed the Autoregressive Conditional Heteroscedasticity (ARCH) model, it continues to be the standard method for modeling volatility in the literature. However, while the ARCH model was originally intended to discover statistically significant correlations between distant data that vary over time, a number of enhancements have since arisen, including the ARCH-in-Mean (ARCH-M) established by Engle et al. (1987). Bollerslev (1986) also developed the Generalized ARCH (GARCH) model. The Integrated GARCH (IGARCH) model is part of the GARCH model family. The latter comprises Engle and Bollerslev (1986) integrated GARCH (IGARCH) model, Nelson (1991) exponential GARCH (EGARCH), also known as asymmetric GARCH, and Glosten et al. (1993) GJR-GARCH model. Ding et al. (1993) created the asymmetric power GARCH (APGARCH) model.

One of the main innovations of this study is to control for the role of investors sentiment in the volatility dynamic of ESG returns. Hence, this study also considers another expanded version of the GARCH model, such as GARCH-X. As a result, the main goal of this section is to identify which of the aforementioned possible GARCH models is best suited for simulating the persistence of volatility in the ESG returns. To rank the accuracy of each GARCH model in terms of suitability for predicting the persistence of the volatility dynamics of the ESG returns, we essentially used two model selection criteria: AIC and SIC. By combining these approaches for selection criteria with the question of whether convergence was reached when solving a certain GARCH model, we were able to determine the preferred GARCH model. More importantly, the procedure to modelling with GARCH models usually begins with understanding the nature and statistical feature of the variables of interest. Thus, the methodological section of this study begins with the description of the variables to unravel some of the salient features that makes GARCH models appropriate for modelling the volatility dynamics of the ESG returns.

4.3.2 Data and Sampling for volatility dynamics and investor sentiments

Regarding the period covered and measurement of the variables, the procedure remains as earlier established in the section 3.3.1 of the previous chapter. On the one hand, the daily ESG indices for each of the market blocs - BICS and G7 countries remain as earlier defined, for instance, it is measured, in terms of its returns, such as; $ESGR_t = 100 * \log\left(esg - esg(-1)\right)$ where ESGR denotes ESG returns. However, while acknowledging a wide range of economic and financial market fundamentals have been proven a good measure of investor sentiment in the literature, Rupande et al. (2019) and Reis and Pinho (2020a) are of the view that it is more informational when the numerous indicators of investor sentiment are harmonised to form a composite index. For instance, using a single variable may not be sufficient to explain investor sentiment. Hence, we employ the principal component analysis (PCA) technique to generate the composite index of the individual indices whose measurement and description were earlier detailed in the Chapter 3 of this study.

4.3.3 The Research Estimation Techniques for volatility dynamics and investor sentiments

4.3.3.1 Preliminary tests for volatility dynamics and investor sentiments.

Aside from the BDS test and the unit root test, every other preliminary test, namely, ARCH test and the autocorrelation test performed and reported in Chapter three of this research thesis remains important pre-condition estimates for modelling with GARCH models. The ARCH test in particular usually follows and AR(k) process as shown in equation (4.1).

$$esgr_t = \delta + \sum_{i=1}^{k} \eta_i esgr_{t-i} + \varepsilon_t \tag{4.1}$$

where $i = 1,...,k; \quad t = 1,...,T; \quad \varepsilon_t : \; IID\left(0, \sigma^2\right); \; and \; |\eta_i| < 1$

As demonstrated in the study by Salisu (2011), the procedure to validate or refute the null hypothesis of no volatility in the series when performing the ARCH test is usually in three steps. The first step begins with the estimation of equation (4.1) using OLS and the step is usually completed by obtaining fitted residuals from the estimate. In the second step, the square of the obtained fitted residuals will then be regressed on a constant and on the lags of the squared residuals as shown in equation (4.2) below.

$$\varepsilon_t^2 = \pi_0 + \pi_1 \varepsilon_{t-1}^2 + \pi_2 \varepsilon_{t-2}^2 + \cdots \pi_p \varepsilon_{t-p}^2 + \mu_t \tag{4.2}$$

In the final step, a joint null hypothesis will be performed using the LM test to refute or validate the hypothesis that there is no ARCH effect in the model, such that; $H_0 : \rho_1 = \rho_2 = \cdots = \rho_p = 0$. To determine whether to reject or not reject the hypothesis, we are guided statistically by the use of the F-test and nR2 statistics, with the latter, in particular, obtained via interaction of the number of observations and the coefficient of determination from the estimates in equation (4.2). In a more technical term, the nR^2 is a chi-squared distribution (χ_p) with p in equation (4.2) denoting the number of AR terms in the specification. In sum, the evidence of overwhelming rejection of the null hypothesis of no ARCH effect as earlier demonstrated in the previous Chapter confirms the appropriateness of the following specified GARCH model for analyzing the volatility dynamics of the ESG returns in this study.

4.3.3.2 The GARCH models

The ARCH and GARCH models of Engle (1982) has continued to be acknowledged as basis of the whole genre of GARCH modelling and it usually begin with an AR process as shown in equation (4.3) below.

$$esgr_t = \delta + \sum_{i=1}^{k} \eta_i esgr_{t-i} + \varepsilon_i \tag{4.3}$$

The subscripts *i* and *t* remains as earlier defined, the term η is the autoregressive parameter while δ_i measure the risk premium for investing in financial assets, while $esgr_t$ denotes the return from holding financial assets, in this case the ESG. Moving forward, $esgr_{t-i}$ represents the autoregressive component of the return series. It must be further pointed out, that the $esgr_t$ in equation (4.3) is presumed to be conditional on immediate past information, and therefore the basis for the conditional mean represented below.

$$E\left(esgr_t \mid \Omega_{t-i}\right) = \delta + \sum_{i=1}^{k} \eta_i esgr_{t-i} \tag{4.4}$$

The assumption that the conditional mean of $esgr_t$ in equation (4.3) is time varying is in line with the inherent feature of financial series. Moving forward, we arrived at equation (4.5) with the assumption that the error term (ε_t) follows the Engle (2002) procedure.

$$\varepsilon_t = \mu_t \left(\psi + \sum_{j=1}^{q} \beta_j \varepsilon_{t-1}^2 \right)^{1/2} ; j = 1, \ldots, q \tag{4.5}$$

Equation (4.5) is the starting point of our conditional variance equation upon which the volatility dynamics of the ESG returns will be examined. In order to ensure that the conditional variance is positive as presume in line with the non-negative constraint imposed on the ARCH model of Engle (1982), it is assumed that $\psi > 0$ and $0 < \beta_1 < 1$, such that $\mu_t \sim IID(0,1)$. The ARCH (q) model in the equation can as well rewritten as follows:

$$\varepsilon_t^2 = \mu_t^2 \left(\psi + \sum_{j=1}^{q} \beta_j \varepsilon_{t-j}^2 \right) \tag{4.6}$$

Taken both equations (4.5) and (4.6) into consideration, we arrived at the conditional variance model having taken expectation with respect to the relevant information set $\left(\zeta_{t-1}\right)$. Given that $E\left(\mu^2 \mid \zeta_{t-1}\right) = 1$, for example, then the conditional variance equation is as given below.

$$\operatorname{var}\left(\varepsilon_t \mid \zeta_{t-1}\right) = \psi + \sum_{j=1}^{q} \beta_j \varepsilon_{t-j}^2 \tag{4.7}$$

Using lag operator (L), the unconditional variance model can as well be re-specified as follows:

$$\sigma_t^2 = E\left(\varepsilon_t^2\right) = \frac{\psi}{1 = \beta\left(L\right)} \tag{4.8}$$

where $\sum_{j=1}^{q} \beta_j \varepsilon_{t-j}^2 = \beta\left(L\right) \varepsilon_t^2$ and by extension $\beta_1 + \beta_2 L^2 + \cdots + \beta_q L^q$ given that $\beta\left(L\right)$ is defined as polynomial lag operator.

The ARCH (q) model in equation (4.6) is defined in a way that the value of conditional variance $\left[\operatorname{var}\left(\varepsilon_t \mid \zeta_{t-1}\right)\right]$ is treated as a function of the squared error term of the past periods $\left(\varepsilon_{t-j}^2\right)$. As earlier established in the section for preliminary test, both the F-test and/or nR^2 is used to validate ore refute the hypothesis of no ARCH effect with the null represented as: $H_0 : \beta_1 = \beta_2 = \cdots = \beta_j = 0$. For the non-rejection of the hypothesis, the implication is that there is no ARCH effect (no evidence of volatility) in the estimated model. However, where there is evidence of volatility, then the implication, as shown in equation (4.8), is that the variance is larger.

Following the Salisu (2011) procedures, we further extended equation (4.7) to accommodate the lag of the conditional variance and subsequently arrived at the GARCH model of Bollerslev (1986), which is an extension of the Engle (1982) ARCH model.

$$\sigma_t^2 = \psi + \sum_{j=1}^{q} \beta_j \varepsilon_{t-j}^2 + \sum_{i=1}^{p} \gamma_i \sigma_{t-i}^2 \tag{4.9}$$

Equation (4.9) is our standard GARCH(*p*,*q*) model where *p* is the lagged terms of the conditional variance while *q* on the other hand is the squared error term. For $j = 1,\ldots,q$ and $i = 1,\ldots,p$, it is expected that $p \geq 0,\ q > 0, \beta_0 > 0, \beta_j \geq 0, \gamma_i \geq 0$. The $\sum_{j=1}^{q} \beta_j \varepsilon_{t-j}^2$ component of the equation (4.9) captures the ARCH effect while $\sum_{j=1}^{p} \gamma_i \sigma_{t-i}^2$ component captures the GARCH effect. That said, the GARCH(*p*,*q*) can also be equivalently rewritten as shown below using lag operator (L).

$$\sigma_t^2 = \psi + \beta(L)\varepsilon_t^2 + \gamma(L)\sigma_t^2 \tag{4.10}$$

where $\gamma(L)\sigma_t^2 = \sum_{\gamma=1}^{p} \gamma_t \sigma_{t-i}^2$ and $\gamma(L)$ is the polynomial lag operator $\gamma_1 L + \gamma_2 L^2 + \cdots + \gamma_p L^p$.

However, since risk-averse investors need greater returns to engage in riskier assets, one may anticipate that when modelling the returns from investing in a hazardous asset, the variance of those returns would greatly contribute to the explanation of the behaviour of the conditional mean (see Harris & Sollis, 2005). Thus, in addition to the standard ARCH and GARCH models considered so far, the GARCH family of ARCH-in-Mean (ARCH-M) and GARCH-in-Mean (GARCH_M) are also of interest in this study to enable us accommodate the role of conditional variance in volatility modelling. Hence, equation (4.4) is changed to the following for the ARCH-M:

$$esgr_t = \theta + \lambda\sigma_t^2 + \sum_{\gamma=1}^{p} \gamma_i \delta_i esgr_{t-i} + \varepsilon_t; \quad i = 1,\ldots,k \tag{4.11}$$

Thus; $\eta_t = \theta + \lambda\sigma_t^2$ (4.12) where σ_t^2 is as earlier defined in equation (4.8). The standard deviation of the conditional variance can also be used in lieu. For the GARCH-M, the only difference is that conditional variance σ_t^2 follows equation (4.10) instead.

Another variant of volatility models that is equally of interest to this study are those that capture the asymmetric effects or leverage effects not accounted for in the ARCH and GARCH models. Nelson (1991) proposed an exponential GARCH (EGARCH) model to capture the leverage effect. The EGARCH(*p*,*q*) is given as:

$$Log\left(\sigma_t^2\right)=\Psi+\left[1-\gamma\left(L\right)\right]^{-1}\left[1-\beta\left(L\right)\right]f\left({\varepsilon_{t-1}}/{\sigma_{t-1}}\right) \tag{4.13}$$

and

$$f\left({\varepsilon_{t-1}}/{\sigma_{t-1}}\right)=\alpha\varepsilon_{t-1}+\vartheta\left(\left|{\varepsilon_{t-1}}/{\sigma_{t-1}}\right|-E\left|{\varepsilon_{t-1}}/{\sigma_{t-1}}\right|\right) \tag{4.14}$$

Unlike the traditional ARCH and GARCH models, equation (4.13) shows that, in the EGARCH model, the log of the conditional variance is a function of the logged error terms. The asymmetric effect is captured by the parameter α in equation (4.14) (i.e. the function $f\left({\varepsilon_{t-1}}/{\sigma_{t-1}}\right)$). There is evidence of the asymmetric effect if $\alpha<0$ and there is no asymmetric effect if $\alpha=0$. Essentially, the null hypothesis is $\alpha=0$ meaning there is asymmetric effect and testing is based on the t-statistic. The conditional variance in the EGARCH model is always positive with taking the natural log of the former. Thus, the non-negativity constraint imposed in the case of ARCH and GARCH models is not necessary.

Another GARCH family that also allows for the asymmetric effect to be captured is the GJR-GARCH model developed by Glosten et al. (1993), which modifies equitation (4.10) to include a dummy variable I_{t-j}.

$$\sigma_t^2=\psi+\sum_{j=1}^{q}\beta_j\varepsilon_{t-j}^2\varepsilon_{t-j}^2+\sum_{\gamma=1}^{p}\gamma_i\sigma_{t-i}^2+\sum_{j=1}^{q}\varphi_j\varepsilon_{t-j}^2 I_{t-j} \tag{4.15}$$

where $I_{t-j}=1$ if $\varepsilon_{t-j}>$ (positive shocks) and $I_{t-j}=0$ otherwise. Therefore, there is evidence of asymmetric effect if $\varphi_j<0$ which implies that positive shocks reduce the volatility of $esgr_t$ more than negative shocks of the same magnitude.

The Role of Investor sentiments in volatility modelling

Finally, one of the main innovations of this study is to control for the role of investor sentiment in the volatility dynamic of ESG returns. To this end, another extended variant of GARCH model for instance GARCH-X is also considered in this study. Essentially, we extend the conventional GARCH (1, 1) model in the equation (4.10) to include the X component which in the context of this study is measured in term of the investors' sentiment index (ISI) as shown below.

$$\sigma_t^2=\psi+\sum_{j=1}^{q}\beta_j\varepsilon_{t-j}^2+\sum_{\gamma=1}^{p}\gamma_i\sigma_{t-i}^2+\sum_{j=1}^{m}\lambda_j ISI_{t-j} \tag{4.16}$$

where the ISI an exogenous regressor reflecting the role of investor sentiments in the ESG–based volatility model.

4.3.3.3 Measures of Persistence and Half-Life

When modeling volatility in the context of the GARCH model, the standard procedure for determining the persistence of shock is the sum of the coefficients for ARCH and GARCH effects, for instance $(\beta+\gamma)$. Another component of determining the persistence dynamics of volatility when modeling with the GARCH model is the concept of the half-life technique of Engle and Patton (2007). The half-life technique usually measures the time it takes for volatility to revert halfway back towards its unconditional mean value after shock. According to Samouilhan (2007), this measure is helpful and objective when comparing the persistence of shocks on volatility for different series or for different economies. Technically, the volatility half-life values can be calculated as shown below.

$$HL = \ln(0.5) / \ln(\beta + \gamma) \tag{4.17}$$

4.3.3.4 Model Selection Criteria

Information Criteria are used to compare and choose among different models with the same dependent variable. Akaike Information Criterion (AIC) and Schwarz Information Criterion (SIC) are mostly commonly used for model selection. These criteria help measure how well the model fit the given data and the best model according to Brooks (2019) should minimise information criteria (Brooks, 2019). The criteria were further complimented with the log likelihood approach. When we use AIC and SIC to select the best model, we choose the model with the lowest AIC and/or SIC values, but in the case of the log-likelihood value of a regression model which is also a way to measure the goodness of fit for a model, it is the higher the value of the log-likelihood, the better a model fits a dataset.

4.4 Result and Discussion of Findings on volatility dynamics and investor sentiments

The presentation of the empirical results and the discussion of findings are carried out under two broad sections. The first is the preliminary analysis which in this case include the procedure to determining the most suitable for analyzing volatility dynamics of the ESG returns among the numerous GARCH models estimated. The second is concerned with the presentation and discussion of the empirical findings based on the estimates obtained from the preferred GARCH model. More importantly, the presentation of the result and discussion of finding were considered along the individual BICS and G7 member countries as well as in terms of their representative as developed and emerging markets, respectively.

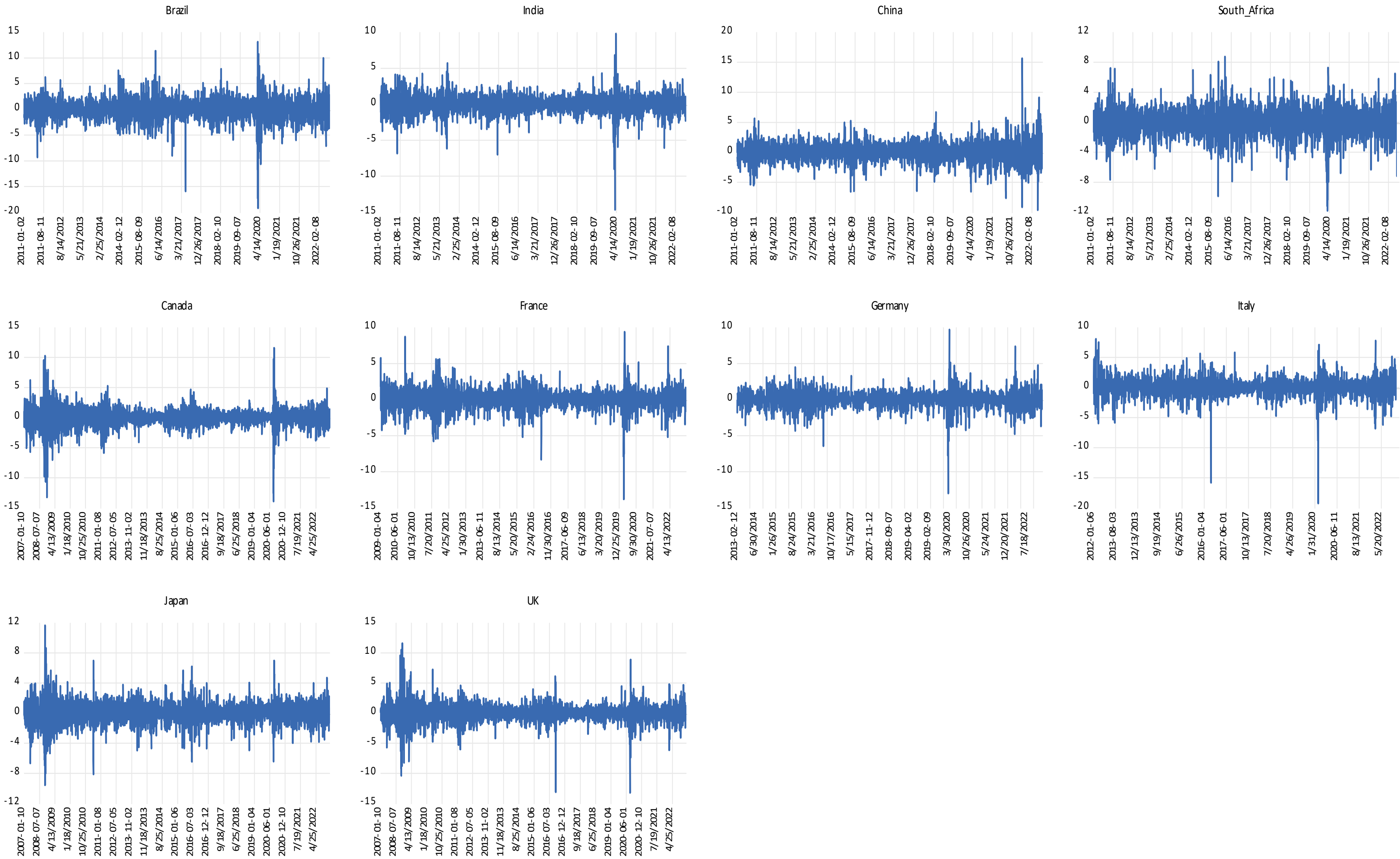
4.4.1 Preliminary Results on volatility dynamics and investor sentiments

Given that the ESG returns series as well as the composite investor sentiment index (CIS) remains as earlier defined in the Chapter three of this thesis, then the preliminary analysis earlier presented and discussed in the section 3.4 of the Chapter three remains a valid reference for evidence of autocorrelation and conditional heteroscedasticity. The overwhelming evidence of autocorrelation and ARCH effects reported in Table 3.4 therefore remains a valid condition to warrant the analysis of the volatility dynamics of the ESG returns while accounting for the role investor sentiment. That said, we extend the preliminary analysis to now include graphical illustration of the ESG returns series in Figure 4.1. Depicted in Figure 4.1 are daily ESG returns plots for each individual market in both developed and emerging markets.

A cursory look at the figure indicates the variance of the ESG returns is not constant but instead follows an autoregressive pattern, which is complemented by the evidence of volatility clustering in all of the BICS and G7 markets in Figure 4.1. Quite obvious in the plots are instances of some periods appearing riskier than others, thereby depicting higher volatility of ESG returns in the said periods. Notable events that have been prominent in the literature to coincide with these riskier periods include the 2007/2008 global financial crisis as well as the recent COVID-19 health-related economic crisis. In all of these, an equally interesting observation in the plots is the fact that the ESG returns series appears to be stationary in all of the markets in the BICS and G7 countries as it exhibits constant means over the sample period.

Among the BICS market bloc, the South African ESG stock returns exhibit higher risk than all the other individual markets in BICS member countries. Compared to the G7 market bloc, the ESG returns seem to be more volatile among individual countries in the BICS market bloc. Notwithstanding the clarity of the figure, we still subject the inference drawn from the illustration to an empirical test in the following section, where we employ variants of the GARCH models to determine whether the ESG returns volatility is permanent or temporary.

Figure 4.1: Daily ESG Return Series of the BICS and G7 Countries



4.4.2 Determination of the best fit GARCH model for ESG volatility in BICS and G7 markets

In order to ensure that the discussion of results is mainly based on the GARCH model with the best fit, we employed model selection criteria, namely, AIC and SIC and complement them with log likelihood, to rank each of the GARCH models estimated. We arrived at the preferred GARCH model for modelling ESG returns volatility by combining these selection criteria methods with whether convergence was achieved in solving a specific GARCH model. Presented in Table 4.1and Table 4.2 provide the summary of the different features of the various GARCH models estimated across the individual BICS and G7 ESG markets, respectively.

Table 4.1: Selected best fit GARCH model to modelling ESG returns volatility in BICS

Model Type	Selection Criteria			
	Log-likelihood	**AIC**	**SIC**	**Rank**
Brazil				
GARCH(1, 1)	-5704.649	2.869170	2.877071	3rd
EGARCH(1,1)	-5637.703	2.836032	2.845513	1st
GJR-GARCH(1,1)	-5644.916	2.839656	2.849137	2nd
India				
GARCH(1, 1)	-4730.214	3.046133	3.055850	3rd
EGARCH(1,1)	-4679.565	3.014195	3.025855	1st
GJR-GARCH(1,1)	-4684.364	3.017281	3.028942	2nd
China				
GARCH(1, 1)	-5489.287	3.534440	3.544157	3rd
EGARCH(1,1)	-5463.979	3.518803	3.530463	2nd
GJR-GARCH(1,1)	-5460.645	3.516658	3.528319	1st
South Africa				
GARCH(1, 1)	-6119.639	3.939942	3.949659	3rd
EGARCH(1,1)	-6076.365	3.912747	3.924407	1st
GJR-GARCH(1,1)	-6089.637	3.921284	3.932945	2nd
Emerging Market Index				
GARCH(1, 1)	-5704.649	2.869170	2.877071	3rd
EGARCH(1,1)	-5637.703	2.836032	2.845513	1st
GJR-GARCH(1,1)	-5644.916	2.839656	2.849137	2nd

Source: Compiled by the authors

The larger the log likelihood values and smaller the AIC or SIC values for the solved model, the better the fit model. When the AIC and SIC judgments disagree, the SIC is considered superior because it assigns higher penalties to too many parameters in the model (Salisu and Oloko, 2015).

Starting with the BICS markets as presented in Table 4.1, the study found each of the criteria consistently identified with the EGARCH model as the most appropriate for modelling the volatility dynamics of the ESG returns in Brazil, India, and South Africa, with China being the only exception. However, the fact that we find the GJR-GARCH as the variant of the GARCH model most suitable in the case of China tends to reiterate the fact that asymmetries matter in the volatility dynamics of ESG returns in the emerging market bloc, herein referred to as the BICS countries.

As with the emerging market bloc, a look at Table 4.2 shows that all of the model selection criteria are consistent in their preference for the EGARCH model as the most appropriate for determining the persistence dynamics of ESG returns volatility in each of the G7 member countries in the developed market bloc. The only exception in this regard is when the G7 markets are considered as a whole in terms of developed market index and the preferred model is the GJR-GARCH model.

In view of the foregoing, it can be inferred that the variant of the GARCH that captured the 'asymmetry effect', also known as the 'leverage effect', is the most suitable for analysing ESG returns, irrespective of whether the market is an established one (developed) or emerging. The underlying intuition herein is that an unexpected fall in ESG returns may increase volatility more than an unexpected increase of the same magnitude. In other words, 'bad news' may increase ESG returns volatility more than 'good news' in both developed and emerging markets.

Although both EGARCH and GJR-GARCH variants of GARCH models that allow for accounting asymmetry effect appear to be relevant in this study, we find the EGARCH to be the most prominent except for a few instances, such as the case of China and when the G7 markets are reflected as developed market index as a whole. To test for asymmetries, the parameter of interest when the estimated GARCH model is EGARCH is λ. If $\lambda > 0$; then positive shocks (good news) generate higher volatility than negative shocks (bad news), and vice versa. In the case of the GJR-GARCH, the parameter of interest is φ, and if $\varphi > 0$; then positive shocks (good news) give rise to higher volatility than negative shocks (bad news), and vice versa.

Table 4.2: Selected best fit GARCH model to modelling ESG returns volatility in G7

Canada				
	Selection Criteria			
Model Type	**Log-likelihood**	**AIC**	**SIC**	**Rank**
Canada				
GARCH(1, 1)	-5955.240	2.995095	3.002996	3rd
EGARCH(1,1)	-5883.342	2.959468	2.968949	1st
GJR-GARCH(1,1)	-5900.768	2.968225	2.977706	2nd
France				
GARCH(1, 1)	-5425.101	3.026812	3.035432	3rd
EGARCH(1,1)	-5325.019	2.971583	2.981926	1st
GJR-GARCH(1,1)	-5347.312	2.984009	2.994352	2nd
Germany				
GARCH(1, 1)	-3496.303	2.954686	2.966861	3rd
EGARCH(1,1)	-3448.691	2.915351	2.929960	1st
GJR-GARCH(1,1)	-3461.594	2.926240	2.940849	2nd
Italy				
GARCH(1, 1)	-4753.843	3.447188	3.457915	3rd
EGARCH(1,1)	-4721.481	3.424470	3.437342	1st
GJR-GARCH (1,1)	-4729.578	3.430335	3.443207	2nd
Japan				
GARCH (1, 1)	-6249.753	3.143092	3.150993	3rd
EGARCH (1,1)	-6199.113	3.118147	3.127628	1st
GJR-GARCH (1,1)	-6211.929	3.124587	3.134068	2nd
UK				
GARCH(1, 1)	-6139.264	3.087570	3.095471	3rd
EGARCH(1,1)	-6076.348	3.056456	3.065937	1st
GJR-GARCH(1,1)	-6087.354	3.061987	3.071468	2nd
USA				
GARCH(1, 1)	-1969.710	2.793083	2.811662	3rd
EGARCH(1,1)	-1950.408	2.767197	2.789492	1st
GJR-GARCH(1,1)	-1956.087	2.775229	2.797524	2nd
Developed Market Index				
GARCH(1, 1)	-1839.969	2.459959	2.477670	3rd
EGARCH(1,1)	-1835.787	2.455716	2.476969	2nd
GJR-GARCH(1,1)	-1813.395	2.425860	2.447113	1st

Source: Compiled by the authors

4.4.3 Empirical results on ESG volatility dynamics in emerging and developed markets

4.4.3.1 The average returns

Although the focal point of this study is on the volatility dynamics of the ESG returns, however, equally of utmost concern that have continued to received attention in the literature is the mean equation coefficient. This coefficient is expected to be significant and positive based on finance theory. Thus, the mean equation intercept (δ) in Table 4.3. represents the return when the total risk, the effect of shocks, and the previous period return are zero. However, we find this parameter largely not statistically significant in all of the BICS and G7 countries with USA the only notable exception. Where the fact that the parameter is non-significant in virtually all of the BICS and G7 countries is an indication that the average ESG returns in these markets is indeterminable when total risk, the effect of shocks and the previous period return are zero, coefficient is positive and statistically significant (Muguto and Muzindutsi, 2022). However, we find the average ESG returns of about 0.07% in the USA not attributable to the total risk not the effect of past shocks or the previous period return.

On the previous period of the ESG returns, we find the coefficient denote as AR (1) to be statistically significant in all of the BICS except for South Africa. In similar development, we find the statistical significance of the coefficient on the lag of the ESG return evident in five of the seven of the G7 countries investigated. What this portends, is that the effect of the past information on the ESG returns could be used to explain the future returns of the ESG fund in many of the BICS and G7 countries. When the individual BICS and G7 member countries are captured in terms of their representation as emerging market economy (EME) and developed market economy (DME), we find the coefficient on the lag of the ESG returns to be positive implying that past positive shocks could explain future returns in both markets. From the perspective of the individual economy, we find the likelihood of the past returns causing a decline in future returns of Italy, Japan, UK and USA, but largely otherwise in the case of the BICS markets.

4.4.3.2 The Dynamics of the Persistence of the ESG Returns Volatility

Following our earlier findings in Tables 4.1 and 4.2, when the asymmetry variant of the GARCH model was consistently revealed as the most suitable for modelling the volatility dynamics of the ESG returns both in BICS and G7 markets. As result, we begin our discussion of the estimates based the conditional variance equation from the view point of the leverage effect parameter, which is λ when the estimated GARCH model is EGARCH and φ when the estimated GARCH model is GJR-GARCH. Irrespective of whether the preferred asymmetry GARCH model is EGARCH or GJR-GARCH, the coefficients on the leverage effect were found to be positive and statistically significant across the emerging and developed market blocs. Being positive and statistically significant, therefore implies that negative shocks (bad news) tend to increase the volatility of series by more than positive shocks (good news) of the same magnitude in the ESG returns of both the BICS and G7 market blocs, However, if it is negative and also statistically significant; then, it suggests that, positive shocks (good news) tend to increase the volatility of series by more than negative shocks of the same magnitude. On the other hand, if it is not statistically significant; then, the effects of both shocks are identical. Howbeit, it is instructive that the statistical significance of this evidence does not hold in the case of the South African market.

Table 4.3. GARCH estimates on the persistence of ESG returns volatility in BICS and G7

Emerging Market Economies	Mean Equation		Variance Equation				Shock Persistence	Half - Life	Diagnostic test	
	δ	AR(1)	ψ	β_j	γ_i	*Asym* $(\lambda\ or\ \varphi)$	$(\beta+\gamma)$		Ljung Box	ARCH LM
Brazil	0.0016 (0.0142)	0.1797*** (0.0168)	-0.1122*** (0.0095)	0.1451*** (0.0121)	-0.1053*** (0.0075)	0.9794*** (0.0025)	0.04	0.22	21.182	1.791**
India	0.0195 (0.0176)	0.0580*** (0.0188)	-0.0748*** (0.0088)	0.1049*** (0.0114)	-0.1036*** (0.0067)	0.9759*** (0.0028)	0.00	0.10	22.222	1.040
China	0.0294 (0.0236)	0.0347* (0.0193)	0.0551*** (0.0078)	0.0249*** (0.0056)	0.9047*** (0.0082)	0.0908*** (0.0101)	0.93	9.50	20.815	0.687
South Africa	-0.0231 (0.0294)	0.0257 (0.0185)	-0.0479*** (0.0090)	0.0944*** (0.0114)	-0.0934*** (0.0072)	0.9774 (0.0037)	0.00	0.10	22.742	1.113
EME	0.0014 (0.0122)	0.2917*** (0.0071)	-0.1012*** (0.0675)	0.1712*** (0.0221)	-0.0778*** (0.0041)	0.9144*** (0.0145)	0.02	0.18	29.118	0.669**
Developed Market Economies										
Canada	0.0029 (0.0137)	0.0670*** (0.0163)	-0.1062*** (0.0077)	0.1404*** (0.0096)	-0.1085*** (0.0067)	0.9879*** (0.0015)	0.03	0.20	14.548	1.226
France	-0.0054 (0.0151)	0.0043 (0.0155)	-0.1018*** (0.0089)	0.1408*** (0.0115)	-0.1578*** (0.0084)	0.9694*** (0.0026)	-0.02	34.66	12.581	0.794
Germany	-0.0090 (0.0187)	-0.0098 (0.0198)	-0.0934*** (0.01048)	0.1287*** (0.0138)	-0.1173*** (0.0081)	0.9719*** (0.0035)	0.01	0.15	15.839	0.841
Italy	0.0181 (0.0217)	-0.0666*** (0.0178)	-0.1065*** (0.0077)	0.1636*** (0.0108)	-0.0922*** (0.0066)	0.9729*** (0.0036)	0.07	0.26	31.220*	1.183
Japan	0.0170 (0.0163)	-0.1272*** (0.0157)	-0.0978*** (0.0079)	0.1349*** (0.0105)	-0.0944*** (0.0063)	0.9757*** (0.0026)	0.04	0.22	9.7246	1.573**
UK	-0.0105 (0.0149)	-0.0340** (0.0160)	-0.1229*** (0.0063)	0.1721*** (0.0085)	-0.1156*** (0.0068)	0.9769*** (0.0024)	0.06	0.24	16.211	1.002
USA	0.0724*** (0.0217)	-0.0552** (0.0266)	-0.2322*** (0.0184)	0.3046*** (0.0228)	-0.1369*** (0.0124)	0.9537*** (0.0057)	0.17	0.39	24.556	0.617
DME	-0.0019 (0.0217)	0.1170*** (0.0289)	0.0251*** (0.0024)	0.0042 (0.0069)	0.8987*** (0.0108)	0.1310*** (0.0129)	0.90	6.79	22.703	0.667

Note: *The values in the parenthesis are the standard errors while ***, ** and * implies significant at 1%, 5% and 10% levels of significance.*

From the foregoing, the null hypothesis of no significant leverage effect only holds in the case of South Africa. But the fact that the leverage effect is significantly evident in all of the G7 markets and in the majority of BICS markets, is in support of the findings of Black (1976) and Christie (1982) hypotheses of asymmetric volatility.

Furthermore, if the ESG returns are linked to volatility, then BICS markets, with the exception of South African market and all of the G7 markets, are likely to have a greater risk premium since volatility increases following good news. Again, South Africa appears to be the only country with a lower risk premium, given that the effects of both positive and negative shocks of the same magnitude appear to have the same impacts on the volatility dynamics of the ESG returns.

Regarding the parameter (β), which captures the effect of past shocks, we find the coefficient to be positive and statistically significant in all of the BICS and G7 markets. What this portends is that past innovations are significant for explaining the current volatility in the individual 4 BICS markets as well as the G7 markets. The fact that the coefficient on the parameter β is consistently less than those on the parameter for the leverage effect further reiterates the fact that the effect of positive shocks is much larger than that of negative shocks of the same magnitude.

On the degree of volatility persistence, as measured by $\beta + \gamma$, it seems mostly close to zero in the majority of the BICS and G7 markets, suggesting shock to ESG returns volatility is mean reverting. Even though we find the degree of persistence very high in China and when the G7 is captured as a whole in terms of developed market index, yet we find the $\beta + \gamma$ to be less than one in both instances, implying that the impact of the shock is not permanent despite the high persistence.

Confirming our finding of widespread evidence of low persistence in the majority of the countries in the BICS and G7 ESG market blocs, the volatility half-life measure shows that it will take less than a day for a shock on the conditional volatility to decline by half in virtually all of the BICS and G7 markets. Some of the few notable exceptions is the case of China, where it will take about 9 to 10 days for conditional volatility to decline by half, and France in the case of the G7 economies where it may take about 35 days but between 6 to 7 days when the G7 are captured as a whole in the form of a developed market index. Here, it will take about 6 to 7 days for the conditional volatility to decline by half. It must be acknowledged, however, that these results are to a very large extent consistent with the results derived from the volatility persistence measure.

4.4.3.3 The role of Investor Sentiment in the persistence of the ESG returns volatility

One of the main novelties of this study boils down to the question of whether investor sentiment induces or moderates the persistence of the volatility dynamics of ESG returns. To this end, we extend each variant of the preferred asymmetry GARCH model to include an X component, for instance, EGARCH-X and GJR-GARCH-X, where the X is an exogenous factor that reflects the role of investor sentiment in the GARCH framework. Thus, presented in Table 4.4 are the estimates obtained from the estimation of the extended EGARCH and GJR-GARCH models that include the role of investor sentiment index (ISI).

Essentially, we find the coefficient on the ISI positive and statistically significant in both the BICS and G7 markets. The only exception is when the G7 markets are expressed in group as developed markets index, and there we find the coefficient on the ISI to be negative but remains statistically significant. However, while the ISI exhibit the likelihood of inducing the volatility of ESG returns in all of the BICS markets in the emerging market bloc, the magnitude of the impact appears to be higher for South Africa, where a 1% change in the investor sentiment tends to increase the volatility of the ESG returns by 0.98%. In a similar development, the likelihood of the ISI increasing the volatility of ESG is evident in all of the G7 member markets but the magnitude is relatively higher for UK market compared to the rest of the G7 market bloc.

On whether investor sentiment matters in the persistence of the volatility of the ESG returns, we find the results in Table 4.4 on the degree of persistence measured by $\beta+\gamma$ to be consistent with those earlier reported in Table 4.3, where the estimated asymmetry GARCH models do not include the role of investor sentiment. For instance, despite extending the models to include ISI, the values of the $\beta+\gamma$ in Table 4.4 appear to be close to zero in majority of the BICS and G7 markets, which is an indication that, with or without accounting for the role of investor sentiment, shocks to ESG returns volatility are largely temporary and mean reverting. That said, we find the likelihood of the ISI increasing the degree of persistence when the G7 is expressed as a developed market index. Compared to the model without the ISI, where the degree of persistence for the developed market index is 0.92 in Table 4.3, it is, however, 0.93 in Table 4.4 when we account for the role of the ISI.

More so, the half-life values reported in Table 4.4 seem to suggest that the inclusion of the ISI in the model increases the number of days required for the shock to halve. For instance, while it may take less than a day for the shock to half in India when the model is without ISI, a look at Table 4.4 shows that it may take almost 70 days for the shock to half in the same India when the ISI is included in the model. Again, compared to the model without ISI, the inclusion of the ISI tends to extend the number of days required for the shock to be halved in China, France, and the developed market.

4.4.3.4 Diagnostic/Post Estimation Results of volatility dynamics and investor sentiments

To assess the validity of the chosen models, two model adequacy tests were performed: the ARCH LM test for heteroscedasticity and the Ljung-Box (LB) test for autocorrelation, the results of which are shown in the extreme right-hand side of Tables 4.3 and 4.4, respectively. There should be no significant autocorrelation or heteroscedasticity in the standardized residuals. The LB statistic was used to assess the residual independence, and the test statistics were negligible for the majority of the BICS and G7 markets in both the model with and without ISI. As a result, in almost all markets, the null hypothesis of no serial correlation in the standardized residuals could not be rejected. This means that the mean equation was given appropriately for all of the models in those countries. Furthermore, the results of Engle (1982) ARCH test revealed that there were no ARCH effects in any of the indices' standardized residuals, as the test statistics were insignificant in almost all of the countries. Thus, in many cases, the variance equations for the indices in the corresponding selected GARCH models were accurately given.

Table 4.4: GARCH estimates on the role of investor sentiment in the persistence of volatility of ESG returns in BICS and G7

Emerging Market Economies	Mean Equation		Variance Equation					Shock Persistence	Half Life	Diagnostic test	
	δ	AR (1)	ψ	β_j	γ_i	*ISI*	*Asym* $(\lambda\ or\ \varphi)$	$(\alpha+\beta)$		Ljung Box	ARCH LM
Brazil	-0.0010 (0.0142)	0.1795*** (0.0167)	-0.1088*** (0.0094)	0.1401*** (0.0118)	-0.1093*** (0.0077)	0.0288*** (0.0087)	0.9790*** (0.0025)	0.03	0.20	2.866*	1.869**
India	0.0163 (0.0176)	0.0580*** (0.0188)	-0.0724*** (0.0088)	0.1021*** (0.0114)	-0.1085*** (0.0072)	0.0250*** (0.0083)	0.9748*** (0.0028)	-0.01	69.31	22.985	1.039
China	0.0275 (0.0236)	0.0337* (0.0194)	0.0588*** (0.0081)	0.0239*** (0.0057)	0.9015*** (0.0086)	0.0556** (0.0222)	0.0957*** (0.0104)	0.93	9.55	13.593	0.664
South Africa	-0.0253 (0.0296)	0.0257 (0.0185)	-0.0452*** (0.0091)	0.0906*** (0.0113)	-0.0948*** (0.0079)	0.9776*** (0.0037)	0.0115 (0.0092)	0.00	N/A	17.028	0.905
EME	-0.2110 (0.1342)	0.0925*** (0.0087)	-0.1262*** (0.0413)	0.2111*** (0.0445)	-0.3121** (0.1007)	0.1142*** (0.0088)	0.9244*** (0.0514)	-0.10	6.93	31.39*	1.614**
Developed Market Economies											
Canada	-0.0001 (0.0137)	0.0670*** (0.0163)	-0.1032*** (0.0078)	0.1360*** (0.0097)	-0.1133*** (0.0068)	0.0289*** (0.0071)	0.9874*** (0.0015)	0.02	0.18	22.429	1.097
France	-0.0056 (0.0151)	0.0051 (0.0160)	-0.0968*** (0.0089)	0.1331*** (0.0116)	-0.1573*** (0.0081)	0.0398*** (0.0079)	0.9700*** (0.0026)	-0.02	34.66	21.365	1.095
Germany	-0.0055 (0.0186)	-0.0132 (0.0202)	-0.0978*** (0.0100)	0.1332*** (0.0133)	-0.1190*** (0.0086)	0.0694*** (0.0114)	0.9691*** (0.0038)	0.01	0.16	24.400	1.196
Italy	0.0135 (0.0221)	-0.0634*** (0.0179)	-0.0978*** (0.0077)	0.1501*** (0.0108)	-0.0994*** (0.0074)	0.0637*** (0.0096)	0.9744*** (0.0035)	0.05	0.23	31.18*	1.566*
Japan	0.0128 (0.0163)	-0.1285*** (0.0159)	-0.1035*** (0.0083)	0.1424*** (0.0110)	-0.0947*** (0.0064)	0.0382*** (0.0091)	0.9735*** (0.0028)	0.05	0.23	35.17**	1.652**
UK	-0.0123 (0.0150)	-0.0322** (0.0159)	-0.1170*** (0.0064)	0.1634*** (0.0085)	-0.1177*** (0.0069)	0.9772*** (0.0023)	0.0273*** (0.0062)	0.05	0.22	16.436	0.860
USA	0.0721*** (0.0217)	-0.0601*** (0.0276)	-0.2389*** (0.0189)	0.3109*** (0.0236)	-0.1377*** (0.0129)	0.0687*** (0.0222)	0.9523*** (0.0060)	0.17	0.40	12.626	0.655
DME	0.0047 (0.0207)	0.1236*** (0.0286)	0.0194*** (0.0020)	0.0040 (0.0059)	0.9136*** (0.0082)	-0.0346*** (0.0047)	0.1186*** (0.0110)	0.92	8.06	8.278	0.413

Note: *The values in the parenthesis are the standard errors while ***, ** and * implies significant at 1%, 5% and 10% levels of significance. The N/A means not applicable*.

4.4.4 Discussion of results on ESG volatility dynamics in emerging and developed markets

Upon the analysis and interpretation of the research results, this section of the dissertation expounds on the findings of the study by providing further discussions. The discussion of the research results on ESG volatility dynamics in emerging and developed markets were offered in a thematic structure.

4.4.4.1 Nature of ESG volatility dynamics in emerging and developed markets

Commencing with the first objective of this chapter, the discussions of the findings will be conducted from the standpoint of the nature and dynamics of ESG volatility in emerging and developed market blocs. Therefore, upon the determination of the best fit GARCH model for each of the ESG markets in the BICS and G7 market blocs, this section considered the nature of ESG returns volatility, as well as the dynamics of ESG volatility in emerging and developed market blocs.

On the best fit GARCH model, findings of this study suggest that asymmetry GARCH models are best suitable for understanding the nature of the volatility in ESG markets in the emerging and developed markets blocs. From the perspective of emerging markets bloc, the results of the analysis noted that except for the Chinese ESG market, that the nature of volatility in all individual ESG markets as well as the index market as represented by the EME can be best modelled using the EGARCH asymmetry model. However, it was revealed that the best model to understand the nature of the Chinese ESG market volatility is the GJR-GARCH model. Conversely, from the domain of the developed markets blocs, the results of the analysis found that the EGARCH model is best suited for deciphering the nature of all individual ESG markets in the developed market bloc as represented by the G7 member countries. Of noteworthy, it was further discovered that developed markets (DME) index can be best modelled using the GJR-model.

Studies such as Dedi and Yavas (2016), Thampanya and Pornpikul (2020), and Akkaya (2021) found that EGARCH models are best suited for modelling volatility of traditional equity markets. However, Muguto (2021) observed that the GJR-GARCH-M model are best appropriate for BRICS stock markets and the GARCH-M (1.1) works best for G7 stock markets.

Subsequently, this research expanded on the understanding of the nature of volatility across market blocs of the emerging and developed markets, by exploring the returns volatility via the mean equations as presented in Table 4.3. To comprehensively actualize this, the study critically evaluated the ESG mean equation and the past returns volatility across the emerging and developed markets. Considering for the mean equation in the emerging market bloc, the study observed that returns volatility was consistently insignificant among all the member ESG markets. This implies that the average ESG returns in these markets is indeterminable when total risk, the effect of shocks and the previous period return are zero, as compared to when coefficients are positive and statistically significant (Muguto and Muzindutsi, 2022). Conversely, with regards to the mean equation risk premium in developed markets bloc, the findings of the study evidenced that except for the US ESG market, the return volatility among the individual ESG markets within the G7 bloc are also consistently insignificant. This implies that the return volatility in the individual ESG markets of the G7 bloc, except for the US, does not play a statistically significant role in the mean equation risk premium. It suggests that changes in return volatility in these markets may not be strongly associated with changes in the mean equation risk premium.

Likewise, from the perspective of past returns volatility across the emerging and developed markets, the study observed that the previous period ESG returns of the emerging markets, as denoted by the coefficient of AR (1), were all statistically significant in all of the BICS except for South Africa. Conversely, from the perspective of the developed markets, except for France and Germany, all other G7 member markets were found to be statistically significant. In general, this suggests that in the context of past returns volatility in both market blocs, past ESG returns were statistically significant predictors of future returns in most individual ESG markets except for South Africa, France and Germany, as indicated by the autoregressive coefficients.

These findings are consistent with the findings of Dedi and Yavas (2016), Oredegbe and Abioye (2022), and Muguto and Muzindutsi (2022). The study of Muguto and Muzindutsi (2022) asserts that within the BRICS market bloc, past returns volatility was significant and positive stock markets such as Brazil, Russia, and China. Likewise, in the case of G7 markets, their study observed that past return volatility statistically predicts future returns of markets such as France, the UK and the US.

In general, except for the South African ESG market, the leverage effect parameter as represented by either the EGARCH or GJR-GARCH evident positive and statistical significance across both emerging and developed market blocs. This suggests that negative shocks (bad news) tend to increase the volatility of series by more than positive shocks (good news) of the same magnitude in the ESG returns of both the BICS and G7 market blocs.

These findings are consistent with the findings of Dedi and Yavas (2016), Bagchi et al. (2019), Thampanya and Pornpikul (2020) and Oredegbe and Abioye (2022). The study of Thampanya and Pornpikul (2020) concludes that negative shocks increase volatility than positive shocks in ASEAN market bloc, implying that bad news causes higher volatility than good news. Whilst considering the nature of volatility in ETF markets, Dedi and Yavas (2016) observed that the results of the EGARCH model suggests leverage effects in emerging and developed markets such as China, Russia, and Germany. Likewise, the study of Muguto (2021) found leverage effects in specific BRICS and G7 stock markets such as Brazil, India, South Africa, Canada, Italy and Japan. However, Akkaya (2021) found that the asymmetric effect parameter appears to be negative and statistically significant for emerging and developed stock markets, except China. This shows that the asymmetric effect, or in other words, the leverage effect, is valid in the stock markets other than China.

Considering for effect of past shocks, the finding of the results analysis revealed all coefficients of past shocks to be positive and statistically significant across the emerging and developed ESG markets. This implies that that past innovations are significant for explaining the current ESG volatility in both the emerging market bloc as well as the developed market bloc. Furthermore, with reference to unraveling the nature of shock persistence across the market blocs, the study found ESG volatility persistence to be close to zero in most member markets in the emerging and developed blocs. This suggests that shocks to ESG returns volatility is mean reverting across both market blocs. An exception to this can be seen in the case of China, the USA and the developed market index (DME) which evidenced high degree of persistence which was close to one.

These findings are consistent with the findings of Duță (2018), Muguto (2021) and Oredegbe and Abioye (2022). Investigating persistence of volatility in European and the US financial markets, the study of (Duță, 2018) concluded that except for the Polish market, volatility in Europe and American financial markets indicated high persistence and mean reversion. Similarly, Muguto

(2021) finding past negative and significant shocks in BRICS and G7 stock markets (except Germany), further reported high volatility persistence in both emerging and developed market blocs. Also, Oredegbe and Abioye (2022), whilst exploring the nature of volatility in high income and middle income economies found volatility to be persistent and mean reverting.

Additionally, the research investigated the dynamics of volatility persistence from the perspective of the half-life measure in both the emerging and developed market blocs. herein, the findings further confirm the widespread evidence of low persistence in the majority of the ESG markets in the emerging and developed market blocs. This was explicated in the emerging markets bloc as the half-life measure depicts that except for China, it would take less than a day for a shock on the conditional volatility to decline by half. Likewise, in the case of developed markets, except for France and the developed market index (DME), the half-life measure depicts it would take less than a day for a shock on the conditional volatility to decline by half. Whilst this exception can be explained by the observation of France being the only country having a negative shock persistence, and the developed market index (DME) having a near one shock persistence. This finding of the study is in consonance with studies such as Duță (2018), Muguto (2021) and Oredegbe and Abioye (2022) which have offered half-life days similar to the Chinese and French markets.

4.4.4.2 Investor Sentiments and nature of ESG volatility in emerging and developed markets

Ultimately, the study considered for the impact of investor sentiments on the volatility of ESG returns in both the emerging and developed market blocs. Although, the study found that investor sentiments significantly influence ESG volatility in emerging market bloc, more extensively, the findings further revealed that this influence varies across the individual markets within the emerging markets bloc. For instance, based on the results, it was depicted that the South African ESG market is most susceptible to the influence of investor sentiments. Contrarily, findings of the study suggest that the Indian ESG market volatility is least susceptible to the influence of investor sentiments.

In a like manner, whilst the revelations of the research noted that ESG volatility in developed market bloc is significantly impacted by investor sentiments, it was further observed that the significance of this impact varies across the member markets within the developed markets bloc. In this dimension, the research findings suggest that the UK ESG market is most susceptible to the influence of investor sentiments. Conversely, findings of the study suggest that the Canadian ESG market volatility is least susceptible to the influence of investor sentiments.

Studies such as Kumari and Mahakud (2015), Shahzad et al. (2017), Rupande et al. (2019), and Muzindutsi et al. (2023) have found a relationship between investor sentiments and volatility of returns in different markets. For instance, whilst Shahzad et al. (2017) noted that investor sentiment has a superior significant impact on commodity markets compared to economic uncertainty, Rupande et al. (2019) unveiled a significant connection between investor sentiment and stock return volatility, suggesting that behavioral finance can offer valuable insights into the behavior of stock returns on the Johannesburg Stock Exchange (JSE), South Africa. Additionally, Muzindutsi et al. (2023) extend the exploration of the influence of investor sentiment in the property market, found that positive changes in investor sentiments lead to increased property returns and decreased conditional volatility. However, the study of Dhasmana et al. (2023) found that ESG index is not affected by investor sentiment implying that investors show a certain level of apathy towards ESG initiatives adopted by companies. This was based on an investigation into the relationship between the ESG index and investor sentiment in India. Further finding uncovers an imbalanced link, demonstrating that the surge in the ESG index diminishes investor sentiment, whereas underperformance in the ESG index triggers sentiment.

4.5 Conclusions on Investor sentiment and ESG volatility

The chapter four of this dissertation investigated the nature of volatility of ESG volatility in emerging and developed markets, as well as the impact of investor sentiments on ESG volatility in emerging and developed markets. In this concluding section of the chapter, the research objectives vis-à-vis corresponding findings on the nature of ESG volatility and the relationship between ESG volatility and investor sentiments are reviewed. Thereafter, suggestions for future studies are highlighted.

4.5.1 Review of study objectives and findings

The goal of this chapter has been to determine the persistence of the volatility dynamics of the ESG and to determine the extent to which investor sentiment induces or moderates the degree of the persistence. Quite an important reference point for this chapter is the overwhelming evidence of autocorrelation and conditional heteroscedasticity previously reported in the previous chapter. To effectively explore this inclination, this chapter of the study expounded on the subject matter from two pivotal dimensions of inquiry: (1) to determine and compare the nature of ESG volatility in emerging and developed markets, and (2) to determine and compare the impact of investor sentiments on ESG volatility in emerging and developed ESG markets.

Thus, the study extended the preliminary analysis in the context of this chapter to include a graphical illustration of the ESG returns of each of the BICS and G7 member markets. Both the evidence of the presence of the ARCH effect as well as the graphical depictions of volatility clustering in the ESG returns series motivate our preference for the GARCH models as suitable for determining the degree of persistence of the volatility of ESG returns. Employing some of the model selection criteria in the literature, the results of analysis found the EGARCH and GJR-GARCH as the preferred variants of the GARCH model most suitable for modeling the volatility dynamics of the ESG returns. The empirical estimates from these models show the leverage effect is statistically significant in all of the BICS and G7 market blocs. Thus, compared to the negative shocks (bad news), the positive shocks (good news) have a larger impact on the volatility of ESG returns. On the whole, the degree of persistence of the volatility is predominantly low in the majority of the investigated markets, with the mean reversion process taking less than a day in most of the BICS and G7 markets. But, with the inclusion of investor sentiment in the model, the degree of persistence seems relatively higher. What is, however, not clear and largely unexplored is whether the dynamics of ESG return volatility in a particular country are due to financial and economic activities in other countries.

Thus, the innovation in the following chapter is to determine the spillover of the volatility of the ESG return among emerging (BICS) market bloc, the developed (G7) market bloc, and between the emerging market bloc and the developed market bloc. The goal is to determine whether a shock to the volatility of the ESG returns in a particular market or country spillovers to that of another market.

CHAPTER FIVE: ANALYSIS OF RETURN AND VOLATILITY SPILLOVERS OF ESG IN EMERGING AND DEVELOPED MARKETS

5.1 Introduction

At no better time in global history has there been a more conscious and concerted concern for ESG matters as witnessed in the year 2023. Commencing with the unprecedented corporate governance saga of OpenAI, where employees en-masse protested against the board's decision to fire the CEO – Sam Altman (Perrigo, 2023). The consciousness of ESG was even more evident in the recently concluded 2023 COP28, which recorded the largest participants ever since its inception (Nevitt, 2023; UnitedNations, 2023). With delegates from developed and developing countries concluded with agreements signaling the beginning of the end of fossil fuel era. Being supported with actionable plans to reduce methane emissions, expand renewable energy and establish a loss and damage fund to support developing nations dealing with the dire effects of climate change (Matthews, 2023). Whilst this stance generally amplifies that the future is green, it could further echo the ideals of globalisation and the reality of interdependencies among nations.

From a financial economics perspective, the interdependencies among countries and markets remain a domain that has aroused never-ending interest in academic research. This interest has been further intensified by the exponential rise in technology, communication and global investing, which seeks to understand how asset markets interact in order to gain insights and beneficial opportunities (Sironi, 2016). Technically, Trinh (2018) posits that co-movements among individual markets can be understood from the concept of " stock market interdependency", which comprises of economic integration, contagion effect and stock market characteristics. The phenomenon of increased stock market interdependency is explicated through the lens of economic integration, signifying that more integrated economies generate heightened levels of market interdependence (Muguto, 2021). Robust international trading ties within economically integrated regions contribute to an augmented degree of markets co-movement. A second pivotal factor contributing to this co-movement is the contagion effect, defined as alterations in stock market correlation arising from unforeseen shocks in foreign markets rather than shifts in economic fundamentals (Gulzar et al., 2019). This phenomenon, elucidated by Sewraj et al. (2018), Gkillas et al. (2019) and Yarovaya et al. (2022), captures co-movements not tethered to economic fundamentals. Informational and institutional factors, as delineated by Forbes and Rigobon (2002), play crucial roles in explaining the contagion effect. Lastly, beyond macroeconomic variables, characteristics like market volatility, market size, and industrial similarities are identified as potential contributors to regional and global market correlations (Trinh, 2018).

The examination of international stock market interdependence is distinguished by two crucial facets: the interdependence of the first moments, encapsulating return spillover effects, and the interdependence of the second moments, encompassing volatility transmissions (Trinh, 2018). Noteworthy contributions to the understanding of return spillovers have been made by seminal studies such as Hilliard (1979) and Errunza and Losq (1985), which have evaluated the degree of interdependence in returns. Yarovaya (2016) builds upon this foundation, defining return spillover as a scenario wherein changes in return in one market influence changes in return in another. Simultaneously, the conceptualization of volatility spillover involves changes in the volatility of one market affecting that of another. Yarovaya's (2016) work posits that spillover effects can manifest across both returns and volatility, with the intensity of these effects evolving over time. The notion of heightened spillover magnitudes, termed "bursts in spillovers," following a crisis shock, is indicative of contagion (Yarovaya, 2016).

In the pursuit of comprehending the mechanisms underlying spillover effects transmission, Huo (2018) draws on the work of Moser (2003) to elucidate the cross-country propagation of shocks not rooted in economic fundamentals. Moser identifies three primary activities driving spillover effects: international trade, counterparty defaults, and portfolio rebalancing. International trade emerges as a significant channel for shock and volatility propagation, particularly evident when economic crises, such as recessions or currency devaluations, in one country negatively impact trading partners' exports due to reduced demand and weakened price competitiveness (Muguto, 2021). The proximity of trade relationships accentuates the impact of such propagation mechanisms. Counterparty defaults, particularly in the banking sector, can trigger shock propagation, as substantial losses from defaults on foreign loans by major banks easily traverse borders (Buckley et al., 2020). Furthermore, portfolio rebalancing, prompted by liquidity and capital constraints, offers another lens for understanding spillover effects. Liquidity constraints may compel investors to sell assets for liquidity, while capital constraints drive banks to adjust capital ratios, potentially leading to cutbacks in foreign loans or a shift to low-risk assets to enhance capital-asset ratios (Flores, 2019).

The examination of return, shock, and volatility spillovers in financial markets is integral to comprehending the intricate dynamics of information transmission and various theoretical frameworks. Rooted in the Information Transmission Theory, scholars such as (Ross, 1989) and King and Wadhwani (1990) assert that the rate of information flow influences market volatility, establishing a foundation for understanding return and shock spillovers. In contrast, the “wake-up call” hypothesis by Goldstein (1998) introduces a distinct perspective, positing that a crisis in one country serves as a signal for investors to scrutinize similar countries' fundamentals more closely, thereby triggering informed adjustments rather than irrational contagion. Building upon this, Modern Portfolio Diversification Theory, as pioneered by Markowitz (1952), emphasizes the importance of diversification in managing return and volatility spillovers. The Efficient-Market Hypothesis (Fama, 1970) contends that spillovers are limited in an efficient market where prices instantaneously reflect available information. Behavioral Finance Theory, influenced by Kahneman and Tversky (1979), acknowledges the role of irrational behavior in generating return and shock spillovers. Lastly, the Adaptive Market Hypothesis (Lo, 2004) suggests that adaptive strategies lead to evolving return spillovers as the market adapts over time.

Thus, this chapter of the research study critically examines the nature of shock and volatility spillovers of ESG returns within and between different markets blocs of emerging and developed markets. To effectively achieve this, the chapter sought to actualize the third set of research objectives highlighted in the chapter one of this dissertation, which were: (1) to determine the nature of ESG return and volatility spillovers within the emerging markets, (2) to determine the nature of ESG return and volatility spillovers within the developed markets (3) to determine and compare the nature of ESG return and volatility spillovers between the emerging and developed ESG markets blocs. Using a variety of a multivariate Generalized Autoregressive conditional Heteroskedasticity (MGARCH) models, the study employed ESG index data and selected economic data over a sample period ranging 2011:01 to 2022:12 (See section 3.3.1 in Chapter 3). The rest of the chapter is outlined thus: Section 5.2, succinctly considers empirical studies and findings on the return and volatility spillovers within the emerging and developed markets. Additionally, relevant relative studies on return and volatility spillovers across emerging and developed markets based on several approaches were explored. Section 5.3, provides in-depth clarifications and justifications on the methodology and estimation procedures adopted. Section 5.4, covers the results for the preliminary tests, data analysis as well as complementary discussions. Section 5.5, concludes the chapter, proffers recommendations and offers suggestions for future studies, amongst which are considered in the subsequent chapters.

5.2 Empirical literature review

This section of the research provides an extensive review of empirical literatures on return and volatility spillovers across emerging and developed market blocs via a systematic approach. Herein, the empirical review considers diverse relevant literatures across applicable geographical blocs, as well as timeframes. In addition, based on the several techniques of analyzing spillovers, this section further provides an extensive review of empirical literatures based on the approaches that have been used by existing studies.

5.2.1 Empirical studies on return and volatility spillovers in Emerging markets

The literature on spillovers among stock markets, particularly focusing on BRICS countries, presents a comprehensive understanding of the interconnected dynamics of returns and volatility. This review synthesizes findings from various studies, emphasizing the methodologies employed, key outcomes, implications, and limitations.

5.2.1.1. Empirical evidence on spillovers in Emerging markets as a BRICS bloc

A number of critical studies have considered spillovers among emerging markets focusing on BRICS markets bloc conceptualization. Kumar (2013) delved into the returns and volatility spillovers between stock prices and exchange rates in India, Brazil and South Africa (IBSA) countries. Utilizing VAR frameworks and the Diebold-Yilmaz spillover measure, the study identifies bidirectional volatility spillovers between stock and foreign exchange markets. The results suggested the importance of considering the relationship between exchange rates and stock indices for effective portfolio management. Likewise, Syriopoulos et al. (2015) analyzed the risk-return properties of BRICS capital markets, emphasizing time-varying correlations and volatility spillovers with the US stock market. The VAR (1)–GARCH (1,1) framework reveals significant return and volatility dynamics between the US and BRICS stock markets, impacting efficient global portfolio diversification and risk management strategies. Similarly, Bagchi (2017) explored the relationship between crude oil price volatility and stock markets in BRIC countries. Employing an Asymmetric Power ARCH model, the study reveals an asymmetric response to positive and negative shocks, with a negative correlation between returns and volatility. The research extends the literature by considering the impact of declining crude oil prices on stock indices. The study of Panda and Thiripalraju (2018) investigated return and volatility spillovers among BRICS stock markets. Using VAR Granger causality tests and EGARCH models, they identified bidirectional and unidirectional return spillovers. Further noting that negative news negatively impacts volatility. More recently, Khan (2023) focuses on BRICS nations, evaluating the possibility of Indian stock market investors diversifying their portfolios within the group. The study of Khan (2023), employing Granger causality, VAR, and DCC-MGARCH techniques, indicates that stock market volatility spills over from the Indian market to other BRICS nations, suggesting limited opportunities for portfolio diversification.

In synthesizing these comprehensive studies on spillovers within the BRICS emerging markets, several overarching implications emerge. Kumar (2013) identification of bidirectional volatility spillovers underscores the need for a nuanced approach to portfolio management, integrating exchange rates and stock indices for optimal outcomes. Likewise, Syriopoulos et al. (2015) emphasis on time-varying correlations and volatility spillovers between the US and BRICS markets highlights the intricate dynamics impacting global portfolio diversification strategies and risk management. The exploration of crude oil price volatility asymmetric impact by Bagchi (2017) contributes to our understanding of the nuanced responses of BRIC stock markets to external shocks. Furthermore, the revelation of bidirectional and unidirectional return spillovers, coupled with the impact of negative news on volatility, underscores the directional nature of these dynamics (Panda and Thiripalraju, 2018). The recent study adds a contemporary perspective, suggesting limited opportunities for portfolio diversification within the BRICS nations, emphasizing the interconnectedness of market volatility across the bloc (Khan, 2023).

5.2.1.2 Empirical evidence of spillovers in emerging Asian and South American markets bloc

Some studies have inquired on spillover effects from the standpoint of emerging markets within South America and Asia regional bloc. Commencing with the works of Erten et al. (2012) which explored volatility spillovers in emerging markets including Brazil, Poland, Hungary and Turkey during the global financial crisis, employing the Multivariate BEKK methodology. The results indicate significant spillover effects, suggesting a high level of financial integration among the studied countries. The findings have implications for investors considering the inclusion of stocks from different emerging markets in their portfolios. Also, Chkili (2012) investigates the dynamic relationship between exchange rates and stock prices in emerging countries consisting of Brazil, Argentina, Mexico, Malaysia, Indonesia and South Korea. Using BEKK-MGARCH models, the study identifies a significant mean transmission from the foreign exchange market to the stock market in most emerging countries. Bidirectional shocks and volatility spillovers emphasize the importance of currency risk hedging strategies for international portfolio managers.

Focusing on emerging markets in Asia, the study of Kumar and Kamaiah (2017) adopted a wavelet approach to analyzed return and volatility spillover across selected Asian equity markets comprising of Bombay Stock Exchange, Hong Kong Shanghai Index (HSI), Korea Composite Stock Price Index (KOSPI), Amman Equity Index, Singapore Strait Time Index (STI) and Tokyo Stock Exchange NIKKEI 225. The study covers the period from 03/01/2000 to 31/12/2013. Findings indicate long-term co-integration among Asian markets, with identified potential leaders or followers. At intraweek scales, the study suggests the possibility of diversification, while long-term dynamics converge, cautioning against long-term diversification strategies. Similarly, Roni et al. (2018) concentrated on Asian emerging stock markets, encompassing Bangladesh, China, India, Malaysia, the Philippines, and South Korea. Their study spans the pre-crisis, crisis, and post-crisis periods, with a focus on the 2007∼2008 global financial crisis. Employing GARCH models, Granger causality tests, and generalized VAR models, the research uncovers distinct behaviors of return and volatility spillovers over time. The study finds heightened spillover indices during the global financial crisis, emphasizing the impact of external shocks on these markets. Investigating return and volatility spillover effects among Vietnam, Singapore, and Thailand stock markets, Trinh (2018) employed the MGARCH framework, the study reveals weak return linkages but significant volatility linkages. Notably, the findings suggest unidirectional shock transmission from developed markets (Singapore) to emerging markets (Vietnam, Thailand) and bidirectional volatility transmission. This study has implications for investors, policymakers, and the potential gains from international portfolio diversification.

More recently, using a vector autoregression with a bivariate GARCH-BEKK model, Hung (2019) sets out to explore the daily returns and volatility spillovers between China and four Southeast Asian countries, the study covers the pre- and post-2008 Global Financial Crisis periods. The key finding underscores the significant impact of Chinese market volatility on other markets in the sample, particularly during and after the crisis. This insight holds substantial implications for portfolio managers and institutional investors in shaping investment and asset allocation decisions. Hamid et al. (2020) extended the examination to emerging economies of Pakistan, China, Bangladesh, and India from January 2000 to December 2015. Multivariate GARCH and causality models are employed to identify spillover effects. The study identifies significant spillover from Pakistan to India and from India to China, with larger negative shifts in volatility occurring more frequently than positive shocks. This emphasizes the dominance of own market dynamics in shaping volatility during the studied period. Furthermore, Habiba et al. (2021) delved into the dynamics of volatility spillover among Asian emerging stock markets from January 2002 to December 2017. Using an extended EGARCH model, the study uncovers bidirectional and asymmetric volatility spillovers. Notably, China exhibits statistically insignificant spillovers to certain markets. The study underscores the implications for global investors, portfolio managers, and policymakers in understanding return linkages and volatility spillovers among Asian emerging financial markets. Likewise, Ahmed et al. (2022) inquired on the dynamics of return linkages and volatility spillovers among Asian emerging stock markets, including China, Hong Kong, Japan, Malaysia, Pakistan, and South Korea. Employing a bivariate EGARCH (1) model, the study covers the period from January 01, 2010, to December 31, 2018. The findings illuminate statistically significant own lagged spillovers and asymmetric volatility spillovers in most cases, underscoring the interrelated nature of these markets.

5.2.1.3 Empirical evidence of spillovers in emerging African Markets bloc

The exploration of return and volatility spillovers within and across diverse emerging African markets has been a subject of growing importance in financial research. Korkmaz et al. (2012) initiate this discourse by shedding light on the CIVETS group - Colombia, Indonesia, Vietnam, Egypt, Turkey, and South Africa. Originating in 2009, CIVETS represents frontier emerging markets with dynamic economies. The study employs causality-in-mean and causality-in-variance tests to delve into return and volatility spillovers. While contemporaneous spillover effects are generally low, the study unveils the presence of intra-regional and inter-regional return and volatility interdependence effects, offering insights into the dynamics of this emerging market constellation. Additionally, Fowowe and Shuaibu (2016) contribute by examining the dynamic interdependence and integration between South African, Nigerian, and international equity markets. The study employs a generalized VAR framework, uncovering substantial return and volatility spillovers within and between markets. Notably, the findings highlight greater interdependencies with Asian markets than with European markets, emphasizing the need for enhanced financial integration within Africa. Furthermore, Fowowe (2017) expanded on the intricate relationship between oil and stock markets in Nigeria and South Africa. Employing an innovative spillover index methodology, the study uncovers bi-directional, albeit weak, interdependence between stock markets and oil markets in both countries. The time-varying total spillover plots for returns and volatilities reveal patterns observed in other studies, emphasizing the changing dynamics during crisis and non-crisis periods. Likewise, Vardar et al. (2018) employ a VAR-BEKK GARCH model to scrutinize shock transmission and volatility spillover effects among daily stock market indices and commodity spot prices in advanced and emerging markets. Their findings, covering the pre-crisis, crisis, and post-global financial crisis periods, indicate bidirectional spillover effects between stock and commodity returns. Importantly, the study highlights that the post-crisis era witnesses an increase in significant spillover effects, indicating that shock transmission and volatility spillovers have become the "new normal" for stock and commodity markets.

More recently, Claassen (2019) thesis explores return and volatility spillovers across major African equity markets, employing both time and frequency-domain approaches. Notably, the study reveals moderate return connectedness but significant volatility connectedness. South Africa and Egypt emerge as net transmitters, while Morocco, Nigeria, and Tunisia are net receivers. The analysis over time indicates increasing interconnectedness, with spikes during crises. Robustness checks across different frequency windows support the central tenets of the findings, emphasizing the evolving nature of African equity market connectedness. Adopting various econometric techniques, Panda et al. (2019) delve into stock market interdependence and volatility spillover in the Africa and Middle East region. The study unveils non-uniform interlinkages across the region, with certain markets, such as Israel, South Africa, and Jordan, exhibiting higher connectivity. The study also emphasizes the co-integration of stock markets and provides insights into the key drivers of market connectedness, offering valuable information for firm managers and international investors. In a similar vein, Were (2020) investigated this phenomenon in East Africa, emphasizing the importance of low spillovers for effective international portfolio diversification. The study focuses on NSE, USE, DSE, and RSE, employing E-GARCH and GJR-GARCH models. Notably, findings reveal volatility asymmetry and persistence, suggesting that turbulence takes time to settle. The study recommends further analysis using regime-specific models or Granger causality to enhance our understanding of volatility spillovers in East African markets. Utilizing a network methodology, the research of Atenga and Mougoué (2021) study delves into the transmission of international and regional shocks to African equity markets. The findings highlight heterogeneous and time-varying effects on African markets. Bidirectional spillovers underscore African markets as net receivers, with volatility shocks spreading more vigorously than return shocks. The study emphasizes the role of global factors, such as oil and metal prices, as key channels for foreign shocks to African stock markets.

5.2.2 Empirical studies on return and volatility spillovers in Developed markets

A number of relevant studies have considered spillovers among developed markets with emphasis on the G7 markets bloc conceptualization.

5.2.2.1 Empirical evidence from Developed markets Early studies – 2000s

Beginning with the study of Kanas (2000) which investigated interdependencies between stock returns and exchange rate changes in six industrialized countries via a bivariate EGARCH model, volatility spillovers from stock returns to exchange rate changes was observed among the developed markets except for the German stock market. These spillovers are symmetric, and no evidence is found for spillovers from exchange rate changes to stock returns. The results suggest increasing integration in international financial markets, particularly in the transmission of volatility from stock returns to exchange rate changes. Furthering this discovery, Baele (2005) inquired on the globalization and regional integration effects on equity market interdependence in Western Europe. Employing a regime-switching model, the author analyzed the volatility spillovers among 13 local European markets, the European Union and American markets. Findings of the study reveals substantial increases in spillover intensity over the 1980s and 1990s. it was further suggested that the rise could be attributed to increased trade integration, equity market development, and low inflation. Likewise, Baur and Jung (2006) explored the contemporaneous correlation and spillover effects between the U.S. and German stock markets. Based on intra-day data for the Dow Jones Industrial Average and Deutsche Aktienindex, the study found that foreign daytime returns influence domestic overnight returns, further emphasizing the importance of institutional peculiarities in market spillover analysis.

5.2.2.2 Empirical evidence from Developed markets 2010s – 2020s

Taking in to account the studies carried out 2010-2020, focusing on Exchange-Traded Funds (ETFs) in Canadian and U.S. equity markets, Krause and Tse (2013) provided insights into price discovery and volatility spillovers of American and Canadian ETFs. The research noted that whilst volatility spillovers are largely bidirectional between the developed markets, it was observed that asymmetry in volatility created feedback effects, which stressed the cruciality of American market conditions for Canadian circuit-breakers. In another study, KARĞIN et al. (2018) evaluated the volatility spillover effects of German, French, and American stock markets on the Turkish stock market index. Utilizing the E-GARCH (1, 1) and Threshold VAR (TVAR) methods, the study observed that volatility spillover effect on the Turkish stock market (BIST 100 index) was low during low global risk regimes and higher during high-risk regimes. Further investigation noted that the United States (US) S&P 500 index was the most influential index affecting BIST 100 under both high and low-risk conditions. Likewise, while utilizing a multivariate generalized autoregressive conditional heteroskedasticity (MGARCH) model, Alfreedi (2019) studied the nature of spillover of returns, information, and volatility between developed countries such as the United States, United Kingdom, and Gulf Cooperation Council (GCC) countries. Upon investigation, the research identified positive correlations in GCC markets and significant cross-information spillover effects between Qatar and Oman. extending the exploration spillovers to international crude oil and financial markets, Chang et al. (2019) analyzed the conditional correlations and co-volatility spillovers between in the U.S, the UK, and Chinese markets. By examining co-volatility spillovers, the study sought to identify sources and magnitudes of volatility spillover among these significant global markets. Results of the study suggest that the Chinese markets differ from both the American and British markets, implying the possibility of dynamic hedging strategies.

Constructing volatility spillover indexes for major global stock market indexes using a DCC-GARCH framework, Gamba-Santamaria et al. (2019) identified net positions of countries as either transmitters or receivers, varies over time based on volatility intensities. The study further noted that although the Chinese stock market grows, it remains a net receiver of volatility spillovers, highlighting the evolving dynamics of global financial interconnectedness. More so Jain and Sehgal (2019) conducted a comprehensive examination of price discovery and volatility spillover among eight mature market economies (MMEs) comprising of the G7 nations and Australia . The study which utilized multivariate GARCH (MGARCH) models, investigated spillovers across three critical periods—pre-global financial crisis (GFC), during the crisis, and post-crisis. In general, the study evidenced a high asymmetric dynamic conditional correlation (ADCC-EGARCH) coefficients are high between Australia and Japan, and among European Union. More specifically, it was observed that, Italy and the U.K. lead in price discovery during pre-crisis and crisis periods, respectively, emphasizing regional patterns in information linkages. However, it observed that the U.S. was negatively associated with other developed markets, except Canada which was uncorrelated. The study of Spulbar et al. (2019) contributed to the understanding of long-term behavior of developed markets, focusing on the USA, Canada, France, and the UK. Adopting a financial econometrics approach, the study explored volatility spillovers, dynamic causal linkages, and international contagion patterns in stock markets. The GARCH model identified a consistent pattern in the stock markets of the US, UK, France, and Canada. This pattern is characterized by continuous volatility, a high degree of shocks, and ambiguity in transmitting trends. Although the S&P TSX index (Canada) exhibited greater volatility, it also depicts a remarkable capacity to rebound from negative shocks, as seen by its significant upward movement and degree of changes. The FTSE 100 index of the UK has achieved the second position in terms of being a positive market, indicating a lower level of significant fluctuations in typical market transmission patterns. Regardless, it was concluded that amongst the developed markets bloc, the US market remains a favorable option for achieving positive outcomes and a greater likelihood of safer investments.

5.2.2.3 Empirical evidence from developed markets 2020s – Present

Maraqa and Bein (2020) examined the dynamic interrelationship and volatility spillover among sustainability stock indices (SSIs), international crude oil prices, and major stock returns of European oil-importing and oil-exporting countries. Whilst the oil-importing countries include: Italy, United Kingdom, France, Germany, Netherlands and Switzerland, the oil-exporting countries were: Russia and Norway. Using the DCC-MGARCH model, the study identified varying degrees of correlation and significant volatility spillovers. It was found that SSIs have a stronger association with nations that import oil, while oil-exporting countries showed a stronger correlation with the oil market. Additionally, the link between oil and stock returns significantly increased during and after the global financial crisis. These findings suggest the presence of substantial volatility transmission between the returns of sustainable stocks, global oil prices, and the primary indices of nations that import or export oil. Using a time-frequency framework, Su (2020) investigated the evolution and determinants of volatility spillover dynamics in G7 stock markets Decomposing volatility spillovers into short-, medium-, and long-term components, the study found that volatility spillovers are crisis-sensitive and closer to a memory-less process. Further noting that the contributing factors have different effects on short, medium, and long-term volatility spillovers, and the results suggest the absence of a systematic pattern. Similarly, Tiwari et al. (2021) explored oil–stocks return and volatility connectedness across major stock markets such as the SPTSX, NYSE, DAX,FTSE, CAC40, SPX et cetera, utilizing the Diebold and Yilmaz (2012) spillover index. The study which assessed the overall spillover index sensitivity to different lag structures and forecast horizons, highlighted dynamic and volatile characteristics in returns and volatility series across major markets, with specific markets identified as net receivers or contributors in return spillovers.

With reference to the COVID-19 pandemic, Salisu et al. (2021) analyzed return and volatility transmission between health and tourism stocks in the United States of America, particularly during the COVID-19 pandemic. Adopting the VARMA–CCC-AGARCH model to identify bidirectional return spillovers and of health stocks for risks associated with tourism stocks the study used data from January 02, 2018 and July 09, 2020, in partition of full period, pre-covid-19 and covid-19 periods. The finding underscored a significant bidirectional transmission of negative returns between the health and tourism sectors, especially during the COVID-19 pandemic.

Employing a tail-based approach to study the propagation of stock volatility shocks within a system, Bouri and Harb (2022) analyzed 5-minute data on six major stock market indices from February 14, 2000, to September 30, 2021, the study revealed that the size of volatility shocks affects spillovers. The study further introduced the Relative Intensity of Shock Spillover (RISS) measure to capture the heterogeneity and intensity effects of shock size, hereby highlighting the importance of considering the magnitude of shocks. The findings indicate that the spread of volatility shocks throughout the system is influenced not only by the nature of the shocks (positive vs negative volatility) but also by their magnitude. Also, evidence of variation in the extent of spillovers between the higher and middle quantiles for both positive and negative volatility spillovers were observed. Ma et al. (2022) delve into the relationship between economic policy uncertainty (EPU) and stock market volatility in G7 countries. Employing a Fourier transformation, the study provides a clear understanding of the spillover characteristics, emphasizing the impact of major economic events such as the financial crisis and Brexit on the level and duration of EPU spillovers. Results of the analysis revealed that the impact of Economic Policy Uncertainty (EPU) on stock market volatility is significant in the United States, Japan, and Canada. Furthermore, there are notable parallels in this spillover effect across these regions. More so, it was further noted that the Economic and Monetary Union (EMU) has more pronounced spill-over effects on the stock markets of France, Germany, and Italy, particularly within a time frame of 3-18 months. Lastly, it was reported that significant economic events, such as the financial crisis and Brexit, have led to an increase in the degree and duration of economic policy uncertainty (EPU) spillover.

Charda and Pendaraki (2023) extended the exploration of spillover effects to international stock indices, providing valuable insights for policymakers by unraveling the dynamics during normal periods and crises. Employing a Vector Autoregression (VAR) framework, the study reveals the intricate relationships among major international stock indices. Based on the econometric results, it was revealed that there is a significant correlation between the German DAX30 and the British FTSE100 indices and the Greek ATX and the Portuguese PSI20 indexes. Howbeit, it was further observed that this effect becomes less prominent when more lags were considered. Also, it was discovered that the French CAC40 index exhibited a declining negative effect on the Greek and Portuguese indices. Similarly, while a negative effect was observed between the Argentinian stock index and both the Italian and Spanish market indices, a positive effect was noted in the case of the Argentinian, Greek and Portuguese indices.

5.2.3 Empirical studies on return and volatility spillovers across Emerging and Developed markets

A plethora of studies have considered the subject matter of return and volatility spillovers across emerging and developed markets using several models and approaches. An extensive review of empirical literatures identified the approaches that have been used by existing studies. This section of the discusses return and volatility spillovers across market blocs thematically captioned based on applicable methodical approaches.

5.2.3.1 Empirical Studies on the Correlation and Co-integration approach

The correlation and co-integration approach play a crucial role in modeling return and volatility spillovers, providing insights into the dynamic interactions among financial assets. Whilst correlation measures the degree to which two variables move together, co-integration reflects the long-term equilibrium relationship between them. Although, Engle and Granger (1987) introduced the concept of co-integration and applied it to financial time series, Johansen (1988) extended this work by developing a framework for testing co-integration, which has become widely adopted in empirical studies.

The correlation and cointegration models have been used for understanding spillovers and market interdependencies by various scholars such as

Using a multivariate cointegration analysis model, Sakthivel (2012) examined the dynamic interdependencies among global stock markets in Asia, Europe, and America. The study which considered twelve stocks from both emerging and developed markets over a twelve-year period, investigated both the short- and long-term relationships using models such as the Johansen-Juselius cointegration, Vector Error Correction model (VECM) as well as the Impulse Response Function (IRF). Upon analysis, findings of the VECM indicate that the stock markets in the United States, as well as some European and Asian markets, have a significant influence on the Indian stock market. Likewise, the co-integration test indicated a robust co-integration link among worldwide stock price indexes. Ultimately, the data indicates that the influence of the US market on Indian stock returns is far greater than the reverse scenario. Focusing on stock markets in Central and South America, Panda and Nanda (2017) explored the plausible linkages and correlations subsisting in the American markets. Also, adopting the Johansen-Juselius cointegration, Vector Error Correction model (VECM) as well as the variance decomposition analysis. The cointegration test validates the existence of a long-term equilibrium link among the prominent stock markets in the region, as asymmetries in the stocks conditional correlations were observed. Empirically, while it was further found that Chile, Peru, and Venezuela markets are most dynamically linked, the VECM revealed that the returns of stock markets in Argentina, Brazil, Chile, and Venezuela are significantly interdependent. This suggests a stronger connection among national markets.

Referencing the 2007/2008 Global Financial Crisis, Sehgal et al. (2018) inquired on information transmission, price discovery and volatility spillovers in pre, during and post crisis periods among eight emerging and eight developed markets. Using the Johansen cointegration test, the study noted that all developed markets are cointegrated with the Chinese market in the pre-GFC period. Furthermore, with the exception of a link between South Africa and developed markets in Europe, the co-efficient of the asymmetric dynamic conditional correlation (ADCC-GARCH) indicated a cointegration trend among emerging markets and developed markets. Rehman et al. (2021) conduct a comprehensive analysis of stock market integration in Asian developed and emerging markets, focusing on Japan (Nikkei 225), South Korea (KOSPI), Pakistan (KSE 100), China (SSE Composite), Sri Lanka (ASPI), India (BSE 200), and Malaysia (KLSE Composite) over a 19-year period from January 2001 to December 2019. Employing a robust methodology involving Descriptive Statistics, Correlation Matrix, Unit Root Test, Johansen Co-Integration Test, Vector Error Correction Model, Granger Causality test, Variance Decomposition, and Impulse Response Function (IRF), the study unravels short-run, long-run, and causal relationships among these markets. The study further noted a cointegration relationship which was confirmed by the Granger causality, Variance Decomposition, and IRF. Finding both short-term and long-term linkages in these markets, implies that there are limited diversification benefits for international investors but potential short-term advantages.

More recently, in the exploration of the dynamic interactions between house prices, stock markets, and exchange rates in the Iranian economy, Mahmoudinia and Mostolizadeh (2023) conducted a meticulous investigation spanning from April 2004 to March 2019. Augmenting their base model with control variables such as real interest rate, real GDP, and FDI, the study employs the Autoregressive Distributed Lag (ADRL) and Nonlinear Autoregressive Distributed Lag (NARDL) models, building upon the works of Lean and Smyth (2014), Ali and Zaman (2017), and Coskun et al. (2017). Whilst the findings unveiled a cointegration relationship between housing market prices and determinants, the linear model further highlighted positive short- and long-run effects of exchange rates and stock market prices on real estate inflation. Additionally, GDP was identified as a stimulant for housing prices in both temporal domains, whereas FDI and real interest rates exhibit opposing effects. The introduction of an asymmetric/non-linear model reveals rejection of the null hypothesis of no cointegration, indicating the presence of asymmetries in the relationships. Specifically, the study identifies asymmetric short- and long-term effects of stock prices and an asymmetric long-run impact of real exchange rates on real estate prices in Iran.

5.2.3.2 Empirical Studies on the Network Analysis approach

Network analysis has emerged as a powerful approach for modeling return and volatility spillovers, offering a holistic understanding of the complex interconnectedness among financial assets. This approach allows researchers to explore the structure of relationships, identify key players, and comprehend the transmission mechanisms in financial markets. The literature on financial interconnectedness and network analysis presents a rich landscape of studies, each contributing unique insights into the complex relationships within financial systems.

The landmark research of Diebold and Yılmaz (2014) delve into the network topology of variance decompositions, offering a clinical examination of the connectedness among financial firms. Their empirical findings provide a detailed understanding of the network structure of variance decompositions, enabling a distinct assessment of interconnectedness. The study introduces measures to quantify connectedness, fostering enhanced risk management strategies and serving as a foundation for targeted regulations to mitigate systemic risks and informing policies that are critical to improving the stability of the financial sector.

Shifting focus to a broader application of network analysis in economics and finance, Kenett et al. (2015) employed empirical methods to uncover intricate patterns of connections among entities, contributing to the understanding of relationships and interactions within economic and financial systems. The multifaceted implications of this research extend to economic and financial policy, risk management strategies, and insights into market behavior for various stakeholders. Utilizing the connectedness network approach, Geng et al. (2021) researched on the returns and volatility system networks of global new energy companies. Results of the empirical investigation revealed a high total information spillover degree among these companies, particularly in the volatility system. Also. highlighting asymmetric effects in the information transmission mechanism, the study emphasized the impact of bad news on systemic risk. More particularly, it was deciphered that certain new energy companies emerge as net information transmitters, signifying their importance in the networks. These findings have direct implications for investors in the new energy sector, guiding portfolio development and risk management.

Whilst exploring the impact of the COVID-19 pandemic on 51 major stock markets, including both emerging and developed economies, Samitas et al. (2022) adopted a bivariate network analysis approach, to distinguishes countries susceptible to shock transmissions and those resilient during the lockdown. The evidence presented underscores the instantaneous financial contagion triggered by lockdown measures and the spread of the novel coronavirus. Although, the research sheds light on volatility and contagion risks inherent in stock markets during the pandemic, a distinctive feature of the study relates to its emphasis on network topologic metrics within financial networks, a facet often overlooked in prior research especially from the standpoint of the COVID-19 pandemic. Similarly, Cheng et al. (2022) inquired on the repercussions of the COVID-19 pandemic on the interconnectedness network of stock market volatility across 19 global markets comprising of both emerging and developed economies. Building on the Diebold-Yilmaz volatility network model, the authors developed a volatility spillover index and utilized a lag sparse group LASSO to address the challenges posed by a high-dimensional system. Empirical findings from the inquiry revealed a heightened overall volatility connectedness following the outbreak of the pandemic, with global connectedness remaining substantial throughout 2020. Of noteworthy, it was observed that the connections across different continents strengthen during this period, emphasizing the impact of the pandemic on the global financial landscape. However, it was further found that China emerged as an exception, remaining disconnected from the global volatility connectedness network until late November 2020, and challenging the narrative of China as the primary source of volatility spillover during the COVID-19 pandemic.

The recent study of Gong et al. (2023) proposed a multiplex network to investigate volatility information transmission among global financial markets. Through a spillover index in the variance decomposition framework, the study examined the connectedness of global volatility, distinguishing between realized variance, implied variance, and variance risk premium. The outcome of the investigation highlighted the differences in information transmission mechanisms among the layers, with implications for global risk management and prevention. It was revealed that European and US markets emerge as the main spillover emitters, while Asian markets predominantly act as spillover recipients.

5.2.3.3 Empirical Studies on the Granger Causality tests approach

The Granger causality tests approach is a widely used methodology in the domain of financial economics for modeling return and volatility spillovers among various assets or markets. Originally developed by Nobel Laureate Clive Granger in 1974, this approach assesses the causal relationships between time series variables such as financial markets. Within the context of spillovers, some relevant studies that have adopted this approach.

In an examination of the causal effect of volume on stock returns and conditional volatility, Kumar and Thenmozhi (2012) employed a comprehensive approach encompassing both linear and non-linear dynamics. Utilizing the vector autoregression-based Granger causality framework for linear causality and a bivariate noisy Macke-Glass model for non-linear causality, their research provided insights into the relationship between trading volume, returns, and volatility. The study revealed a unidirectional causality from returns to volume and from volatility to volume, challenging the notion that trading volume Granger causes returns and volatility. Affirming the noise trader model, the research findings further offered a partial backing to the sequential information model hypothesis, and contradicted the efficient market hypothesis.

In an extensive exploration of financial market spillovers on a global scale, Dimpfl and Jung (2012) examined the return and volatility dynamics of futures data from the Dow Jones Euro Stoxx 50, S&P 500, and Nikkei 225. Applying a Structural Vector Autoregressive (SVAR) model to separately model devolatized returns and realized volatilities, this approach considered the specific sequential time structure of trading venues, allowing for a detailed analysis. The study evaluated hypotheses using Granger causality tests, Impulse Response (IR) functions to study short-run dynamics in the three markets, and variance decomposition to find leadership impacts. Key findings indicated weak and short-lived return spillovers, specifically from the USA to Japan. Although, volatility spillovers were more pronounced and persistent internationally, the home market played a pivotal role in influencing both returns and volatilities, with foreign markets contributing less to returns than to volatility.

Focusing on understanding the structure of return spillovers through the lens of Granger causality networks, Výrost et al. (2015) analyzed the daily closing prices of twenty stock markets from four continents from January 2, 2006, to December 31, 2013. The study, involving over 94 sub-samples, yielded three key findings. Firstly, there was a discernible decline in the impact of the US stock market post the recent financial crisis. Second, the spatial Probit models underscored the significance of temporal proximity between market closing times, highlighting that the time distance between national stock markets played a crucial role in return spillovers. Third, the study identified a preferential attachment among stock markets, emphasizing that the probability of spillover effects between any two markets increased with their degree of connectedness to others.

Likewise, Roni et al. (2018) conducted a thorough investigation into the dynamics of return and volatility spillovers in the Asian emerging stock markets, encompassing Bangladesh, China, India, Malaysia, the Philippines, and South Korea.. Employing daily stock market index data, the research utilized GARCH (Generalized Autoregressive Conditional Heteroscedasticity), pairwise Granger causality tests, and forecast error variance decomposition within a generalized VAR (Vector Auto Regression) framework. The study revealed distinct behavioral patterns of volatility and return spillovers over time, particularly during pre-crisis, crisis, and post-crisis periods. More so, whilst the interaction among Asian emerging stock markets was found to be less pronounced before the global financial crisis, the return and volatility spillover indices peaked significantly during the tumultuous period of the global financial crisis in 2007–2008, with the Bangladeshi market experiencing a similar condition in 2009–2010. Adopting VAR Granger causality tests among stock indices to discern return spillover effects, Panda and Thiripalraju (2018), sought to explore the dynamics of return and volatility spillovers among the stock markets of the BRICS nations – Brazil, Russia, India, China, and South Africa. Results of the investigation evidenced the existence of both bidirectional and unidirectional return spillovers, with negative news impacting the volatility of these nations' stock markets. Intriguingly, the study demonstrated that diversification did not provide economic value from the stock markets of India, Russia, and Brazil to the stock market of China.

In their comprehensive analysis, Zhong et al. (2019) shed light on the spillover effects between oil and natural gas prices, presenting evidence drawn from both emerging and developed markets. Spanning the timeframe from December 2001 to June 2017, the study employed a Granger causality test alongside the Diebold and Yilmaz (2012) spillover index to scrutinize the interconnectedness in energy markets, focusing on the USA, Europe, and China. The key findings of the research emphasized the substantial Granger causality present in oil and natural gas markets. More specifically, it was reported that emerging markets emerged as influential players, exerting a significant impact on various developed markets in terms of both return and volatility spillover systems. Also, the time-varying characteristics of the spillover index between different markets, coupled with its robust correlation with specific events, were highlighted.

5.2.3.4. Empirical Studies on the Time-Frequency Analysis approach

The Time-frequency analysis is an essential approach for modeling return and volatility spillovers, offering insights into the dynamic nature of financial markets. This method allows researchers to investigate how these spillovers evolve over different time horizons, providing a more nuanced understanding of market interactions. Several academic studies have employed time-frequency analysis to study return and volatility spillovers, contributing to the broader literature in finance and economics.

Beginning with the seminal work of Diebold and Yilmaz (2012) which presented a methodological advancement in the measurement of volatility spillovers within a generalized vector autoregressive framework, ensuring forecast-error variance decompositions' invariance to variable ordering. The study applied these measures to assess both total and directional volatility spillovers across the American stock, bond, foreign exchange, and commodities markets spanning January 1999 to January 2010. Findings revealed that despite substantial volatility fluctuations in all four markets throughout the sample period, cross-market volatility spillovers were relatively limited until the onset of the global financial crisis in 2007. As the crisis unfolded, the intensity of volatility spillovers heightened, with particularly significant spillovers originating from the stock market to other markets following the collapse of Lehman Brothers in September 2008. The outcome of the study offered significant contributions in the understanding of volatility spillovers dynamics, from the purview of financial markets interconnectedness during times of crisis. This was followed by the groundbreaking work of Barunik et al. (2016), who introduced an innovative approach to modeling and forecasting exchange rate volatility, particularly emphasizing the time-frequency domain and utilizing high-frequency data. Herein, the authors proposed a forecasting model based on Realized GARCH, incorporating multiple time-frequency decomposed realized volatility measures. This approach allowed for a thorough exploration of the influence of different timescales on volatility forecasts, providing insights into the behavior of traders at corresponding investment horizons. In addition to this, the methodology also addressed the impact of jumps, introducing a jump wavelet two-scale realized volatility estimator. The study further proposed realized Jump-GARCH models, estimated through both maximum likelihood and an observation-driven estimation framework of generalized autoregressive score.

In their comprehensive study, Kumar and Kamaiah (2017) employed a wavelet approach to investigate returns and volatility spillovers across selected Asian equity markets. Utilizing wavelet multiple correlation and cross-correlation, the analysis incorporated daily return data from prominent equity markets, including Bombay Stock Exchange SENSEX, Tokyo Stock Exchange NIKKEI 225, Hong Kong Shanghai Index (HSI), Amman Equity Index, Korea Composite Stock Price Index (KOSPI), and Singapore Strait Time Index (STI), spanning from March 1, 2000, to December 31, 2013. The findings revealed the long-term co-integration of Asian markets. Particularly, it was observed that a substantial portion of each market's volatility pattern at the intraweek scale could be attributed to individual shocks. However, over the long run, the dynamics of market volatility shifted as the extent of spillover increased. Furthermore, the wavelet multiple cross-correlation values identified two developed markets, STI and HSI, as potential leaders or followers within the group. Interestingly, the analysis indicated relatively low volatility spillover across the studied markets at high frequency, hereby suggesting possibilities for diversification at a daily to intraweek scale.

Employing the methodology proposed by Baruník and Křehlík (2018), Mensi et al. (2021) critically examined the volatility spillovers across developed (Australia, Canada, France, Germany, Japan, UK, and US) and emerging BRICS (Brazil, Russia, China, India, and South Africa) stock markets, alongside strategic commodity futures markets (oil and gold). The study unveiled compelling evidence of time-varying volatility spillovers, which were found to intensify during major events. Remarkably, the total volatility spillovers exhibited higher magnitudes in the short term compared to both intermediate and long terms. Utilizing a portfolio analysis, the authors demonstrated that a mixed portfolio comprising both commodity and stock markets enhances hedging effectiveness across both emerging and developed markets. It was observed that irrespective of frequencies, BRICS markets exhibited higher hedging effectiveness compared to developed markets. Furthermore, the study highlighted that hedging effectiveness was more pronounced using gold than oil and was more effective in the short term as opposed to both intermediate and long terms. Expounding on the discourse, Pinho and Maldonado (2022) undertook an empirical exploration of the intricate relationship between shocks in commodity markets and stock markets. Using a total volatility connectedness measure, the study delved into the dynamics of shocks impacting oil, gold, copper, and agricultural commodity markets in conjunction with emerging and developed stock markets. This was done via a thorough analysis in both time and frequency domains, the authors quantified market linkages through volatility spillovers spanning from 2004 to 2021. Upon investigation, it was determined that the relationship between return and volatility change over time and are vulnerable to significant external shocks. More precisely, the results indicated that slightly over 35% of the total variance of forecast errors was elucidated by market shocks from January 2004 to June 2021, and the impact of equity market shocks to other markets surpassed that of commodities in both volatility and returns. Additionally, it was found that the total link between market returns was more pronounced in the short run compared to the long run, while for volatility, the long-run frequencies concentrated the market link.

In a more recently conducted inquiry, Mensi et al. (2023) explored the intricate dynamics of dynamic return spillovers and connectedness networks across international stock exchange markets, focusing on the asymmetry between positive and negative returns. Adopting the spillover index introduced by Diebold and Yilmaz (2012), the study quantified volatility spillovers for total, positive, and negative volatility. The findings revealed time-varying and asymmetric volatility spillovers among the examined stock markets. Notably, during the COVID-19 pandemic, bad volatility spillovers took precedence and were more pronounced than good volatility spillovers, underscoring the prevalence of contagion effects. The study further identified a connection between confirmed COVID-19 cases and the nature of good and bad spillovers, with positive (negative) effects observed under low and intermediate (upper) quantiles. Additionally, the number of COVID-19 deaths exerted influence on both types of spillovers across various quantiles, adding depth to our understanding of the impact of the pandemic on financial market dynamics.

5.2.3.5. Empirical Studies on the GARCH Family approach

The Generalized Autoregressive Conditional Heteroskedasticity (GARCH) models have been a fundamental approach in modeling return and volatility spillovers in financial markets. These models capture the time-varying nature of volatility, allowing researchers to understand the dynamic interactions between different assets. Numerous academic studies have utilized GARCH models to investigate return and volatility spillovers, contributing valuable insights to the field of finance and economics.

Early studies by Bhar and Nikolova (2007) analyzed the integration of BRIC countries on a regional and global basis, focusing on daily equity index level data using a GARCH (1,1)-in Mean model. The study concludes that a high degree of integration exists between BRIC countries and their respective regions, particularly due to regional trends. However, China stands out with a negative relationship between volatility spillover effects on a regional and global basis, suggesting diversification opportunities. In parallel, the study conducted by Joshi (2011) investigates the return and volatility spillovers among Asian stock markets, including India, Hong Kong, Japan, China, Jakarta, and Korea, during the period from February 2, 2007, to February 29, 2010. Employing a six-variable asymmetric GARCH-BEKK model, the research inquiry sought to unravel the bidirectional return, shock, and volatility spillovers prevalent among the studied stock markets. The findings of the study indicated a low magnitude of volatility linkages, signifying weak integration within the Asian stock markets. More precisely, it was determined that Japan exhibits the highest overall volatility persistence, emphasizing the potential diversification benefits and risk spread in such a weakly integrated environment.

Utilizing an unrestricted bivariate GARCH-BEKK representation and VAR models, Manex (2011) conducted a two-fold study on the co-movement and volatility spillover between American and South African stock markets. Outcome of the study highlighted return spillovers from NYSE to JSE and a persistence in the volatility spillover. More so, it was observed that the direction of transmission is from NYSE to JSE, indicates a strong influence of the American. market on the South African market. Leveraging on asymmetric multivariate GARCH model, the research of Li and Giles (2015) found significant unidirectional shock and volatility spillovers from the American market to both Japanese and Asian emerging markets. This discovery was based on the examination of the linkages of stock markets across the USA, Japan, and six Asian developing countries over a significant period from January 1, 1993, to December 31, 2012. However, the focus of the study was restricted to the understanding of shock and volatility spillovers in these markets rather than return spillovers.

Focusing on selected emerging and developed markets in Europe, Yavas and Dedi (2016) investigated linkages among equity returns and volatility spillovers in Germany, Austria, Poland, Russia, and Turkey, using MARMA and GARCH methodologies. The results of the research investigation identified a significant co-movement of returns among countries, with Turkey and Russia experiencing higher volatility. This suggests the possibility of spillover effect among markets that share a common bloc. Likewise, Yarovaya (2016) contributes to the literature with a comprehensive dissertation examining intra- and inter-regional transmission of information across developed and emerging markets. Using a generalized vector autoregressive framework, the study emphasizes that markets are more susceptible to domestic and region-specific volatility shocks than to inter-regional contagion. The findings of the study have dire implications for international portfolio diversification, as it highlights the cruciality of spillovers in global investing.

Examining the financial cointegration and spillover effects of the global financial crisis on emerging Asian financial markets, Gulzar et al. (2019) found evidence of long-term cointegration between the U.S. market and emerging stock markets, with increased cointegration after the crisis period. The study further stressed the short-term impact of financial market shocks from America on the returns of emerging financial markets, emphasizing the importance of considering past shocks and volatility in selected stock markets. Hung (2019) focused on examining daily returns and volatility spillover effects in common stock prices between China and four Southeast Asian countries: Vietnam, Thailand, Singapore, and Malaysia. Adopting a vector autoregression with a bivariate GARCH-BEKK model, the research spans the period surrounding the 2008 Global Financial Crisis. The study revealed a significant impact of Chinese market volatility on other markets in the sample, particularly during and after the crisis. The implications extend to portfolio managers and institutional investors, emphasizing the importance of assessing linkages and volatility transmissions across markets for effective investment and asset allocation decisions. Lubys and Panda (2021) contributed to the discourse on spillovers by examining the effects of the

US and EU unconventional monetary policy announcements on BRICS financial markets through an event study methodology. The findings revealed significant abnormal returns during some events, emphasizing dependencies on the announcing central bank authority, sector, and country. The study underscores the impact of unconventional policy announcements on specific sectors in BRICS financial markets. Turning to the European context, Trivedi et al. (2021) investigated volatility spillovers and co-movements among selected developed and former communist emerging stock markets within the European Union employs GARCH family models. The empirical results highlight the significant presence of volatility clustering in most financial markets, with exceptions noted for Poland and Croatia. Despite the focus on eight stock markets, the study provided valuable perspectives, shedding light on the behavioral dynamics of European stock markets and their sensitivity to both recent and past news.

5.2.4 Gaps in Literatures for ESG volatility spillovers in emerging and developed markets

The subject matter of market interconnectedness remains a thriving domain in the finance research that have continually drawn interests and curiosity of scholars and researchers. This is largely due to factors such as increased globalization, technological revolution and the sheer instances of historical occurrences such as the COVID-19 pandemic, the Suez Canal blockage, the Russia-Ukraine war et cetera which have revealed that the world is indeed a global village where actions could have ripple effects globally. in this same light, there is no more binding theme that stresses this reality than the issue of ESG which touches on the matters of global sustainability and efforts to mitigate the pending disaster of climate change effects that spills over both emerging and developed nations alike.

Given the severity of interconnectedness of markets and ESG matters, there is lacking in empirical evidence on the nature of ESG return and volatility spillovers in the BRICS emerging markets. This is because majority of reviewed literatures have mainly focused on traditional markets such as stocks and bonds, adopting differing methodologies and conceptualizations for the construct of emerging and developed markets. More severely is the fact that there have been warning predictions that emerging markets such as South Africa will be among the most negatively impacted by the effects of ESG concerns such as climate change (UnitedNations, 2020).

Likewise, an investigation on ESG matters focusing only on nations within the emerging markets bloc is would be incomplete. This is because multiple reports have noted that industrialized and advanced economies such as the USA are among the biggest contributors to ESG issues such as Climate change, hence play a significant role in turning the tide (Jinga, 2021). Again, the review of empirical literatures shows that the nature of ESG return and volatility spillovers in the G7 developed markets remains unclear.

Understanding the nature of ESG returns and volatility spillovers within and across the emerging and developed markets, is would offer invaluable contributions on the general nature of ESG markets interconnectedness vis-à-vis traditional stock market. Also, deeper insights can be gained on which markets are significant or sensitive to and from influences from other markets. These insights are further believed to not just serve as a pointer of ESG in these markets, but also offer investors veritable insight on how to make sustainable returns on investments.

5.3 Methodology for the Spillover Effects of the Volatility of ESG Returns

This chapter aims to examine the spillovers of shocks and volatility dynamics of the ESG returns among the BICS and G7 economies. Indeed, the vector autoregressive (VAR) model has been the workhorse in the literature for analysing such spillovers in the form of causality regression (see Salisu and Oloko, 2015). However, our finding of the significant presence of volatility in the series and the inability of the VAR model to capture it makes a multivariate GARCH (MGARCH) model the most appropriate in this study. McAleer et al. (2009), Mollick and Assefa (2013), Engle et al. (2013), Conrad et al. (2014), Salisu and Oloko (2015), among others, are some of the notable studies in the literature that have employed the MGARCH models in their spillover analysis of the volatility of financial series. The preference for the MGARCH models as opposed to the univariate ARCH or GARCH models is motivated by the inability of the latter to capture the causality between the conditional variances of the variables of interest (see McAleer, 2003). Also, while acknowledging that vector conditional heteroscedasticity (VECH) is the genesis of MGARCH models in the literature, the fact that too many parameters characterize it has led to the emergence of alternative MGARCH models that allow for some restrictions as well as the possibility of volatility transmission (see Caporin and McAleer, 2010).

Among the alternatives to MGARCH models prominent in the literature are the Bollerslev (1990) Constant Conditional Correlation (CCC)-GARCH model; the Baba, Engle, Kraft, and Kroner (BEKK)-GARCH model developed in 1995; and the Dynamic Conditional Correlation (DCC)-GARCH model developed by Engle (2002). Another is the VAR-GARCH developed by McAleer (2003), which was further modified to account for a moving average (MA) term, thus leading to what is known as the VARMA-GARCH model. These latter variants of the MGARCH models, for instance, VAR-GARCH and VARMA-GARCH, can capture volatility spillovers in their respective variance equations. However, the VARMA-GARCH has an additional feature that enables it to capture shock spillovers in the mean equation thus making it the most appropriate in the context of this study (see Salisu and Oloko, 2015). Having earlier established the presence of asymmetries in the volatility dynamics of the ESG returns in the Sections 4.4.3 and 4.4.3 of the Chapter 4 of this study, it does become inevitable herein to also consider the asymmetric variants of the VARMA-GARCH models.

More importantly, both the symmetric and asymmetric variants of the VARMA-GARCH model would be estimated with the options of CCC and DCC, respectively. For the CCC, the assumption is that the conditional correlation is constant, whereas it is assumed to be dynamic, for instance, time dependent in the case of the DCC (McAleer, 2009, Salisu and Oloko, 2015). The essence is to ensure that all the possible inherent features of the investigated series are accounted for in the estimation process. Essentially, the study employed model selection criteria, namely Schwartz Bayesian Information Criterion (SBIC), Akaike Information Criterion (AIC), and the log-likelihood (Log-LL) to determine the variant of the VARMA-GARCH model that is most appropriate in the context of this study. Thus, the presentation and the discussion of the empirical findings are based estimates obtained from the overall best-fit VARMA-GARCH model.

5.3.1 Data for volatility spillovers

Extant studies on the spillover analysis of the financial series can be categorised into two strands of studies including those that concerns with the spillovers of volatility of different financial variables on the one hand (see Syriopoulos and Roumpis, 2009; Sylignakis and Kouretas, 2011; Nishimura et al., 2015), and those concern about the spillovers of the volatility of a single financial asset within a particular country or across borders (see Yilmaz, 2010; Zhang et al., 2012; Tsai, 2014). However, it is the latter strand of studies that seems more suitable in the context of this study, where the concern is to understand the shock transmission and volatility spillover of ESG returns among BICS countries, among G7 countries, and then the emerging market (BICS economies) and the developed market (G7 economies). Thus, to examine shock transmission and stock return volatility spillovers among BICS member countries, among G7 members, and across the two groups, the daily ESG returns for the individual countries in the various groups they belong to remain as measured in Chapters 3 and 4. However, there is a need for the variable interest to have an equal sample period length since the spillover is about the interconnectedness of the variables among countries in the same group and across two different groups. The start date for the documentation of ESG stocks varies for the different economies depending on when the ESG initiative is adopted in a particular country. Therefore, the start data of the ESG used in this study varies for the different countries being investigated and it solely determine based on the availability of the ESG data. For the spillover of the volatility of ESG returns among the BICS economies, the start date is January 31, 2011, while it is July 31, 2017, in the case of the volatility of ESG returns among the G7 economies. However, the sample starts on March 31, 2017, when the volatility spillover is being examined across the two groups such as emerging market economy (EME) and developed market economy (DME).

5.3.2 Estimation techniques for the spillover effect of the ESG volatility

The estimation techniques herein include those employ for the preliminary analysis and the essence is to understand the inherent statistical features of the variable of interest and by extension determine the most suitable model for the main empirical analysis. The second stage involves the specification and presentation of the suitable econometric method capable of accommodating the various statistical features of the variables established in the preliminary stage.

5.3.2.1 Preliminary tests on spillover effect of the volatility of ESG returns

The procedure for pre-estimation analysis can be divided into two groups: the informal pre-test and the formal pre-test. The former is in the form of graphical representations and descriptive statistics, while the latter includes ARCH and Ljung-Box tests, which are usually employed to test whether there is a presence of heteroscedasticity and autocorrelation in the variable of interest. The detailed explanation and equational representation of these tests have been well documented in Section 4.3.2.1. of the previous chapter (i.e., Chapter 4).

5.3.2.2 Method of analysis for shock transmission and volatility spillover

Since the VAR-GARCH model is a subset of the VARMA-GARCH model, the conditional mean and the conditional variance equations presented in the following sub-section are based on the VARMA-GARCH framework, for instance, the VARMA(p,q)-MGARCH(1,1) model. However, same as Salisu and Oloko (2023), this present study allowed for more than one lag in the mean equation, while the variance equation contains only one lag (i.e., GARCH (1,1). This is because, where the mean equation is wrong, it usually assumes that there are more dynamics in the model than are included, which, as stated in the study by Salisu and Oloko (2015), can be fixed by reasonably increasing the number of lags in the mean equation. Regarding the variance equation (MGARCH), the rejection of the MGARCH is an indication that the GARCH part is somehow inadequate, but it is very rare in the literature to add lags to an MGARCH specification. Rather, a different version of the MGARCH, such as BEKK, CCC, or DCC -MGARCH is often considered.

5.3.2.3 The specification of the VARMA-GARCH model

Although conditional correlations can be calculated in practice, the CCC and DCC models do not allow for shock spillovers across borders. As a result, Ling and McAcleer (2003) suggested a vector autoregressive moving average (VARMA) framework for the conditional variances of the individual series to account for the spillovers, as shown below:

$$\Phi(L)(Z_t-\mu)=\Psi(L)\varepsilon_t \tag{5.1}$$

$$\varepsilon_t = D_t\eta_t$$

$$H_t = W + \sum_{l=1}^{r} A_l\varepsilon_{t-l}^2 + \sum_{l=1}^{s} B_l H_{t-l} \tag{5.2}$$

where $Z_t=(z_{1t},\ldots,z_{mt})'$ denotes $m\times 1$ vector of the ESG return series; $\mu=(\mu_1,\ldots,\mu_m)'$ is a vector of constants for the mean equations of the series; $\Phi(L)=I_m-\Phi_1 L-\cdots\Phi_1 L^p$ and $\Psi(L)=I_m-\Phi_1 L-\cdots\Phi_1 L^q$ are polynomials in the lag operator (L); $D_t = diag\left(h_{i,t}^{1/2}\right)$ for

$i=1,\ldots,m$; $\eta_t=(\eta_{1t},\ldots,\eta_{mt})'$ is a sequence of independently and identically distributed random vectors; $H_t=(h_{1t},\ldots,h_{mt})'$, $\varepsilon^2=(\varepsilon_{1t}^2,\ldots,\varepsilon_{mt}^2)'$. Note also that $h_{i,t}^{1/2}$ and $h_{i,t}$ are conditional standard deviation and conditional variance for return i, m is the number of returns, W is a vector of constants for the variance equations of the return series and A_l for $l=1,\ldots,r$ and B_l for $l=1,\ldots,s$ are $m\times m$ matrices and represent the ARCH and GARCH effects, respectively.

When the volatility spillovers is among the BICS markets, the study was concerned with four ESG return series and seven ESG return series when the volatility spillovers is among the G7 economies. Where the two economies are as group such as emerging market economies (EME) and developed market economies (DME), then the study was concerned with two ESG return series. Thus, for the sake of convenience, a bivariate VARMA-GARCH (1,1) model which mainly suitable for the case of volatility spillovers between EME and DME would be considered for the purpose of allowing for simplicity in our specification. For the estimation proper, therefore, it will be quadrivariate in the case of the BICS and septuple in the case of the G7 countries. Thus, following the bivariate approach, presented in the equation (5.3) is mean and conditional variance equations.

- ***The conditional mean equations*:**

$$\begin{aligned}&\text{Mean eqn for EME esg return: esgr}_{eme,t}=\mu_{eme}+\phi_{eme}esgr_{eme,t-i}+\theta_{eme}esgr_{dme,t-i}+\varepsilon_{eme,t}\\&\text{Mean eqn for DME esg return: esg}r_{dme,t}=\mu_{dme}+\phi_{dme}esgr_{dme,t-i}+\theta_{dme}esgr_{eme,t-i}+\varepsilon_{dme,t}\end{aligned}\tag{5.3}$$

The spillover of the ESG return from DME to EME is measured as θ_{eme} while from EME to DME is capture as θ_{dme}. Indeed, all the MGARCH models including the VARMA-GARCH have similar mean equations with the difference usually lies in the way the variance and covariance equations are specified and estimated.

- ***The Conditional variance equation [Multivariate-GARCH (1,1)]:***

$$H_t=W+A\varepsilon_{t-1}^2+BH_{t-1}\tag{5.4}$$

where $H_t = (h_{1t}, \ldots, h_{mt})'$, $\varepsilon_t^2 = (\varepsilon_{1t}^2, \ldots, \varepsilon_{mt}^2)'$, and W, A, and B are $(m \times m)$ matrices of constants, ARCH effects and GARCH effects respectively.

Equation (5.4) can be further simplified into individual conditional variance equations for the two ESG return series as described below:

$$
\begin{aligned}
&\text{Variance eqn for EME esg return: } h_{1t} = c_1 + \alpha_{11}\varepsilon_{1t-1}^2 + \alpha_{12}\varepsilon_{2t-1}^2 + \beta_{11}h_{1t-1} + \beta_{12}h_{2t-1} \\
&\text{Variance eqn for DME esg return: } h_{2t} = c_2 + \alpha_{21}\varepsilon_{1t-1}^2 + \alpha_{22}\varepsilon_{2t-1}^2 + \beta_{21}h_{1t-1} + \beta_{22}h_{2t-1}
\end{aligned}
\tag{5.5}
$$

The shock or the volatility spillover effects seem more evident in equation (5.5). For example, the conditional variance of the EME ESG return (EME_ESGR) depends not only on its own past conditional variance and shocks, but also on those of the DME ESG returns (DME_ESGR). The same explanation holds for the conditional variance of the DME_ESGR. More specifically, the shock spillover effects from DME_ESGR to EME_ESGR are captured by the parameters α_{12} while α_{21} measures the shock spillover effects from EME_ESGR to DME_ESGR. Thus, the transmission of shocks from one ESGR to another is easily quantified using the VARMA-GARCH model. Although, these spillovers cannot be evaluated using the CCC and DCC models, but in the computation of conditional covariances, the VARMA-GARCH model assumes constant conditional correlations. Hence, the CCC-GARCH model is a special case of VARMA-GARCH model. The latter reduces to the former if the variance-covariance matrix is diagonal. However, it is instructive that while the VARMA-GARCH model accounts for both return and shock spillovers, it does not allow for asymmetric effect. Thus, presented below, is the asymmetric version of the VARMA-GARCH model.

5.3.2.4 The specification of the asymmetric VARMA-GARCH model

The asymmetric variant of the VARMA-GARCH model developed McAleer et al. (2009) followed the GJR-type of asymmetry to accommodate the asymmetric impacts of the unconditional shocks on the conditional variances. The following is the generic representation of the asymmetric version of the VARMA-GARCH model:

$$\Phi(L)(Y_t - \mu) = \Psi(L)\varepsilon_t \quad (5.6)$$

$$\varepsilon_t = D_t \eta_t$$

$$H_t = W + \sum_{l=1}^{r} A_l \varepsilon_{t-l}^2 + \sum_{l=1}^{r} C_l I_{t-1} \varepsilon_{t-l}^2 + \sum_{l=1}^{s} B_l H_{t-l} \quad (5.7)$$

where C_l are $m \times m$ matrices for $l = 1, \ldots, r$, and $I_t = diag(I_{1t}, \ldots, I_{mt})$ is an indicator function and is given as:

$$I_{it} = \begin{cases} 1, & \varepsilon_{it} \le 0 \\ 0, & \varepsilon_{it} > 0 \end{cases} \quad (5.8)$$

Once again, the study employed the bivariate approach to specify the mean and variance equations. However, the mean equation remains as earlier defined, therefore the asymmetric is usually captured via the variance equation, with 1 lag, as given below.

$$\begin{aligned} &\text{Variance eqn for EME esg return: } h_{1t} = c_1 + \alpha_{11}\varepsilon_{1t-1}^2 + \gamma_1 \varepsilon_{1t-1}^2 I_{1,t-1} + \alpha_{12}\varepsilon_{2t-1}^2 + \beta_{11} h_{1t-1} + \beta_{12} h_{2t-1} \\ &\text{Variance eqn for DME esg return: } h_{2t} = c_2 + \alpha_{21}\varepsilon_{1t-1}^2 + \alpha_{22}\varepsilon_{2t-1}^2 + \gamma_2 \varepsilon_{2t-1}^2 I_{2,t-1} + \beta_{21} h_{1t-1} + \beta_{22} h_{2t-1} \end{aligned} \quad (5.9)$$

If the γ_i is positive and statistically significant, then it implies that negative shocks (bad news) increases the volatility of say series i by more than positive shocks (good news) of the same magnitude. On the other hand, if the γ_i is negative and also statistically significant, then that implies that positive shocks increase the volatility of series i by more than negative shocks of the same magnitude. In a situation where the γ_i is not statistically significant, then it implies that the effects of both positive and negative shocks are identical thereby nullifying the asymmetric assumption.

5.3.2.5 The estimator for the Multivariate GARCH Models

The quasi-maximum likelihood estimator (QMLE) is widely regarded as the most appropriate estimation technique to estimate parameters in the GARCH based volatility model. The QMLE as given by McAleer (2003) involves maximizing the likelihood function.

$$L_n(\lambda) = \frac{1}{n}\sum_{t=1}^{n} l_t(\lambda),\ l_t(\lambda) = \frac{1}{2}\ln\left|D_t \Gamma D_t\right| - \frac{1}{2}\varepsilon_t'\left(D_t \Gamma D_t\right)^{-1}\varepsilon_t, \tag{5.10}$$

where $L_n(\lambda)$ takes the form of the Gaussian log-likelihood; λ denotes the vector of parameters to be estimated and $D_t \Gamma D_t = \varepsilon_t \varepsilon_t' = D_t \eta_t \eta_t' D_t$. One of the attractions to the QMLE is the fact that η_t is assumed to be non-normal which is a prominent feature of most financial series including those under consideration in this paper. Thus, when η_t does not follow a joint multivariate normal distribution, the appropriate estimator is the QMLE.

5.4 Presentation of results and discussion of findings on the spillovers of ESG volatility

The standard practice in the literature when modelling volatility is to begin with the pre-estimation of the variable of interest, engaging some prominent statistical and econometric tests. The bulk of these tests, namely the ARCH test and the Ljung-Box test, as well as their respective outcomes suggesting evidence of heteroscedasticity and autocorrelation, have been well documented in the previous chapters, for instance, Chapters 3 and 4, respectively. However, while the empirical analysis in the previous chapters was mostly about the nature of the volatility of the ESG returns, the focal point of this present chapter is the spillover effect of the volatility. Thus, the preliminary results presented in this chapter are mainly about the conditional correlation of the ESG returns among the BICS economies, among the G7 economies, and between the emerging market economies (EME) and the developed market economies (DME). The report of the model selection criteria based on the SIC and AIC, as well as the log-likelihood, were also discussed as part of the preliminary results so as to determine the model with the most accurate estimates. More importantly, the spillover results were presented under two main headings, namely, the return spillovers and the volatility spillovers.

5.4.1 Preliminary results on unconditional correlations

Again, the preference for the volatility-based model as the most appropriate in this study is motivated by the overwhelming evidence of autocorrelation and ARCH effects earlier reported in Table 3.4 in Chapter 3. However, the research herein extended the preliminary analysis to include an unconditional correlation matrix presented in Table 5.1. First, the study found the unconditional correlation to be positive among the BICS economies. The degree of the correlation is about 80% between Brazil and India and between Brazil and South Africa, respectively. It was also found the degree of the correlation to be strong between India and South Africa, where the unconditional correlation is about 76%. The degree of the unconditional correlation is about 25% and 24% in the case of Brazil and China and between India and China, respectively. Whereas, the degree of unconditional correlation between China and South Africa is 31%. These findings suggest that Brazil and India, followed by Brazil and South Africa, are the most integrated pairs of the BICS countries, followed by India and South Africa. The least integrated pairs of the BICS countries are Brazil and China, and India and China, respectively. In view of this, among other things, the study expected the spillover of the volatility of the ESG returns to be strong between Brazil and India, Brazil and South Africa, and between India and South Africa.

Table 5.1: Unconditional Correlation Matrix

Table 5.1(a): Unconditional correlation of ESG volatility among BICS countries

	Brazil	China	India	South Africa
Brazil	1.0000			
China	0.2456	1.0000		
India	0.7994	0.2359	1.0000	
South Africa	0.7932	0.3116	0.7579	1.0000

Table 5.1(b): Unconditional correlation of ESG volatility among G7 countries

	Canada	France	Germany	Italy	Japan	UK	USA
Canada	1.0000						
France	0.6972	1.0000					
Germany	0.6966	0.9412	1.0000				
Italy	0.6509	0.8269	0.8124	1.0000			
Japan	0.2644	0.2357	0.2410	0.2404	1.0000		
UK	0.6696	0.8127	0.7952	0.7616	0.3116	1.0000	
USA	0.7961	0.5989	0.5932	0.5368	0.1581	0.5138	1.0000

Table 5.1(c): Unconditional correlation of ESG volatility between EME and DME

	Emerging Market Economies	Developed Market Economies
Emerging Market Economies	1.0000	
Developed Market Economies	-0.0111	1.0000

Note: EME and DME mean emerging market economies and developed market economies, respectively.

As with the BICS economies, the unconditional correlation of the ESG return is positive for all of the G7 countries. More importantly, the degree of the correlation appears to be strong generally, with the case of Japan being the only notable exception. To begin with, the research found that the degree of the unconditional correlation of the ESG returns between France and Germany to be as high as 90%, while it is about 82% in the case of Italy and France, Italy and Germany, and France and the UK, respectively. The study further found that the correlation to be strong between Canada and the USA, Germany and the UK, and the UK and Italy, where the degree of correlation is 80% in the case of Canada and the USA, Germany and the UK, and 76% in the case of the UK and Italy. However, while the degree of the correlation is generally strong among the G7 countries, hovering between 50% and 70% on average in many instances, Japan, as earlier mentioned, appears to be the only country whose ESG returns have the least correlation with the rest of the G7 member countries.

On the whole, the results give credence to evidence of a strong unconditional correlation of the ESG returns among the G7 countries, indicating the potential for strong spillovers of the volatility of the ESG returns in the G7 economy. Interestingly, however, the study found that the unconditional correlation between the group of emerging economies (EME) and the group of developed economies (DME) to be negative, with the degree of the correlation being less than 1%. This, among other things, is an indication that volatility spillovers of the ESG returns are likely to be stronger among countries with the same economic growth compared to the spillover between different economic groups.

5.4.2 Determining the overall best fit MGARCH model

Having shown strong evidence of the unconditional correlation of the ESG return among the BICS markets and among the G7 markets, respectively, the empirical analysis of the return and volatility spillovers of the ESG returns commenced with the intent to determine the most appropriate conditional variance models. Presented in Table 5.2 are the outcomes of the model selection based on the SBC AIC and the maximum log likelihood (Log-LL) approaches. The various VARMA-GARCH and VARMA-AGARCH models presented in the table remain as earlier defined, both for the CCC and the DDC options, respectively. For each of the scenarios considered, such as the BICS economies and the G7 economies, as well as the scenario for spillovers between EME and DME, the model with the lowest SBC and AIC values and the maximum log-LL is the best MGARCH model in each of the scenarios. For the case of the BICS economy, the VARMA-AGARCH with the DCC option is ranked first as the model with the least SBC and AIC values and also has the maximum log likelihood values. What this portends is that the conditional correlation of the ESG returns among the BICS economies is a better model under the assumption that it is both time-varying and asymmetric.

Table 5.2: Best fit MGARCH model for shock and volatility spillovers

MGARCH model type for BICS	Selection Criteria			Rank
	SBC	*AIC*	*Log-LL*	
CCC: VARMA-GARCH	-22.940	-23.060	35909.38	4th
DCC: VARMA-GARCH	-22.971	-23.084	35941.62	3rd
CCC: VARMA-AGARCH	-22.993	-23.122	36008.50	2nd
DCC: VARMA-AGARCH	-23.022	-23.142	36036.24	1st
MGARCH model type for G7				
CCC: VARMA-GARCH	-49.231	-49.907	35466.25	2nd
DCC: VARMA-GARCH	-49.331	-49.936	35467.95	1st
CCC: VARMA-AGARCH	-48.405	-49.108	34908.03	4th
DCC: VARMA-AGARCH	-49.269	-49.901	35449.92	3rd
MGARCH model type for EME and DME				
CCC: VARMA-GARCH	-13.064	-13.128	9298.17	2nd
DCC: VARMA-GARCH	No Convergence			
CCC: VARMA-AGARCH	-13.150	-13.220	9365.75	1st
DCC: VARMA-AGARCH	No Convergence			

Source: Compiled by the authors

Regarding the G7 economies, the respective outcomes of the alternative model selection criteria consistently confirmed the VARMA-GARCH model with the DCC option as the most accurate for modelling return and volatility spillovers of the ESG returns among the G7 member countries. To this end, the assumption of conditional time-varying seems applicable in both the BICS and G7 economies, thus motivating the infusion of the DDC in the variants of the VARMA-based MGARCH models found to be the best-fitting modelling frameworks for the analysis of return and volatility spillovers in the BICS and G7 economies. However, compared to the G7 markets, the study found that accounting for asymmetries matters in the volatility spillovers of the ESG returns among the BICS economies, which explains why the preferred MGACH model in the case of the BICS is DCC-VARMA-AGARCH and DCC-VARMA-GARCH in the case of the G7. Finally, the research found that an MGARCH model that assumes constant correlation of the conditional variance but accounts for the role of asymmetry in the volatility spillovers of the ESG returns is the most appropriate and best-fit MGARCH model when the spillover is between the EME and the DME.

5.4.3 Empirical results from the Multivariate (MGARCH) models (per objectives)

Following the determination of the appropriate MGARCH model for analysing the return and volatility spillovers of the ESG returns, the study then proceeded herein to present and discuss the empirical estimates as obtained from the variant MGARCH models estimated and across the BICS, G7, and EME and DME scenarios considered. The sub-section 5.4.2.1, for example, presents the empirical estimates on the returns and volatility spillovers of ESG returns among the BICS countries, while the sub-section 5.4.2.2, on the other hand, presents the empirical estimates on the returns and volatility spillovers of ESG returns among the G7 member countries. The empirical estimates presented in sub-section 5.4.2.3 are the returns and volatility spillovers of ESG returns between the EME and DME.

5.4.3.1 Return and volatility spillovers among BICS countries

This section presents and discusses the empirical estimates on the spillover dynamics of both the returns and volatility of the ESG among the individuals BICS countries under consideration. However, while the estimates for both the returns and volatility spillovers are jointly presented in Table 5.4., the analysis of the finding were carried out via the separate sub-headings of return spillovers and volatility spillover as shown below.

i. ***Return spillovers***

The parameters of interest here are: $\theta_{21}, \theta_{23}, and\, \theta_{24}$ measuring return spillover from ESG in India, China and South Africa to ESG in Brazil; $\theta_{21}, \theta_{23}, and\, \theta_{24}$ measuring return spillover from ESG in Brazil, China and South Africa to ESG in India; $\theta_{31}, \theta_{32}, and\, \theta_{34}$ measuring return spillover from ESG in Brazil, India and South Africa to ESG in China, and $\theta_{41}, \theta_{42}, and\, \theta_{43}$ measuring return spillover of ESG in Brazil, India and China to ESG in South Africa. This, notwithstanding, also reported from the mean equation are parameters on own lagged returns ($\phi_{11}, \phi_{22}, \phi_{33}, and\ \phi_{44}$), and the essence is to ensure that spillover effects are not confounded with serial dependence. Starting with the case Brazil, a look at the Table 5.3 show that the return spillover estimates are not statistically significant indicating that the ESG returns in Brazil are not influence by ESG returns in the rest of the BICS countries. However, the study found evidence of positive and statically significant spillover effect of the ESG returns from Brazil and

South Africa to ESG returns in India. the study also found ESG returns in China responding positively to the spillover of ESG returns from Brazil and South Africa, respectively. The fact that Brazil is also the only country where the effect of the change in the ESG returns spillover to ESG returns in the South Africa show that the spillover effects of the ESG return among the BICS countries is predominantly univariate. For instance, the study found no evidence of the reverse transmission of the effect of change in the ESG of a particular BICS country to that of another BICS.

ii. ***Shocks and volatility spillover***

One of the attractions of the VARMA-GARCH model is that it has the feature that allows for the computation of shocks spillover in addition to the results of the mean equation. Here, the parameter of interest in the case of shock spillover and persistence of shocks are obtained from the conditional variance equation captured as the ARCH (α_{ij}) effect and GARCH (β_{ij}) effect, respectively. Essentially, the estimates from the conditional variance equation presented in Table 5.3 show that lagged own shocks ($\alpha_{11}, \alpha_{22}, \alpha_{33}, and\, \alpha_{44}$) and lagged own conditional variance ($\beta_{11}, \beta_{22}, \beta_{33}, and\, \beta_{44}$) are positive and statistically significant. This is an indication that the volatility of the ESG returns in the BICS economies is significantly sensitive to both past own shocks as well as past own conditional variance. Thus, an unanticipated event in the dynamics of ESG in any of the BICS countries in the current period is capable of fuelling a high volatility in the ESG in the immediate succeeding period. In sum, volatility of the ESG returns in one period has the potentiality of driving a higher volatility in the immediate later period.

More importantly, the study discovered overwhelming evidence shock spillovers of the ESG returns among the BICS countries. The parameter of interesting confirming the said evidence of significant shock spillover of the ESG returns among the BICS member countries are ($\alpha_{12}, \alpha_{13}, and\, \alpha_{14}$) in the case of Brazil, ($\alpha_{21}, \alpha_{23}, and\, \alpha_{24}$) in the case of India, ($\alpha_{31}, \alpha_{32}, and\, \alpha_{34}$), and ($\alpha_{41}, \alpha_{42}, and\, \alpha_{43}$) in the case of South Africa. Starting with the case of Brazil, the results show that a 1% increase in the shock to ESG returns in India will increase the volatility of ESG returns in Brazil by 0.05%, while the same 1% increase in the shock to ESG returns in South Africa will reduce the volatility of ESG returns in Brazil by 0.03%. This is an indication that while shocks to ESG returns in India induce the volatility of ESG returns in Brazil, the reverse appears to be the case when the shock spillover is from South Africa to Brazil. Whereas, shock to ESG returns in China seems to exhibit no significant spillover effect on the ESG returns in Brazil.

Table 5.3: DCC-VARMA-AGARCH Results

Mean Equation: Return Spillovers							
Brazil = 1		**India = 2**		**China = 3**		**South Africa = 4**	
μ_{10}	0.0005 (0.0005)	μ_{20}	0.0002 (0.0001)	μ_{30}	0.0003* (0.0001)	μ_{40}	0.0005 (0.0004)
ϕ_{11}	0.0227 (0.0189)	ϕ_{22}	-0.0237 (0.0182)	ϕ_{33}	-0.0593*** (0.0185)	ϕ_{44}	-0.0427** (0.0197)
θ_{12}	0.0195 (0.0268)	θ_{21}	0.0811*** (0.0009)	θ_{31}	0.0988*** (0.0117)	θ_{41}	0.1230*** (0.0161)
θ_{13}	0.0208 (0.0210)	θ_{23}	-0.0001 (0.0125)	θ_{32}	-0.0004 (0.0202)	θ_{42}	-0.0263 (0.0260)
θ_{14}	0.0003 (0.0201)	θ_{24}	0.0590*** (0.0111)	θ_{34}	0.0915*** (0.0142)	θ_{43}	0.0154 (0.0203)
Variance Equation: Volatility Spillovers							
c_1	0.0003*** (0.0001)	c_2	0.0020*** (0.0006)	c_3	0.0040*** (0.0009)	c_4	0.0050*** (0.0006)
α_{11}	0.0314*** (0.0003)	α_{22}	0.0186** (0.0003)	α_{33}	0.0306*** (0.0000)	α_{44}	-0.0251** (0.0112)
α_{12}	0.0474*** (0.0166)	α_{21}	0.0189*** (0.0003)	α_{31}	0.0004 (0.0003)	α_{41}	0.0003 (0.0003)
α_{13}	0.0003 (0.0109)	α_{23}	-0.0156* (0.0003)	α_{32}	0.0003 (0.0140)	α_{42}	0.0112 (0.0173)
α_{14}	-0.0342*** (0.0121)	α_{24}	-0.0309*** (0.0003)	α_{34}	-0.0309*** (0.0000)	α_{43}	0.0290* (0.0174)
β_{11}	0.9122*** (0.0162)	β_{22}	0.8826*** (0.0171)	β_{33}	0.9169*** (0.0136)	β_{44}	0.8385*** (0.0439)
β_{12}	-0.2044*** (0.0364)	β_{21}	-0.0111 (0.0246)	β_{31}	0.0391 (0.0238)	β_{41}	0.1351*** (0.0406)
B_{13}	0.0003 (0.0361)	β_{23}	0.0564** (0.0270)	β_{32}	-0.0572** (0.0269)	β_{42}	-0.0461 (0.0375)
β_{14}	0.1579*** (0.0358)	β_{24}	0.0307 (0.0348)	β_{34}	0.0223 (0.0280)	β_{43}	0.0658 (0.0415)
Asymmetric Effect							
γ_1	0.0401*** (0.0105)	γ_2	0.1041*** (0.0146)	γ_3	0.0785*** (0.0109)	γ_4	0.1038*** (0.0177)
Shock Persistence							
$\alpha_{11}+\beta_{11}$	0.9436	$\alpha_{22}+\beta_{22}$	0.9015	$\alpha_{33}+\beta_{33}$	0.9475	$\alpha_{44}+\beta_{44}$	0.8134

*Note: The values in parenthesis are the standard errors while ***, ** and * denote statistical significance at 11%, 5% and 10%, respectively.*

Consistent with our earlier pre-evidence of a strong and positive unconditional correlation between ESG returns in Brazil and ESG returns in India, the shock spillover effect appears to be bidirectional in the cases of Brazil and India. For example, similar to the response of the ESG returns in Brazil to shocks to ESG returns in India, the study also found that a 1% increase in the shock to ESG returns in Brazil will increase the volatility of ESG returns in India by 0.2%, while the spillover effects from China and South Africa will reduce the volatility by 0.2% and 0.3%, respectively. In terms of the magnitude of the spillover effect, shocks to ESG in India tend to induce volatility in ESG returns in Brazil more compared to the magnitude of volatility of ESG in India that is due to the spillover of shocks to ESG returns in Brazil. Interesting, the effect of shock spillover is only evident in the volatility of ESG returns in China when shock to ESG is transmitting from South Africa only, and the reverse also holds as the volatility of ESG returns in South Africa is only affected by spillover of shock to ESG returns in China. However, while shock to ESG returns in South Africa reduces the volatility of ESG returns in China, the reverse appears to be the case when the shock spillover is transmitting from China to South Africa.

Thus far, the study has effectively demonstrated that there is possibility of contagion effect among the ESGs in the BICS economies. However, the direction of the effect tends to vary as it is positive in some cases and then negative in other instances. This in a way validates the appropriateness of the variant of the MGARCH model considered for the case of the BICS economies as it accounts for the role of asymmetry. In fact, the statistical significance of all of the coefficients denoting the asymmetric effects in the variance equation is a confirmation of the assumption that asymmetries matter in the shock spillover of ESG return among the BICS countries. More importantly, the parameter γ_i is positive and statistically significant for each of the BICS countries, which it implies that negative shocks (bad news) increases the volatility of ESG return by more than positive shocks (good news) of the same magnitude.

In terms of the persistence of shocks, however, the study found that ESG returns in both Brazil and China experience higher long-run shock persistence, followed by ESG returns in India and South Africa. The magnitude of the long-run persistence of shocks to ESG returns in Brazil and China is almost 1 (i.e., 0.94 and 0.95, respectively), which is clear evidence of the high degree of persistence of shocks to ESG in those countries. At 0.90 and 0.81, the degree of the persistence of the shocks to ESG can as well be regarded as high in India and South Africa but relatively lower when compared to that of China and Brazil.

5.4.3.2 Return and volatility spillovers among G7 countries

Presented in Table 5.4 are empirical estimates obtained from the estimated mean and variance equations of the DCC-VARMA-GARCH model. Although the parameters of interest remain as earlier defined in the case of the BICS economies, the dimension of the spillovers is 7x7 since there are seven-member countries that form the G7. Sustaining the same procedure as earlier established in the case of the BICS markets, the study partitioned the result discussion into return spillover and volatility spillover as follows:

i. ***Return spillover***

A look at the mean equation result in Table 5.4 shows that there is overwhelming evidence of spillover effects of the ESG returns among the G7 countries. However, the dynamics of the spillover effect, such as whether it is unidirectional or bidirectional, as well as whether it is positive or negative, tend to vary for the individual G7 countries. In the case of Canada, for example, changes in the ESG returns of about five of the G7 member countries have a significant spillover effect on the returns on ESG in Canada. However, while the spillover effect of the ESG returns from France, Japan, and the USA increases ESG returns in Canada, the reverse seems to be the case when the spillover effects are from Germany and Italy. More importantly, while the return spillover effect is bidirectional between Canada and France and between Canada and Japan, it is rather unidirectional between Canada and Germany, Canada and Italy, and Canada and the USA. This is an indication that while ESG returns in Canada react significantly to changes in the ESG returns in virtually all of the rest of the G7, the spillover effect of changes in the ESG return in Canada is only significant in two G7 countries.

As with Canada, the study found significant evidence of the spillover effect of changes in the ESG returns of about five of the G7 countries on the returns of ESG in France. That is, in addition to the bidirectional spillover effect of the ESG returns between France and Canada, the study also found that changes in ESG returns in Germany, Italy, the UK, and the USA have a significant spillover effect on the ESG returns in France. However, while changes in the ESG returns in Canada and the USA are capable of enhancing the returns on ESG in France, it is instructive that the spillover effect of such changes in Germany, Italy, and the UK rather reduces the return on ESG in France. So far, the return spillover effect due to changes in ESG returns in Germany and Italy has consistently shown the potential to cause declining returns on the ESG in Canada and France.

Moving forward, the study found ESG returns in Germany responding positively to the spillover of ESG returns from France and the USA but negatively to the spillover effect of changes in the ESG returns in Italy. Not only is the spillover effect of changes in ESG returns bidirectional between Germany and Italy, but the study also found the impact of the spillover to be negative in both cases. Whereas the spillover effects of changes in ESG returns in France and the USA on ESG returns in the rest of the G7, including Italy, have been mostly positive. This is an indication that the spillover effect of changes in ESG returns in France and the USA has been of positive value to ESG returns in most of the G7 countries. Equally interesting is the fact that ESG returns in Japan respond positively to changes in the ESG returns in the rest of the G7 member countries, with Canada being the only exception. Despite changes in the ESG returns in the UK only exhibiting significant spillover effects on the ESG returns in Canada, changes in the ESG returns in Italy, Japan, and the USA all have significant spillover effects on the ESG returns in the UK. But while the spillover effect from the USA is positive, it is negative in the cases of Italy and Japan.

As expected of the widely acknowledged biggest economy in the world, it is only rational that any shock to the USA economy will spill over to the rest of the world. Conforming to this hypothesis, the study found that while there is evidence of a significant spillover effect of changes in the USA's ESG returns to the rest of the G7 countries, ESG returns in the USA only respond to the return spillover effect from France and Germany, respectively. However, while the effect of the return spillover from the ESG in France to the ESG returns in the USA is positive, the effect of the spillover is negative when the spillover is from Germany to the USA. Also, changes in the ESG returns in the USA have the highest spillover effect in terms of the magnitude of the effect on the ESG returns of the rest of the G7 countries. For instance, a 1% change in the ESG returns in the USA has the potential to increase the ESG returns by 0.42%

and 0.31% in Japan and the UK, and by 0.29% in Germany and Italy, respectively. The lowest return spillover effect was from changes in ESG returns in the UK to ESG returns in France.

ii. ***Shocks and volatility spillover***

The only difference between the variance equation of the DCC-VARMA-GARCH estimated in the case of the BICS economies and the variance equation of the DCC-VARMA-GARCH estimated in the case of the G7 economies model is that the former allows for the computation of an asymmetric effect in volatility spillovers, while the latter accounts for no asymmetric effect. Starting with the lagged own shocks ($\alpha_{11}, \alpha_{22}, \alpha_{33}, \alpha_{44}, \alpha_{55}, \alpha_{66}, \textit{ and } \alpha_{77}$) and lagged own conditional variance ($\beta_{11}, \beta_{22}, \beta_{33}, \beta_{44}, \beta_{55}, \beta_{66}, \textit{ and } \beta_{77}$) statistically significant indicating that the volatility of the ESG returns in the G7 are influenced by both past own shocks as well as past own conditional variance. However, while the coefficient on the lagged own shock is predominantly positive, the coefficient on the lagged own conditional variance is mostly negative. This, among other things, is an indication that an unanticipated shock in the dynamics of ESG returns in the current period may increase the volatility in the ESG in some G7 countries but reduce it in others. Saying it differently, the volatility of the ESG returns in one period has the potential to drive higher volatility in the immediate later period, but not in all of the G7 countries, as the same volatility of the ESG returns in one period appears to be capable of causing declining volatility in the immediate later period in some G7 countries.

In conformity with our earlier finding of a robust unconditional correlation of the ESG returns among the G7 countries, estimates obtained from the variance equation show overwhelming evidence of shock spillovers of the ESG returns among the G7 countries. Essentially, the study found significant evidence of a 1% shock to ESG returns in France, Italy, and the USA, increasing the volatility of ESG returns in Canada by 0.27%, 0.09%, and 0.01%, respectively. Meanwhile, the same 1% increase in the shock to ESG returns in Germany and the UK will reduce the volatility of ESG returns in Canada by 0.21% and 0.11%, respectively. It is instructive, however, that while the volatility spillover effect is bidirectional between Canada and Italy and between Canada and the USA, it is mainly unidirectional between Canada and France, Canada and Germany, and Canada and the UK. This is because the shock leading to the volatility spillover only transmits from these latter countries to Canada rather than vice versa.

Also, Shocks to ESG returns in Japan, UK and USA all exhibit the potential of increasing the volatility of ESG returns in France, while a 1% increase in the shock to ESG returns in Germany reduces the volatility of ESG returns in France.

A further look at Table 5.4 shows that a shock to ESG returns in France, Italy, and Japan has a significant volatility spillover effect on the ESG returns in Germany, with a 1% increase in the shock to ESG returns in the mentioned G7 countries capable of increasing the volatility of ESG returns in Germany by 0.11%, 0.02%, and 0.05%, respectively. Similar to Canada, Italy is another G7 country where the ESG return appears to be vulnerable to shocks to ESG returns in about five of the G7 member countries. However, while shocks to ESG returns in Canada and France increase the volatility of ESG returns in Italy, the reverse is evidently the case when the volatility spillover effect is due to shocks to ESG returns in Germany, the UK, and the USA. The study also found significant evidence of the volatility spillover effect of shocks to ESG returns in Germany, Italy, and the USA on the ESG returns of Japan, but while the spillover effect is positive when the shock to ESG returns is in Italy and in the USA, the effect is negative when the shock is in Germany.

The spillover of volatility to ESG returns in the UK is only statistically evident when the volatility spillover effect is attributable to shocks to ESG returns in Germany, Italy, and Japan, respectively. Finally, while the study found a significant volatility spillover effect of shock to ESG returns in the USA on the volatility of ESG returns in four of the G7 member countries, the ESG returns in the USA appear to be only vulnerable to shock to ESG returns in Canada, France, and Germany. On the whole, Germany is the only G7 member country where a shock to its ESG returns results in a significant volatility spillover effect in all of the rest of the G7 member countries. More so, the study found that the volatility spillover effect of a shock to the ESG return in Germany on the ESG return of the rest of the G7 to be predominantly negative, indicating that the shock to the ESG returns in Germany reduces volatility in the ESG returns in the rest of the G7 member countries, with ESG returns in Italy being the only exception.

Compared to the BICS economies, the persistence of shocks, which is the sum of the ARCH and GARCH terms, is relatively lower in the cases of the G7 member countries. For instance, the magnitude of the long-run persistence of shocks to ESG returns in Italy is equal to 1, which suggests not only a high degree of persistence of shocks to ESG in that country but that the shock is permanent and does not mean reverting. The UK, France, and then the USA are also some of the G7 countries where the degree of the long-run persistence of shocks to ESG returns is somehow high as the values are significantly different from zero. For instance, it is 0.79 in the case of the UK, 0.66 in the case of France, and 0.63 in the case of the USA. Japan is the G7 country with the least persistence of shocks to ESG returns, followed by Germany and then Canada. In these latter G7 countries, the persistence of shocks to ESG returns is likely to be temporary. In view of this, among other things, the reversibility of ESG returns to the mean level after a shock is largely more evident in the G7 economies compared to the BICS economies.

Table 5.4: DCC-VARMA-GARCH Results

Mean Equation: Return Spillovers													
Canada = 1		**France = 2**		**Germany = 3**		**Italy = 4**		**Japan = 5**		**UK = 6**		**USA = 7**	
μ_{10}	0.0010*** (0.0003)	μ_{20}	0.0007*** (0.0001)	μ_{30}	0.0004*** (0.0001)	μ_{40}	0.0009*** (0.0002)	μ_{50}	0.0001 (0.0006)	μ_{60}	0.0006*** (0.0001)	μ_{70}	0.0015*** (0.0001)
ϕ_{11}	-0.0827*** (0.0246)	ϕ_{22}	0.0476*** (0.0120)	ϕ_{33}	0.0392** (0.0203)	ϕ_{44}	-0.1512*** (0.0196)	ϕ_{55}	0.1704*** (0.0219)	ϕ_{66}	- 0.0649*** (0.0189)	ϕ_{77}	-0.0242 (0.0252)
θ_{12}	0.2046*** (0.0172)	θ_{21}	0.0641*** (0.0234)	θ_{31}	0.0398 (0.0307)	θ_{41}	0.0398 (0.0307)	θ_{51}	-0.0667*** (0.0253)	θ_{61}	0.0298 (0.0274)	θ_{71}	-0.0420 (0.0257)
θ_{13}	-0.1830*** (0.0185)	θ_{23}	-0.0285*** (0.0104)	θ_{32}	0.0719*** (0.0215)	θ_{42}	0.0719*** (0.0215)	θ_{52}	0.1047*** (0.0229)	θ_{62}	0.0284 (0.0194)	θ_{72}	0.1525*** (0.0195)
θ_{14}	-0.0360*** (0.0133)	θ_{24}	-0.1208*** (0.0105)	θ_{34}	- 0.1512*** (0.0196)	θ_{43}	-0.0392** (0.0203)	θ_{53}	0.0333 (0.0233)	θ_{63}	- 0.0802*** (0.0176)	θ_{73}	-0.1150*** (0.0185)
θ_{15}	0.0459*** (0.0146)	θ_{25}	-0.0099 (0.0123)	θ_{35}	0.0185 (0.0207)	θ_{45}	0.0185 (0.0207)	θ_{54}	0.0768*** (0.0205)	θ_{64}	-0.0380** (0.0174)	θ_{74}	-0.0237 (0.0156)
θ_{16}	0.0048 (0.0153)	θ_{26}	-0.0252* (0.0136)	θ_{36}	-0.0051 (0.0241)	θ_{46}	-0.0051 (0.0241)	θ_{56}	0.0014 (0.0255)	θ_{65}	0.0220 (0.0159)	θ_{75}	0.0124 (0.0167)
θ_{17}	0.1670*** (0.0219)	θ_{27}	0.2406*** (0.0194)	θ_{37}	0.2895*** (0.0268)	θ_{47}	0.2895*** (0.0268)	θ_{57}	0.4206*** (0.0210)	θ_{67}	0.3104*** (0.0208)	θ_{76}	0.0116 (0.0170)
Variance Equation: Volatility Spillovers													
c_1	-0.0004*** (0.0001)	c_2	0.0005*** (0.0001)	c_3	0.0007*** (0,0001)	c_4	0.0002* (0.0000)	c_5	0.0003*** (0.0000)	c_6	0.0001 (0.0001)	c_7	-0.0001 (0.0000)
α_{11}	0.0984*** (0.0113)	α_{22}	0.0990*** (0.0053)	α_{33}	- 0.0849*** (0.0044)	α_{44}	0.0241*** (0.0056)	α_{55}	0.0993*** (0.0265)	α_{66}	0.0996*** (0.0206)	α_{77}	0.0205** (0.0094)
α_{12}	0.2706*** (0.0108)	α_{21}	-0.0056 (0.0060)	α_{31}	0.0110 (0.0081)	α_{41}	0.0765*** (0.0117)	α_{51}	0.0177 (0.0279)	α_{61}	0.0153 (0.0202)	α_{71}	0.0898*** (0.0098)
α_{13}	-0.2117*** (0.0101)	α_{23}	-0.0632*** (0.0060)	α_{32}	0.1072*** (0.0089)	α_{42}	0.2926*** (0.0126)	α_{52}	-0.1109*** (0.0377)	α_{62}	0.1347*** (.0213)	α_{72}	0.2655*** (0.0152)

α_{14}	0.0931*** (0.0103)	α_{24}	0.0026 (0.0040)	α_{34}	0.0182*** (0.0047)	α_{43}	-0.2306*** (0.0115)	α_{53}	0.0942*** (0.0332)	α_{63}	- 0.2243*** (0.0256)	α_{73}	-0.1261*** (0.0135)
α_{15}	0.0244 (0.0228)	α_{25}	0.0198* (0.0120)	α_{35}	0.0531*** (0.0168)	α_{45}	0.0164 (0.0145)	α_{54}	-0.0205 (0.0282)	α_{64}	0.0669*** (0.0215)	α_{74}	-0.0141 (0.0134)
α_{16}	-0.1086*** (0.0106)	α_{26}	0.0196*** (0.0053)	α_{36}	0.0036 (0.0089)	α_{46}	-0.0455*** (0.0084)	α_{56}	0.0173 (0.0373)	α_{65}	-0.0112 (0.0270)	α_{75}	-0.0230 (0.0202)
α_{17}	0.0157** (0.0077)	α_{27}	0.0411*** (0.0075)	α_{37}	-0.0070 (0.0106)	α_{47}	-0.0309*** (0.0112)	α_{57}	0.0727*** (0.0249)	α_{67}	0.0003 (0.0198)	α_{76}	-0.0485 (0.0171)
β_{11}	0.3441*** (0.0069)	β_{22}	0.5651*** (0.0041)	β_{33}	0.4485*** (0.0059)	β_{44}	1.0369*** (0.0066)	β_{55}	0.1191*** (0.0417)	β_{66}	0.8882*** (0.0275)	β_{77}	0.6105*** (0.0070)
β_{12}	-0.6127*** (0.0197)	β_{21}	0.1548*** (0.0057)	β_{31}	- 0.2088*** (0.0133)	β_{41}	-0.1871*** (0.0097)	β_{51}	-0.8807*** (0.1167)	β_{61}	- 1.0587*** (0.0206)	β_{71}	0.2403*** (0.0097)
B_{13}	-0.5322*** (0.0115)	β_{23}	-0.1851*** (0.0045)	β_{32}	- 0.2246*** (0.0067)	β_{42}	-0.5624*** (0.0132)	β_{52}	-4.6806*** (0.1020)	β_{62}	- 0.2915*** (0.0178)	β_{72}	-1.3297*** (0.0208)
β_{14}	0.8121*** (0.0186)	β_{24}	0.1674*** (0.0039)	β_{34}	0.4219*** (0.0069)	β_{43}	0.3181*** (0.0134)	β_{53}	2.0002*** (0.1409)	β_{63}	0.3204*** (0.0137)	β_{73}	0.7547*** (0.0167)
β_{15}	1.6801*** (0.0655)	β_{25}	0.0025 (0.0192)	β_{35}	0.8161*** (0.0263)	β_{45}	0.3858*** (0.0258)	β_{54}	2.3891*** (0.1257)	β_{64}	1.1692*** (0.0250)	β_{74}	0.6520*** (0.0113)
β_{16}	0.5903*** (0.0137)	β_{26}	0.3771*** (0.0074)	β_{36}	0.1151*** (0.0058)	β_{46}	0.1654*** (0.0105)	β_{56}	0.6325*** (0.0661)	β_{65}	3.2062*** (0.0674)	β_{75}	0.2640*** (0.0422)
β_{17}	-0.0463*** (0.0083)	β_{27}	-0.1128*** (0.0059)	β_{37}	0.2642*** (0.0132)	β_{47}	-0.0006 (0.0076)	β_{57}	2.3098*** (0.1285)	β_{67}	0.9299*** (0.0374)	β_{76}	-0.0869*** (0.0169)
Shock Persistence ($\alpha_{ii}+\beta_{ii}$)													
0.44		0.66		0.36		1.06		0.21		0.79		0.63	

***Note:** The values in parenthesis are the standard errors while ***, ** and * denote statistical significance at 11%, 5% and 10%, respectively*

5.4.3.3 ESG volatility spillovers between emerging and developed markets

Having determined the dynamics of the return and volatility spillovers of the ESG separately among the BICS countries and separately among the G7 member countries, the innovation herein is to further evaluate the spillover effect of the ESG returns from the perspective of emerging market economies and developed market economies, respectively. On the one hand, the BICS countries and other emerging countries are considered in groups to form emerging market economies (EME). On the other hand, the G7 and other industrialised economies for the group developed market economies (DME). However, while the assumption of dynamic conditional correlation (DCC) holds when the return and volatility spillovers were considered separately for BICS and the G7 countries, it is however, the assumption of constant conditional correlation (CCC) that holds in the case of the EME and DME. However, inference from the model selection criteria show that the MGARCH model that accounting for asymmetries in the variance equation is the most appropriate for the analysis of the return and volatility spillovers between EME and DME. Hence, the empirical estimates presented in Table 5.5 are obtained from the estimation of the CCC-VARMA-AGARCH model.

Table 5.5: CCC-VARMA-AGARCH Results

Mean Equation: Return Spillovers			
Emerging Market Economies (EME) = 1		**Developed Market Economies (DME) = 2**	
μ_{10}	0.0001(0.0001)	μ_{20}	0.0001(0.0001)
ϕ_{11}	0.1657***(0.0280)	ϕ_{22}	0.1092***(0.0268)
θ_{12}	-0.0428*(0.0251)	θ_{21}	-0.0049(0.0164)
Variance Equation: Volatility Spillovers			
c_1	0.0003***(0.0001)	c_2	0.0008***(0.0002)
α_{11}	0.0088**(0.0045)	α_{22}	-0.0081***(0.0012)
α_{12}	0.0082(0.0203)	α_{21}	0.0054(0.0052)
β_{11}	0.8408***(0.0040)	β_{22}	0.9506***(0.0011)
β_{12}	-1.1844***(0.1664)	β_{21}	0.0346(0.0253)
Asymmetric Effect			
γ_1	0.1908***(0.0105)	γ_2	0.0886***(0.0028)
Shock Persistence			
$\alpha_{11}+\beta_{11}$	0.8496	$\alpha_{22}+\beta_{22}$	0.9425

*Note: The values in parenthesis are the standard errors while ***, ** and * denote statistical significance at 11%, 5% and 10%, respectively.*

Starting with the mean equation, the reported estimates in Table 5.5 show that the return spillover effect is unidirectional, as it is only statistically significant when the spillover is from changes in the ESG returns in the DME to ESG returns in the EME. The fact that the coefficient on the return spillover effect of ESG returns from DME to ESG returns in DME is negative suggests that returns on ESG in the emerging market are likely to be adversely affected by the spillover of changes in ESG returns in the developed market.

Moving to the variance equation, a look at Table 5.5. show that aside from the significant evidence of the lagged own shocks and lagged own conditional variance in the both EME and DME, the effect of a volatility spillover is only evident statistically when the shock to ESG returns is from DME to EME. Similar, to the return spillover, the study found that 1% changes in the shock to ESG returns in the DME is capable of reducing the volatility of ESG return in the EME by 1.2%. Regarding the asymmetric dynamics of the volatility, the study found that irrespective of whether it is EME or DME, negative shocks (bad news) increases the volatility of ESG return by more than positive shocks (good news) of the same magnitude. Finally, the study found the magnitude of the long-run persistence of shocks to ESG returns in EME and DME almost 1 (i.e., 0.85 and 0.94, respectively), which is clear evidence of the high degree of persistence of shocks to ESG in both markets.

5.4.4 Discussion of findings on volatility spillovers

Upon the analysis and interpretation of the research results, this section of the dissertation expounds on the findings of the study by providing further discussions. The discussion of the research results on ESG returns and volatility spillovers in emerging and developed markets were offered in a thematic structure.

5.4.4.1 ESG volatility spillovers within Emerging (BICS) markets

In general, the results of the analysis confirm that there is evidence of both return and volatility spillover effects within the emerging ESG markets, categorically defined as Brazil, India, China and South Africa (BICS). Theoretically, the establishment of presence of spillovers within market blocs such as the BICS markets is an attestation to the core tenets of the concept of “stock market interdependency", which comprises of economic integration, contagion effect and stock market characteristics (Trinh, 2018). The concept which posits that due to the interconnectedness among international stock markets, argues that an event or shock in one stock market can transmit its effects to other markets, thereby, creating a network of interrelated financial systems. In the case of the BICS emerging markets, this was confirmed with the determination of possible contagion effect among the ESG markets as well as the fact that positive shocks (bad news) increases the volatility of ESG return by more than positive shocks (good news) of the same magnitude.

More so, the discovery of return and volatility spillover effects among emerging ESG markets is supported by relevant empirical studies that have found interdependencies among emerging financial markets. The studies of Bein and Tuna (2016) and Singh and Singh (2017) both observed a high degree of co-movement and return-volatility spillover effects among the BRIC equity markets, with Brazil, Russia, and South Africa showing higher correlation levels due to their heavy reliance on commodity exports. Additionally, the analysis of Singh and Singh (2017) on the BRIC equity markets further found evidence of market shocks and negative shocks to volatility spillover. Further affirming this stance is the study of Nyopa and Khumalo (2022), which highlighted the dominance of equity market shocks in the foreign exchange markets of these countries, with Brazil being the largest contributor of volatility spillovers.

With regards to the kind of spillover effect, the results of the analysis confirm that there is evidence of univariate return spillover within the emerging ESG markets, categorically defined as Brazil, India, China and South Africa (BICS). More specifically, the findings of the study evidenced that whilst the ESG returns in Brazil are not significantly influenced by ESG returns from other BICS markets, a positive and statistically significant spillover effect of the ESG returns from Brazil and South Africa to ESG returns in India.

More so, the discovery of return spillover effects among emerging ESG markets is supported by specific research on return spillovers within the emerging markets has offered some empirical findings. The study of Ono (2011) observed that whilst the stock returns of Russia, India, and China positively responded to oil shocks significantly, the stock returns of Brazil did not significantly respond to oil price shocks. The study of Tsuji (2018) on oil futures and equities revealed unidirectional return transmission from oil futures to oil equities in BRIC emerging markets. Likewise, Shi (2021) study on the BRICS stock markets identified return spillovers dominated by high frequency bands, with China and Russia playing influential roles. While Panda and Thiripalraju (2018) found both bidirectional and unidirectional return spillover and that negative news has more impact on the volatility spillovers among BRICS emerging markets, However, using the VAR and Diebold-Yilmaz spillover frameworks, the study identified bidirectional volatility spillovers between stock and foreign exchange markets in India, Brazil and South Africa (IBSA) emerging market bloc. This is similar to the study of Hung (2021) who highlighted the existence of bidirectional return spillover between economic policy uncertainty and BRICS stock returns. Regardless, the examination of Mensi et al. (2021) on strategic commodity futures and stock markets found intensified volatility spillovers under major events, with a higher hedging effectiveness in BRICS markets. These findings collectively support the presence of univariate return spillover within emerging markets.

Considering for shocks and volatility spillover, the results of the analysis confirm that there is an irrefutable evidence of spillover effects within the emerging ESG markets, categorically defined as Brazil, India, China and South Africa (BICS). Consistent with the earlier pre-evidence of a strong and positive unconditional correlation between ESG returns in Brazil and ESG returns in India, the shock spillover effect appears to be bidirectional in the cases of Brazil and India. Additionally, it was found that the effect of shock spillover is only evident in the volatility of ESG returns in China when shock to ESG is transmitting from South Africa only, and the reverse also holds as the volatility of ESG returns in South Africa is only affected by spillover of shock to ESG returns in China. However, the direction of the shocks and volatility spillovers in the emerging market explicated both positive and negative effects, signalling the possibility of contagion effect among the emerging (BICS) ESG markets.

More so, the discovery of shocks and volatility spillover effects among emerging ESG markets is supported by relevant empirical studies focusing on shocks and volatility spillovers within the emerging markets, some studies have offered some empirical findings. The study of Chiang et al. (2013) revealed the significant spillover effects of the sub-prime mortgage crisis on the BRICS stock markets, with Russia and Vietnam experiencing the greatest impact. These studies collectively underscore the complex and multifaceted nature of shocks and volatility spillover within the BRICS emerging markets. Likewise, Zhang et al. (2013) found bidirectional volatility spillovers between the equity and bond markets in Brazil, and South Africa, with weak evidence for Russia. The study of Mensi et al. (2016) also observed the presence of asymmetry and long memory in the conditional volatility, as well as significant dynamic correlations between the U.S. and BRICS stock markets, particularly during the global financial crisis.

On the effects of volatility spillovers in emerging markets, Boubaker and Raza (2017) highlighted the presence of time-varying volatility and the direct and indirect effects of oil price and stock market shocks. Similarly, Bouri et al. (2018) found that oil volatility shocks have a significant impact on the sovereign risk of these countries, with oil-exporting members (Brazil and Russia) and importing markets (India and China) showing different sensitivities to positive and negative shocks. Additionally, the critical study of Panda and Thiripalraju (2018) observed both bidirectional and unidirectional spillovers among the stock markets of these countries, with negative news having a greater impact on volatility. The contagion effect within the emerging markets remains a topical area in the understanding of spillovers. The study of Bonga-Bonga (2018) found evidence of bidirectional spillover between South Africa and Brazil, further noting that South Africa is more affected by crises originating from China, India, and Russia than these countries are by crises originating from South Africa.

5.4.4.2 ESG return and volatility spillovers within developed (G7) markets

In general, the results of the analysis confirm that there is evidence of spillover effects within the G7 developed ESG markets, categorically defined as Canada, France, Germany, Italy, japan, the UK and the USA (G7).

Based on the analysis of the DCC-VARMA GARCH model for the shock volatility spillover of the G7 ESG markets, it was foremostly noted that unlike the BIC ESG markets, the was no asymmetric effects. Thereafter, both the lagged own shocks and conditional variance were found to be statistically significant implying that volatility of the ESG returns in the G7 are influenced by both past own shocks as well as past own conditional variance. However, while it was found that majority of the coefficients of the own shocks were positive, majority of the conditional variance were observed to be negative. An implication of this finding depicts that volatility of the ESG returns in one period has the potential to increase and decrease the volatility in the ESG in some G7 markets. Hence, the results of the unconditional correlation of the G7 ESG further reveals overwhelming evidence of shock spillovers among the G7 ESG markets. This implies that there is market interconnectedness among the ESG markets of the G7 developed markets bloc.

This novel finding of the research study is consistent with the stock market dependency theory (discussed earlier), which posits that stock markets are interconnected with evidences of integration, spillovers and contagion. Empirically, the findings of this objective is in consistency with studies such as Spulbar et al. (2019), Maraqa and Bein (2020), Muguto (2021) and Tiwari et al. (2021) that have reported evidences of market interdependences among developed G7 stock markets.

Spulbar et al. (2019) identified a consistent pattern of continuous shock and volatility transmissions in the stock markets consisting of USA, UK, France, and Canada. Likewise, Maraqa and Bein (2020) using the DCC-MGARCH model, found varying degrees of correlation and significant volatility spillovers among developed European markets comprising of Italy, United Kingdom, France, Germany, Netherlands and Switzerland sustainability stock markets. More recently, the study of Muguto (2021) found evidences of significant interconnectedness among markets in the G7 developed markets bloc. However, the study of Liow (2015) found low levels of domestic volatility spillovers among G7 markets.

Returns spillovers

Considering the nature of return spillovers among the G7 ESG markets, the study found evidences of both bidirectional and unidirectional spillover transmissions. With regards to bidirectional transmission of returns spillovers, the study discovered mutual transmissions between certain markets. This implies that there a mutual exchange of returns spillovers between among these markets in pairs. In the context of this study, bidirectional transmissions were found among the following ESG markets: Canada and France (positive-positive), Canada and Japan (positive - negative), France and Germany (negative – positive), France and Italy (negative – positive), France and USA (positive-positive), Germany and Italy (negative-negative) and Germany and USA (positive negative)

Likewise, on unidirectional return spillover transmissions, the study discovered mutual transmissions between certain markets. This implies that spillover effect is predominantly one-sided, and the changes in returns in an ESG market have a significant influence on the returns of other ESG markets but not vice versa.

In the case of the G7 developed ESG markets bloc, the USA being the highest transmitter of returns spillover implies that a shock to the USA will increase volatility in all the G7 countries. This finding emphasizes the importance and influence of the USA ESG market in affecting the volatility of ESG markets within the G7 market bloc. Balli et al. (2021) notes that the US as a powerful market has significant influence on the other developed markets as several developed markets pay close attention to the domestic affairs of the US economy. More so evidently, the global financial crisis further offers a remarkable instance in global historical milestone reiterating that a recession in the US market could spell doom for the stability of the global economy. Whilst this relates to traditional stock market, the discovery of a like manner influence of the USA market within the ESG markets domain could subtly imply that there is subsisting linkage between the market influence in traditional stock market and the ESG market. This is because several studies on traditional stock markets such as Antonakakis and Badinger (2016), Bathia et al. (2016), and Chuliá et al. (2017) have established that the US market as the highest transmitter of return shocks, especially to developed markets.

Also, closely followed by the US market, the study found that France, Italy and Germany are the second leading transmitters of shocks within the developed markets bloc. This jointly held position, depicts that a shock to any of the three markets is capable of impacting volatility on five other countries within the G7 market bloc. Given that these markets are the only European Union (EU) member countries in the G7, an implication of this could mean that the EU bloc is influential, well interconnected and plays a pivotal role in the discourse of ESG matters. In fact, Golab and Zamojska (2019) and Ben Ameur and Louhichi (2022) assert that the European Union (EU) remains a resilient and robust market bloc that has significant spillover effect within the G7 developed markets bloc and globally.

This further gives credence to the fact that geographical interconnectedness still matters regardless of international economic integration. In affirmation to this, Yarovaya (2016) posits that a markets, particularly from a developed market bloc, is more susceptible to domestic and region-specific volatility shocks than to inter-regional contagion. Likewise, some studies have found evidence of integration and spillovers among markets within regional blocs such as GCC (Ziadat et al., 2020) and African markets (Atenga and Mougoué, 2021).

Conversely, Japan and the UK being the least transmitters of shocks implies that a shock to japan and the UK will have the least volatility effect on the other G7 markets. This implies that these markets are less influential and fairly independent regardless of their membership within the (G7) developed markets bloc. For the UK market, a most likely explanation would be that the Brexit dilemma has hurt the UK's market influence more than any attributable gains. In fact, the Mayor of London recently confirmed that the decision for Brexit has erased 140 billion pounds from the UK economy (Bloomberg, 2024).

On Canada and France being the highest receiver, means that the Canadian and French markets, among the developed markets are the most sensitive/vulnerable to shocks emitting from other developed markets as the returns of the Canadian and French markets can be influenced by shock spillovers from 5 countries within the developed markets bloc. Conversely, with the US being the least receiver of shocks from other markets within the G7 bloc, further implies that the US market is least sensitive to shocks from other markets. This further affirms the robustness and resilience of the US economy as a leading and independent market, which can largely influence the discourse of ESG globally.

Shocks and volatility spillovers

Considering the nature of shocks and volatility spillovers among the G7 ESG markets, the study found evidences of both bidirectional and unidirectional spillover transmissions.

On bidirectional transmission of volatility spillovers, the study discovered mutual transmissions between certain markets. This implies that there a mutual exchange of shocks and spillovers between among these markets in pairs. In the context of this study, bidirectional transmissions were found among the following ESG markets: Canada and Italy (positive bidirectional), Canada and USA (positive bidirectional), France and Germany (negative – positive bidirectional), France and UK (positive bidirectional), France and USA (positive bidirectional), Germany and Italy (positive - negative bidirectional), Germany and Japan (positive bidirectional), and Italy and UK (negative -positive bidirectional).

Likewise, on unidirectional volatility spillover transmissions, the study discovered mutual transmissions between certain markets. This implies that spillover effect is predominantly one-sided, and the changes in volatility in an ESG market have a significant influence on the volatility of other ESG markets but not vice versa.

Again, the empirical evidence shows France, Germany and the USA as the leading transmitting markets of shock and volatility spillovers within the developed market bloc. This implies that a shock to any of these countries (France, Germany and the USA) will increase volatility in most of the G7 countries. Conversely, both the Canadian and Japanese ESG markets were noted as the least transmitter of shocks and volatility spillovers within the G7 ESG markets bloc. From the perspective of shock and volatility receivers, the study observed the leading receiving markets to be Canada, Italy and France, whilst other markets were found to be receivers of shocks from at least three countries. The implication of this findings from the position of shock and volatility spillovers, further reiterates the importance and influence of the USA and EU (except Italy) ESG markets in affecting the volatility of ESG markets within the G7 market bloc. This is further supported by empirical studies that have established that the USA and EU have major impact on shock and volatility spillovers in international markets.

These findings are in consonance with empirical studies such as Maraqa and Bein (2020), (Muguto, 2021), Tiwari et al. (2021) and Ma et al. (2022). Muguto (2021) stressed that evidences of bi-directional spillovers showed that both sets of markets are transmitters and recipients of volatility. Likewise, Tiwari et al. (2021) highlighted dynamic and volatile characteristics in returns and volatility series across major markets including SPTSX, NYSE, DAX, FTSE, CAC40, SPX, with specific markets identified as net receivers or contributors in return spillovers. Ma et al. (2022) emphasized that the impact of Economic Policy Uncertainty (EPU) on stock market volatility was significant in the United States, Japan, and Canada, while significant economic events, such as financial crisis and Brexit, increases spillovers among G7 markets of France, Germany, and Italy.

However, contrary to the findings of this study, Jain and Sehgal (2019) observed that the U.S. was negatively associated with other developed markets, except Canada which was uncorrelated, and Italy and the U.K. lead in price discovery during pre-crisis and crisis periods, respectively, emphasizing regional patterns in information linkages. Also, the study of Charda and Pendaraki (2023) revealed that there is a significant correlation between the German DAX30 and the British FTSE100 indices. This could suggest that even a major event such as Brexit might be insufficient to reduce integration between former ally markets.

5.4.4.3 ESG return and volatility spillovers across emerging (BICS) and developed (G7) markets

In general, the findings of the analysis revealed there is evidence of both return and volatility spillover across emerging and developed markets. More specifically, the return spillover effect was observed to exhibit a unidirectional transmission nature, as it was only statistically significant when the spillover effect emanates from changes in the ESG returns in the developed markets economies (DME) index to ESG returns in the emerging markets economies (EME) index. More so, the coefficient of the return spillover effect of ESG returns from DME to ESG returns in DME was found negative, suggesting further that returns on ESG in the emerging market are likely to be adversely affected by the spillover of changes in ESG returns in the developed market.

Likewise, from the perspective of the volatility spillovers, it was observed that the effect of a volatility spillover is only evident statistically when the shock to ESG returns is from DME to EME Similar, to the return spillover, we find that 1% changes in the shock to ESG returns in the DME is capable of reducing the volatility of ESG return in the EME by 1.2%. In particular, the asymmetric dynamics of the volatility revealed that irrespective of whether it is EME or DME, negative shocks (bad news) increases the volatility of ESG return by more than positive shocks (good news) of the same magnitude. Regardless, the study found clear evidence of the high degree of persistence of shocks to ESG in both markets.

The findings of the study imply that the developed (G7) ESG market bloc have significant spillover influence on both the returns and volatility of the Emerging (BICS) ESG market bloc, and not vice-versa. Further noting the influence of USA and the European Union (EU) ESG markets, the findings of this study suggests that there is a propensity for bad news such as market crashes and instabilities from these markets to affect ESG returns and volatility of emerging markets and not vice-versa.

This is in consistency with empirical studies such as Li and Giles (2015), Gulzar et al. (2019), Zhang et al. (2021b) Agyei et al. (2022) and Mensi et al. (2023). Employing a multivariate GARCH model the research of Li and Giles (2015) found significant unidirectional shock and volatility spillovers from the American market to Asian emerging markets. Similarly, Gulzar et al. (2019) found evidence of long-term cointegration between the U.S. market and emerging stock markets, with increased cointegration after the crisis period. The study further stressed the short-term impact of financial market shocks from America on the returns of emerging financial markets. Adopting Directed Acyclic Graph Structural Vector Autoregression (DAG-SVAR) model, Zhang et al. (2021b) found that that the G7 is a major exporter of risk, with the BRIC markets being the risk recipients. In the short term, Agyei et al. (2022) found spillovers from G7 markets to BRICS to be significant, as markets such as Germany, UK and France were observed to be the highest transmitters of shocks to the BRICS markets. Mensi et al. (2023) asserts that during the COVID-19 pandemic, bad volatility spillovers took precedence and were more pronounced than good volatility spillovers, underscoring the prevalence of contagion effects.

5.5 Conclusions on nature of spillovers in Emerging and developed markets

The chapter five of this research examined the nature of volatility of ESG returns and volatility spillovers in emerging and developed markets. In this concluding section of the chapter, the research objectives vis-à-vis corresponding findings on the nature of volatility spillovers are reviewed. Thereafter, suggestions for future studies are highlighted.

5.5.1 Review of research objectives and findings

The core purpose of this chapter was to determine the spillover effects of the returns and volatility dynamics of ESG markets. To effectively achieve this, the chapter considered the subject matter from three focus areas of inquiry: (1) to determine the nature of ESG return and volatility spillovers within the emerging markets, (2) to determine the nature of ESG return and volatility spillovers within the developed markets (3) to determine and compare the nature of ESG return and volatility spillovers between the emerging and developed ESG markets blocs.

As a result, the research investigation considered several MGARCH models that accommodate not only the return spillover in the mean equation but also shock spillovers in the variance equation. The model was estimated across the competing constant conditional correlation (CCC) and dynamic conditional correlation assumptions. Thereafter, the study then employed some of the model selection criteria in the literature to arrive at the choice of the DCC-VARMA-AGARCH model in the case of the BICS, the DCC-VARMA-GARCH model in the case of the G7, and the CCC-VARMA-AGARCH model in the case of the EME and DME.

Empirically, the research found significant evidence of both return and volatility spillovers among the ESG returns of the BICS countries and the ESG returns of the G7 countries. However, while the spillover effect is primarily unidirectional, both in the BICS economies and in the cases of the G7 countries, the research also noted some instances where the effect is bidirectional. The study further revealed that the extent to which negative shocks (bad news) increase the volatility of ESG returns by more than positive shocks (good news) of the same magnitude is only applicable with respect to the BICS economies and cannot be generalised as it is not applicable to the G7 countries. In sum, the research evidence revealed that returns on ESG in the emerging market vulnerable to shocks to ESG returns in the developed market and never the other way around.

CHAPTER SIX: CONCLUSIONS AND RECOMMENDATIONS

6.1 Introduction

The niche of sustainable finance, despite relatively new, has become a mainstay in the discourse of global finance. Whilst there are multiple factors driving the research interest in this space, chief amongst this, is the purported consequentiality of sustainability concerns that is relatable to even people lacking financial knowledge. Within this dimension, understanding performance of ESG funds in different market conditions of bull and bear offers valuable insights on the profitability, stability and resilience of sustainable investment alternatives across market blocs and conditions. In addition to this, it is equally essential to understand the nature of volatility and volatility spillovers in ESG-focused markets as generalizations could prove to be costly. Given the importance of investor sentiments as a fundamental factor that affects investments in general, the contribution of this inquisition is relevant for stakeholders and the global public committed to a more sustainable world.

Thus, this research employed several models to comprehensively investigate the influence of investor sentiment on Environmental, Social, and Governance (ESG) return and volatility performance in both emerging and developed markets. Specifically, the study aimed to achieve several research objectives: first, to ascertain and compare the impact of investor sentiment on ESG performance under different market conditions (bull vs bear) within emerging markets; second, to assess the influence of investor sentiment on ESG performance in diverse market conditions within developed markets; third, to compare the effects of investor sentiment on ESG performance across market conditions and blocs (emerging vs developed markets); fourth, to analyze and compare the nature of ESG volatility in emerging and developed markets, considering factors such as asymmetry, mean reversion, and persistence; fifth, to explore the impact of investor sentiments on ESG volatility within emerging and developed market blocs; sixth, to evaluate and compare ESG return and volatility spillovers within the emerging markets bloc; seventh, to assess ESG return and volatility spillovers within the developed markets bloc; and finally, to compare the nature of ESG return and volatility spillovers between the emerging and developed ESG markets blocs. Through these objectives, the research aims to provide comprehensive insights into the dynamics of investor sentiments and ESG performance across different market conditions and blocs.

This chapter of the dissertation provides a summary of the findings, conclusions and recommendations. Herein, the chapter commences by highlighting and discussing the summary of findings, which was subsequently followed by the implications of the study findings. Thereafter, the study proceeded with the conclusions, limitations and suggested recommendations for future studies.

6.2 Summary of key findings

This research dissertation explored the investor sentiment and ESG performance under market conditions and characterizations of emerging and developed markets. The study further investigated the nature of ESG volatility and spillovers in emerging and developed markets. In this section of the study, the key findings from the core technical chapters (chapters 3- 5) are here by discussed.

6.2.1 Investor sentiment and ESG performance under different market conditions in emerging and developed market blocs

The first broad objective of this research dissertation as contained in the chapter three, sought to understand the impact of investor sentiment on ESG return and volatility performance across market conditions and market characterizations. Herein, the study utilized the Markov Regime Switching Model to actualize this pursuit.

In general, the first objective of this study found that investor sentiment impacts the performance of ESG funds in emerging markets more than in developed markets regardless of market conditions. From a comparative standpoint, the findings of the study assert that under bull market condition, the emerging markets index is significantly influenced by investor sentiments in statistical terms, as compared to the developed market index. Also, under bear market condition, it was confirmed that ESG performance in emerging market bloc was slightly more influenced by investor sentiments compared to the developed market. From the perspective of Intra-markets bloc, the results of the study established that the influence of investor sentiment on ESG performance varies across market conditions and characterizations. Howbeit, the findings suggest that specific ESG markets such as South Africa, Canada, Japan and the UK are vastly and significantly susceptible to investor sentiments in both bull and bear market periods.

Regarding the return performance of ESG under different market conditions in different markets blocs of emerging and developed markets, the findings of the study in general established mixed outcomes. For instance, in bull market condition, the finding established that the emerging markets index outperformed the developed markets index. However, in a bearish market trend, the findings established that developed markets index performed better than the emerging markets index. This suggest that markets conditions and market characterizations play a pivotal role when considering the return performance of ESG markets. A plausible reason for this could be the general notion that emerging markets are more profitable and have opportunities for abnormal returns due to exploitable market inefficiencies, which are seemingly evasive in developed markets due to saturation and maturity.

From the perspective of Intra-markets bloc, the results of the study established that ESG return performance in the emerging markets bloc varies amongst the markets based on market conditions. For instance, under the bull market condition, it was confirmed that the Chinese ESG market was the topmost performing ESG market, whilst the Brazilian market was found to be the least performing ESG market. Conversely, in the bearish market condition, the Brazilian ESG market was noted as the leading performing ESG market, whilst the South African market was determined as the least performing ESG market. Similarly, the results of the study established that ESG return performance in the developed markets bloc varies amongst the markets based on market conditions. For instance, under the bull market condition, the findings of the study established that Italy, France, the UK, Germany, and the USA ranks as the top positively performing ESG markets in order of sequence, whilst the Canadian and Japanese markets were found to be the least negatively performing ESG markets. Conversely, in the bearish market condition, the ESG market such as Canada, France, Italy, the UK and Japan were noted as the top positively performing ESG markets, whilst the ESG markets including the USA and Germany were noted as the least negatively performing ESG markets.

Regarding the volatility performance of ESG under different market conditions in different markets blocs of emerging and developed markets, the findings of the study in general established mixed outcomes. The findings of the study confirmed that in bull market condition, the developed market index as exhibited a higher volatility than the emerging market index. however, in bear market condition, it was established that the emerging market index exhibited higher volatility than the developed market index. whilst this further validates the effects of market conditions and characterizations, it is however interesting to note that despite the returns of emerging markets outperforming developed markets in the bull regime, the relative volatility was lower in the same regime compared to the developed markets. This could further imply an observable shifting towards ESG funds in emerging markets. However, the evidence of higher volatility in bear market condition could be an indication of faith in the developed markets bloc for safety.

From the perspective of intra-markets bloc, the results of the study established that ESG volatility performance in the emerging markets bloc varies amongst the markets based on market conditions. For instance, in both bull and bear market conditions, the Brazilian and Indian ESG markets were found to be the most and least volatile markets respectively. Likewise, from the standpoint of developed markets, Italy, the UK and Japan, were established as the most volatile ESG markets in the bull period, whilst the US, Canada, Germany and France were confirmed as the least volatile during a bullish market condition. Conversely in the bearish market condition, the most volatile markets during a market downturn are Canada, Italy, and the UK, whilst the least volatile during bearish market are Germany, France, the US, and Japan.

6.2.2 Nature of ESG volatility dynamics in emerging and developed markets

The second broad objective of this research dissertation as contained in the chapter four, sought to understand the nature of ESG volatility dynamics across emerging and developed markets. Herein, the study utilized various GARCH models to examine the stylized facts of volatility across the market blocs. Furthermore, the GARCH-X model was used to test whether investor sentiments impacts ESG volatility in emerging and developed markets.

A foremost critical finding of the study based on the mean equation coefficients was the establishment of weak form of market efficiency across emerging and developed market blocs. This was evident in the consistent insignificance of the mean equation coefficients of all the member ESG markets except the USA ESG market. The statistical significance of the USA ESG market, while consistently insignificant in other markets, affirms the differences in market efficiency between the USA ESG market and other ESG markets. According to the EMH theory, the USA market is more efficient in incorporating ESG concerns into asset prices, hence the statistically significant coefficients for ESG variables in GARCH models. Conversely, the insignificance of mean equations of other markets suggest lower levels of market efficiency of all ESG markets other than the USA ESG market. A plausible cause of this could be attributed to the fact that investors in the US ESG market have greater information transparency. Also, it could mean that investors in the USA ESG markets are more attuned to ESG concerns and regulations as compared to other markets.

Another major finding of the study based on the leverage effect parameters which established that regardless of whether asymmetry was determined by the EGARCH or GJR-GARCH model, the parameters (except for the South African ESG market) were positive and statistically significant in emerging and developed market blocs. This consistent positive significance of leverage effect, suggests that negative shocks (bad news) is more likely to increase the volatility of ESG markets than positive shocks (good news). From the stand point of the EMH theory, this implies that ESG markets incorporates negative information into asset prices faster than positive information. However, if the asymmetry in response to shocks persists over time, it may challenge the weak form of EMH, which assumes that past prices cannot predict future prices. Analysis of the shock persistence in the ESG markets further depict that ESG volatility persistence to be close to zero in most member markets in the emerging and developed blocs. This suggests that shocks to ESG returns volatility persistence is low and mean reverting across both market blocs. However, high volatility persistence is seen in markets such as China, the USA and the DME index, which exhibited means that are closer to one. Thus, from the standpoint of the EMH theory, the low volatility persistence suggests that past volatility levels do not predict future volatility. Further affirming the existence of a weak form of EMH, across the ESG markets which posits that past prices or volatility levels cannot predict future prices or volatility.

Lastly, the research established that investor sentiments statistically significant impact the volatility of ESG returns in both emerging and developed market blocs. Although, it was found that investor sentiments significantly influence ESG volatility in emerging market bloc, more extensively than in the developed market bloc. The findings further noted that the South African and UK ESG markets were the most vulnerable markets to the influence of investor sentiments. While the EMH posits that asset, prices reflect all available information, including investor sentiments, the extent to which these sentiments impact volatility may differ between emerging and developed markets. Also, the observation that investor sentiments have a more extensive influence on ESG volatility in emerging markets compared to developed markets suggests that emerging markets may be more sensitive to non-fundamental factors such as sentiment-driven fluctuations. This could be due to factors such as less mature market structures, lower liquidity, or greater influence of retail investors who may be more prone to sentiment-driven trading. Additionally, the identification of South African and UK ESG markets as the most vulnerable to the influence of investor sentiments indicates specific market vulnerabilities within the context of ESG investing. This vulnerability could stem from various factors such as regulatory environments, socio-political factors, or the composition of market participant

6.2.3 Nature of ESG volatility spillovers in emerging and developed markets

The third broad objective of this research dissertation as extensively detailed in the chapter five, sought to determine the spillover effects of the returns and volatility dynamics of ESG markets. Herein, the study utilized the Multivariate GARCH models such as the DCC-VARMA-AGARCH, DCC-VARMA-GARCH and the CCC-VARMA-AGARCH models to test for the returns and volatility spillover dynamics across the ESG markets.

Firstly, the overall findings of this objective established that there is evidence of both return and volatility spillover across emerging and developed markets. Specifically, from the standpoint of the return spillover effect, a statistically significant unidirectional spillover transmission from the developed markets bloc to the emerging markets bloc was confirmed. More so, the coefficient of the return spillover effect was found to be negative, further suggesting that returns on ESG in the emerging market are likely to be adversely affected by the spillover of changes in ESG returns in the developed market. Likewise, from the perspective of the volatility spillover effect, it was observed that the effect of a volatility spillover is only evident statistically when the shock to ESG returns is from developed markets to emerging markets. Similar, to the return spillover, the finding depicted that 1% changes in the shock to ESG returns in the developed market is capable of reducing the volatility of ESG return in the emerging market bloc by 1.2%. In particular, the asymmetric dynamics of the volatility revealed that regardless of market blocs, negative shocks (bad news) increases the volatility spillovers of ESG return by more than positive shocks (good news) of the same magnitude. The findings of the study imply that the developed (G7) ESG market bloc have significant spillover influence on both the returns and volatility of the Emerging (BICS) ESG market bloc, and not vice-versa. Further noting the influence of USA and the European Union (EU) ESG markets, the findings of this study suggests that there is a propensity for bad news such as market crashes and instabilities from these markets to affect ESG returns and volatility of emerging markets and not vice-versa.

Secondly, a general exploration of the nature of spillovers in emerging markets, established that there is evidence of both return and volatility spillover effects within the emerging ESG markets, categorically defined as Brazil, India, China and South Africa (BICS). With regards to the return spillover effect, the finding of the study confirms that there is evidence of univariate return spillover within the emerging ESG markets. More specifically, the findings evidenced that whilst the ESG returns in Brazil was not significantly influenced by ESG returns from other BICS markets, a positive and statistically significant spillover effect of the ESG returns from Brazil and South Africa to ESG returns in India was found. By the same token, for shocks and volatility spillover, the findings confirmed bidirectional spillover effects in the case of Brazil and India. However, a unidirectional relationship was depicted between China and South Africa. Whilst the effect of shock spillover was evident in the volatility of ESG returns in China when the shock emanates from South Africa, a reverse (negative) spillover effect was noted as the volatility of South African ESG returns were negatively impacted by shocks from China. These findings suggest that there is a possible pairwise spillover relationship between individual markets within the emerging markets bloc.

Thirdly, the overall findings confirm that there is evidence of spillover effects within the G7 developed ESG markets, categorically defined as Canada, France, Germany, Italy, japan, the UK and the USA (G7). Considering the nature of return spillovers within the G7 ESG markets, the study found evidences of both bidirectional and unidirectional spillover transmissions. With regards to bidirectional transmission of returns spillovers, the study discovered mutual transmissions between certain member markets such as Canada and France (positive-positive), Canada and Japan (positive - negative), France and Germany (negative – positive), France and Italy (negative – positive), France and USA (positive-positive), Germany and Italy (negative-negative) and Germany and USA (positive negative). This implies that there a mutual exchange of returns spillovers between among these markets in pairs. Likewise, on unidirectional return spillover transmissions, the US ESG market was found to be the highest transmitter of returns spillover, whilst Japan and the UK were found to be the least transmitters. Conversely, Canada and France were found as the highest receiver of shocks emitting from other developed markets, whilst the US was again confirmed as the least receiver of shocks from other markets within the G7 bloc. This implies that spillover effect is predominantly one-sided, and the changes in returns in an ESG market have a significant influence on the returns of other ESG markets but not vice versa. Considering the nature of shocks and volatility spillovers among the developed ESG markets, the study found evidences of both bidirectional and unidirectional spillover transmissions. On bidirectional transmission of volatility spillovers, the study discovered mutual transmissions between certain markets such as: Canada and Italy (positive bidirectional), Canada and USA (positive bidirectional), France and Germany (negative – positive bidirectional), France and UK (positive bidirectional), France and USA (positive bidirectional), Germany and Italy (positive - negative bidirectional), Germany and Japan (positive bidirectional), and Italy and UK (negative - positive bidirectional). This implies that there a mutual exchange of shocks and spillovers between among these markets in pairs. Conversely, on unidirectional volatility spillover transmissions, the study discovered mutual transmissions between certain markets. Herein, the empirical evidence shows France, Germany and the USA as the leading transmitting markets of shock and volatility spillovers within the developed market bloc, whilst the Canadian and Japanese ESG markets were noted as the least transmitter of shocks and volatility spillovers within the G7 ESG markets bloc. From the perspective of shock and volatility receivers, the study observed the leading receiving markets to be Canada, Italy and France, whilst other markets were found to be receivers of shocks from at least three countries. This implies that spillover effect is predominantly one-sided, and the changes in volatility in an ESG market have a significant influence on the volatility of other ESG markets but not vice versa.

6.3 Implications of research study

Akin to the pursuit of the objectives of this research dissertation, major fundamental empirical facts are established and highlighted. This section hereby discusses the implications of these facts in line with quintessential finance theories that frames this research study.

Empirical fact one: This research investigation empirically established that investor sentiment impacts the performance of ESG funds in emerging markets **more** than in developed markets regardless of market conditions. This finding holds significant implications across various financial theories. In the context of the EMH, the findings challenge the notion of market efficiency by suggesting that investor sentiment can influence the performance of ESG funds, indicating potential inefficiencies in pricing. Likewise, from the standpoint of behavioral finance theory, the findings emphasize the importance of psychological factors in investment decision-making, highlighting how investor sentiment drives market outcomes. Lastly, the AMH theory acknowledges the dynamic nature of markets and the role of investor behavior in shaping them, suggesting that the impact of sentiment on ESG fund performance may vary across market conditions.

Empirical fact two: This research investigation empirically established that although return performance of ESG funds varies across market characterizations and conditions, emerging markets performed better in bull market condition and developed markets performed better in bear market condition. This empirical finding poses intriguing implications across multiple financial theories. Within the framework of the EMH theory, the finding suggests that market efficiency may be influenced by market conditions, with the observed variations in ESG fund performance indicating potential inefficiencies that deviate from the hypothesis. Likewise, from the perspective of the behavioral finance theory, this finding highlights the role of behavioral biases in driving market outcomes, as evidenced by the differential performance of ESG funds in response to market conditions. Moreover, the AMH perspective acknowledges the dynamic nature of markets and suggests that the observed pattern may reflect adaptive behaviors of investors in response to changing market environments.

Empirical fact three: This research investigation empirically established that although volatility performance of ESG funds varies across market characterizations and conditions, developed market as exhibited a higher volatility in bull market condition and emerging markets exhibited higher volatility in bear market condition. Theoretically, these findings could mean that from the perspective of the EMH theory, this finding challenges the notion of market efficiency by showcasing differing volatility patterns across market types and conditions, suggesting potential inefficiencies in pricing and information dissemination. Likewise, From the standpoint of behavioral finance theory, the findings emphasize the influence of investor sentiment and behavior on market volatility, as evidenced by the observed variations in ESG fund volatility. More so, the AMH theory recognizes the dynamic nature of markets and suggests that the observed volatility patterns may reflect adaptive responses of market participants to changing conditions.

Empirical fact four: This research investigation empirically established that there is a weak-form of market efficiency across emerging and developed market blocs except the USA ESG market. Theoretically, this finding implies that in the framework of the EMH theory, the observed weak-form efficiency across emerging and developed markets, with the exception of the USA ESG market, further challenges the theoretical assumption of immediate and complete reflection of all available information in market prices. Likewise, from the lens of the behavioral finance theory, the finding suggests that psychological biases play a role in market inefficiencies. Finally, the AMH further affirms the adaptability of market participants to changing conditions, potentially explaining the variations in market efficiency observed across different regions.

Empirical fact five: This research investigation empirically established that except for China, the EGARCH model is best suitable for understanding the nature of volatility dynamics in majority of the ESG member markets within the emerging and developed market blocs. Theoretically, these findings could mean that from the standpoint of the EMH theory, the preference for the EGARCH model over other volatility models in understanding volatility dynamics suggests potential inefficiencies in pricing and information processing, particularly in the majority of ESG member markets across emerging and developed market blocs. Likewise, from the perspective of behavioral finance theory, the finding highlights the cruciality of understanding investor behavior and sentiment in driving volatility dynamics, as reflected in the choice of the EGARCH model for modeling volatility.

Empirical fact six: This research investigation empirically established that based on the leverage effect, negative shocks (bad news) are more likely to increase the volatility of ESG returns than positive shocks (good news) in both emerging and developed market blocs. Theoretically, this implies that considering the EMH theory, the finding challenges the hypothesis by suggesting that market reactions to negative and positive shocks exhibit an asymmetrical pattern, indicating potential inefficiencies in information processing and pricing within ESG markets across emerging and developed blocs. Also, from the perspective of behavioral finance theory, the finding emphasizes the influence of cognitive biases in amplifying the impact of negative news on market volatility, reflecting the tendency for risk aversion and loss aversion among market participants. Moreover, the AMH theory confirms the adaptive nature of market participants in responding to changing conditions, potentially explaining the observed asymmetry in volatility dynamics.

Empirical fact seven: This research investigation empirically established that although investor sentiments impacts the volatility of ESG returns regardless of market characterizations., emerging markets are extensively more susceptible to investor sentiments than developed markets. This implies that within the context of the EMH theory, the finding challenges the theory by suggesting that market efficiency may be influenced by investor sentiment, particularly in the context of ESG returns where volatility dynamics are impacted. Likewise, from the perspective of behavioral finance theory, this accentuates that the significant role of investor psychology and sentiment in driving market outcomes, with emerging markets showing heightened susceptibility to these factors compared to developed markets. Also, the AMH theory acknowledges the adaptive behavior of market participants, potentially explaining the observed variations in susceptibility to investor sentiment across different market types.

Empirical fact eight: This research investigation empirically established that although there is evidence of return spillovers across emerging and developed markets, ESG returns in emerging market are likely to be adversely affected by the spillover of changes in ESG returns of developed market. Theoretically, this suggest that in the context of the EMH theory, the finding confronts the assumption of independent market movements by revealing the presence of return spillovers between emerging and developed markets, particularly ESG returns. Likewise, from the perspective of behavioral finance theory, it underscores the interconnectedness of global markets and the potential for investor sentiment and behavior to propagate across borders, impacting ESG returns in emerging markets. Lastly, the AMH theory accedes to the dynamic nature of market interactions, potentially explaining how changes in ESG returns in developed markets can influence those in emerging markets.

Empirical fact nine: This research investigation empirically established that although there is evidence of return spillovers across emerging and developed markets, the developed ESG market bloc especially the USA and the EU, have significant volatility spillover influence on both the volatility of emerging markets. Theoretically, this implies that from the context of the EMH theory, the finding challenges the assumption of market independence by revealing significant volatility spillovers from developed ESG markets to emerging markets, suggesting potential inefficiencies in market information processing and pricing. Likewise, from the lens of behavioral finance theory, it affirms the interconnectedness of global markets and the role of investor sentiment in driving volatility spillovers, particularly from developed markets with established ESG frameworks. Additionally, the AMH theory acknowledges the dynamic nature of market interactions, potentially explaining how changes in volatility in developed ESG markets can influence volatility in emerging markets.

Empirical fact ten: This research investigation empirically established that, negative shocks (bad news) from developed markets increases the volatility spillovers of ESG return in emerging markets by more than positive shocks (good news), not vice-versa. For instance, there is a propensity for bad news such as market crashes and instabilities from developed markets to affect ESG returns and volatility of emerging markets and not vice-versa. This further implies that within the EMH framework, this finding questions the theoretical premise of immediate and complete information absorption, suggesting that negative shocks from developed markets can have a disproportionate impact on the volatility of ESG returns in emerging markets, implying potential inefficiencies in market information processing and pricing. Also, from the perspective of behavioral finance theory, the finding highlights the influence of investor sentiment and cognitive biases in amplifying the effects of negative news on market dynamics, particularly in the context of ESG investments where social and ethical considerations play a significant role. More so, the AMH theory acknowledges the adaptability of market participants in responding to changing conditions, potentially explaining how negative shocks from developed markets can exert stronger volatility spillovers on emerging markets.

In general, this research study establishes that investor sentiment significantly impacts ESG fund performance and volatility dynamics across emerging and developed markets, challenging traditional finance theories like the Efficient Market Hypothesis (EMH). The study highlights how market conditions influence the performance of ESG funds differently, with emerging markets showing higher sensitivity to investor sentiment. These findings emphasize the need for revised financial models that incorporate behavioral aspects and recognize market inefficiencies in pricing and information processing. Future research directions could explore cultural and institutional influences on ESG investments globally, aiming to refine risk management strategies and enhance market efficiency. Furthermore, the insights into asymmetric volatility responses to negative and positive shocks suggest opportunities for further investigation into adaptive investor behaviors and sustainable investment practices, integrating insights from finance theory, behavioral economics, psychology, sustainability and policy analysis to advance the field of sustainable finance.

6.4 Conclusions and Recommendations

6.4.1 Concluding remarks

In general, without any iota of doubt, there is an increasing global interest towards sustainable investing, particular investing in ESG funds. Whilst this is a much welcome development, this study resolves that market characterization and market condition are pivotal when making sustainable investment choices via ESG funds. This is because the empirical evidence found in this research investigation has suggested that ESG funds differ across market blocs of emerging and developed markets as well as across market conditions of bull and bear. Regardless, a point worth noting is the remarkable return and volatility performance of ESG funds in emerging markets during bullish market condition which indicates growth opportunities within this market sphere despite infrastructural challenges. In like manner, the empirical evidence stability in developed market as explicated through the lens of low volatility in bearish market condition, further affirms the general notion of developed markets resilience during crisis periods.

Whilst this reverberates global awareness and interest towards sustainable investment as enabled by technological revolutions in investing, mass media and the rise of global finance, the empirical evidence of weak-form of market efficiency across the markets cannot be ignored. This form of efficiency suggests that that investors cannot consistently outperform the market by solely relying on historical price data or technical indicators. However, other forms of efficiency argue for the potential of abnormal returns based on fundamental analysis of publicly available information (legal) as well as insider information (illegal). Further expanding on the nature of ESG markets beyond market conditions, the empirical evidence of this research investigation also notes that investors should take cognizance of fundamental factors such as volatility persistence, market interdependencies and ultimately the influence of investor sentiments.

On volatility persistence, the study resolves that bad news generally affect both return and volatility performance of ESG markets more than good news. This is further supplemented by empirical evidence of interdependences among ESG markets regardless of characterizations. Lastly, of noteworthy to investors and stakeholders, this scientific investigation resolves that investor sentiment significantly influence the general return and volatility performance of ESG markets regardless of market conditions. This premise was further affirmed when considered from the purview of the nature of ESG markets volatility.

6.4.2 Limitations of the research study

In spite of the successful actualization of the objectives of this research study, there remains some inevitable limitations. These limitations are understudied from three dimensions of the research scope, the conceptualization of investor sentiment and the standardization of ESG indices.

Commencing with the research scope limitation, this study considered emerging ESG markets as defined as five-member countries from the standpoint of the BRICS economies. However, due to the Russia-Ukraine war, Russia was barred as an ESG market by all database providers such as Bloomberg. Another delimitation relating to the scope of the study was the birth of the BRICS Plus which was formed at the near-completion of this study. Whilst several studies have ideated emerging markets as MENA, ASEAN, ECOWAS and so on, this study conceptualized emerging markets as BRICS as considered by other authors. Likewise, with regard to developed ESG markets, the G7 countries were favored. In a similar vein to the emerging markets, there is no standard conceptualization of developed markets as some studies have considered market blocs such as the EU and the G10 as advanced economies/ market blocs.

Secondly, with regards to the construct of investor sentiment as a research limitation, there is no one size fit all conceptualization of investor sentiment. Based on empirical studies, such as Baker and Wurgler (2007c), He et al. (2022), and Gric et al. (2023) investor sentiment has been captured as market-based sentiment, media-based sentiment, survey-based sentiment, et cetera. However, due to the global nature of this study, it was deemed appropriate to define investor sentiment as a composite metric consisting of global sentiment indicators. This approach has been widely adopted by closely similar studies that have considered international market blocs.

Lastly, the final research limitation of this study relates to the availability of different measures of ESG indices as computed by varying providers of sustainable finance data such as Sustainalytics, Refinitiv, MSCI, Vigeo Eiris et cetera. Given the availability of alternative data sources, the choice for the use of the MSCI data was due to its robustness to cover all the ESG markets in both the emerging and developed markets as represented by the BRICS and G7 market blocs. In addition to this, the MSCI data is widely accessible and available on the Bloomberg terminal. This in no way does not discredit other studies that have employed alternative ESG indices from other data providers where possible.

To mitigate the aforementioned limitations of this research study, several strategies can be considered. Firstly, to address the scope limitation related to the definition of emerging and developed ESG markets, future studies could adopt a more inclusive approach that encompasses broader regional groupings beyond BRICS and G7. This could involve considering emerging markets from MENA, ASEAN, and ECOWAS regions, and defining developed markets more flexibly to include market blocs like the EU and G10, reflecting diverse economic and geopolitical realities. Secondly, regarding the conceptualization of investor sentiment, researchers could explore hybrid approaches that integrate multiple dimensions of sentiment such as market-based, media-based, and survey-based indicators. This approach would provide a more comprehensive understanding of sentiment dynamics across global markets. Finally, to mitigate the limitation related to ESG indices, future studies could leverage multiple data providers beyond MSCI to capture a broader range of ESG metrics and ensure robustness and comparability across different regions and markets. By adopting these strategies, future research can enhance the depth and breadth of insights into sustainable finance and mitigate the inherent limitations of current methodologies and data availability.

6.4.3 Recommendations for future research studies

With the growing significance of environmental, social, and governance (ESG) concerns in shaping investment choices, scholarly investigations in this domain can provide practical suggestions for investors, regulators, academics, and other pertinent parties; thereby aiding the establishment and development of sustainable financial markets.

Foremost, the perspective of investor sentiments and ESG performance in bull and bear market conditions, some interesting scientific inquisitions can be considered for future explorations. For instance, a future study can assess the effectiveness of regulatory interventions in promoting ESG investing practices across market conditions and characterizations. Such a study holds immense significance for sustainable finance as it could shed light on the impact of regulatory frameworks on investor behavior and market outcome. This would further contribute to the development of evidence-based policies that encourage ESG integration. Also, another future study can explore the impact of media-based investor sentiment on the performance of ESG funds across market conditions and characterizations. As a potential study for advancing sustainable finance research, this proposed scientific investigation could uncover the extent to which media narratives influence investor behavior towards ESG investments, thus shaping market outcomes. Thus, an understanding these dynamics is essential for developing strategies to mitigate potential volatility and enhance the effectiveness of ESG funds in achieving sustainable investment objectives. Lastly, a future study can consider how investor sentiment influence each pillar of ESG (Environmental factors, Social factors, and Governance factors) in bull and bear market conditions across emerging and developed markets. Exploring this research has broad implications for understanding the dynamics between investor sentiments and ESG considerations, offering insights into how market conditions may impact the prioritization and integration of specific ESG factors. Understanding these dynamics can inform the design of tailored strategies to promote sustainable investment decisions, mitigate risk, and enhance market resilience, thereby contributing to the advancement of sustainable finance research globally.

Within the context of ESG market volatility, there are several explorable beneficial research opportunities that can be investigated by future scholars. For instance, the nature of ESG market volatility and investor sentiments can be investigated across other market blocs and geographical clusters. This proposed study has significant relevance as it can provide valuable insights into the cross-border dynamics of sustainable investing, highlighting commonalities and divergences in the nature of ESG volatility and sentiments across various blocs such as ASEAN, SADC, ECOWAS, GCC et cetera. By understanding how the nature of volatility and investor sentiments within these different geopolitical contexts, such study can inform the development of region-specific investment strategies and regulatory frameworks that foster sustainable financial practices globally. Also, as there are several conceptualizations of investor sentiments, ESG volatility across market blocs can be explored based on media form of investor sentiments. Exploring such a study offers an opportunity to understand how media narratives as a form of investor sentiment, influence ESG volatility across different market blocs. By analyzing media forms of investor sentiments, such as news articles and social media discussions, such an investigation can uncover how perceptions of environmental, social, and governance factors vary across market blocs, thus informing the development of region-specific strategies for sustainable investing.

Therefore, future research studies on the nature of volatility of ESG returns and volatility spillovers in emerging and developed markets should focus on an interdisciplinary approach that integrates financial econometrics, behavioral finance, and sustainable development. In this purview, researchers could delve into the underlying drivers of ESG-related return and volatility spillovers, examining how ESG factors interact with market interconnectedness. Additionally, an inquiry on ESG market spillovers in market blocs such as SADC, ECOWAS, MENA and other market characterizations not beyond the scope of this study could be considered. Also, an investigation on the impact of investor sentiments, geopolitical events, and regulatory changes on ESG spillovers in varying market conditions would offer valuable contributions. Lastly, investigation into the long-term implications of ESG practices on global market stability would deepen the current understanding of ESG markets. Lastly, return and volatility spillovers among ESG markets remain unknown and open to future academic investigations. Considering such an inquiry in future studies can significantly elucidate limited knowledge on the interconnectedness and transmission mechanisms within ESG investment ecosystems. This further provides empirical clarity on how returns and volatility propagate across different ESG markets, as well as diversification strategies for possible contagion risks. Further research within this purview, could delve into understanding the underlying drivers of ESG-related return and volatility spillovers, and examining how ESG factors interact with market interconnectedness. This also carries profound implications for understanding the transmission mechanisms of ESG-related shocks across financial markets, as well as the key drivers shaping the integration of sustainability factors into investment decisions

Additionally, an inquiry on ESG market spillovers in market blocs such as SADC, ECOWAS, MENA and other market characterizations not beyond the scope of this study could be considered. The performance of this suggested research carries profound implications for clarifying on the dynamics of sustainable investing within specific regional contexts, offering insights into the transmission mechanisms of ESG-related shocks and the interconnectedness of sustainability factors across markets in different blocs of shared interests and commonalities. Also, an investigation on the impact of investor sentiments, geopolitical events, and regulatory changes on ESG spillovers in varying market conditions would offer valuable contributions. This proposed investigation is relevant as it sheds light on the complex interactions between behavioral factors, external shocks, and regulatory frameworks in shaping the transmission of ESG-related shocks across financial markets. Thus, comprehending how these forces influence ESG spillovers, researchers can inform policymakers, investors, and other stakeholders about the drivers of sustainability-linked market contagion and develop strategies to mitigate systemic risks. Lastly, investigation into the long-term implications of ESG practices on global market stability would deepen the current understanding of ESG markets. This suggested study offers significant implications for understanding the systemic risks and opportunities associated with the integration of environmental, social, and governance factors into investment decisions. Therefore, analyzing the impact of ESG practices on market stability over extended time horizons, future researchers can assess the resilience of financial systems to sustainability-related shocks and identify strategies to promote greater market stability in the face of evolving socio-environmental challenges.

In summary, for future research in sustainable finance, several detailed recommendations can guide scholarly investigations towards broader impact and long-term advancements. Firstly, exploring regulatory interventions' effectiveness across market conditions in promoting ESG investing practices is crucial. This would offer insights into how policy frameworks influence investor behavior and market outcomes, facilitating evidence-based policy development. Secondly, studying the influence of media-based investor sentiment on ESG fund performance can uncover how media narratives shape market perceptions and investment decisions, essential for understanding external influences on sustainable finance. Additionally, investigating how investor sentiment impacts each pillar of ESG in varying market conditions across emerging and developed markets can elucidate dynamics influencing ESG integration strategies. Moreover, exploring the nature of ESG market volatility and sentiments across diverse geopolitical blocs like ASEAN, SADC, and MENA can provide comparative insights into regional variations in sustainable investing practices and regulatory needs. Lastly, an interdisciplinary approach integrating financial econometrics, behavioral finance, and sustainable development is essential for understanding ESG-related return and volatility spillovers, examining their drivers, and assessing long-term implications for global market stability. These research avenues collectively contribute towards enhancing the resilience and effectiveness of sustainable finance practices worldwide.

REFERENCES

Aboluwodi D, Nomlala B and Muzindutsi P-F (2022) The COVID-19 Crisis and Interaction between the JSE, Real Estate, Energy, Commodity and Cryptocurrency Markets. *Journal of Economics and Financial Analysis* 6(1): 55-76.

Abou-Zaid AS (2011) Volatility spillover effects in emerging MENA stock markets. *Review of Applied Economics* 7(1076-2016-87178): 107-127.

Adams K (2021) *Circular economy in the UK building sector: a framework for implementation*. Loughborough University.

Aggarwal R, Inclan C and Leal R (1999) Volatility in emerging stock markets. *Journal of financial and Quantitative Analysis* 34(1): 33-55.

Agudelo Aguirre RA and Agudelo Aguirre AA (2024) Behavioral finance: Evolution from the classical theory and remarks. *Journal of Economic Surveys*.

Agyei SK, Owusu Junior P, Bossman A, et al. (2022) Spillovers and contagion between BRIC and G7 markets: New evidence from time-frequency analysis. *Plos One* 17(7): e0271088.

Ahmed MS (2020) A Look at Behavioral Finance. *International Journal of Economics and Finance* 12(3): 1-73.

Ahmed RI, Zhao G and Habiba U (2022) Dynamics of return linkages and asymmetric volatility spillovers among Asian emerging stock markets. *The Chinese Economy* 55(2): 156-167.

Akkaya M (2021) An Analysis of the Stock Market Volatility Spread in Emerging Countries. *Istanbul Business Research* 50(2): 215-233.

Al-Hiyari A, Mas' ud A and Kolsi MC (2022) Environmental, social and governance (ESG) activity and corporate controversies in South Africa: The interacting role of a skillful board. *The Implementation of Smart Technologies for Business Success and Sustainability: During COVID-19 Crises in Developing Countries*. Springer, pp.335-346.

Albuquerque RA, Koskinen Y and Santioni R (2021) Mutual fund trading and ESG stock resilience during the COVID-19 stock market crash.

Alda M (2020) ESG fund scores in UK SRI and conventional pension funds: Are the ESG concerns of the SRI niche affecting the conventional mainstream? *Finance Research Letters* 36: 101313.

Alfreedi AA (2019) Shocks and volatility spillover between stock markets of developed countries and GCC stock markets. *Journal of Taibah University for Science* 13(1): 112-120.

Ali F, Suri P, Kaur T, et al. (2022) Modelling time-varying volatility using GARCH models: evidence from the Indian stock market. *F1000Research* 11.

Aliyev F, Ajayi R and Gasim N (2020) Modelling asymmetric market volatility with univariate GARCH models: Evidence from Nasdaq-100. *The Journal of Economic Asymmetries* 22: e00167.

Alizadeh S, Brandt MW and Diebold FX (2002) Range-based estimation of stochastic volatility models. *The Journal of finance* 57(3): 1047-1091.

Almansour B (2015) The impact of market sentiment index on stock returns: An empirical investigation on Kuala Lumpur Stock Exchange. *Journal of Arts, Science & Commerce* 6(3).

Amin N and Tauseef S (2022) Does an optimal ESG score exist? Evidence from China. *Macroeconomics and Finance in Emerging Market Economies*. 1-19.

Anamika, Chakraborty M and Subramaniam S (2023) Does sentiment impact cryptocurrency? *Journal of Behavioral Finance* 24(2): 202-218.

Andersen TG and Bollerslev T (1998) Answering the skeptics: Yes, standard volatility models do provide accurate forecasts. *International economic review*. 885-905.

Andersen TG, Bollerslev T, Diebold FX, et al. (2003) Modeling and forecasting realized volatility. *Econometrica* 71(2): 579-625.

Ángeles López-Cabarcos M, M Pérez-Pico A and López Perez ML (2020) Investor sentiment in the theoretical field of behavioural finance. *Economic Research-Ekonomska Istraživanja* 33(1): 2101-2228.

Antonakakis N and Badinger H (2016) Economic growth, volatility, and cross-country spillovers: New evidence for the G7 countries. *Economic Modelling* 52: 352-365.

Antoniou A, Koutmos G and Pericli A (2005) Index futures and positive feedback trading: evidence from major stock exchanges. *Journal of Empirical Finance* 12(2): 219-238.

Anyikwa I and Phiri A (2023) Quantile connectedness amongst BRICS equity markets during the COVID-19 pandemic and Russia–Ukraine war. *Cogent Economics & Finance* 11(2): 2251300.

Ap Gwilym O, Clare A, Seaton J, et al. (2012) Tactical equity investing across bull and bear markets. *The Journal of Wealth Management* 14(4): 61-69.

Apau R, Moores-Pitt P and Muzindutsi P-F (2021) Regime-switching determinants of mutual fund performance in South Africa. *Economies* 9(4): 161.

Arias Fogliano de Souza Cunha F and Samanez CP (2013) Performance analysis of sustainable investments in the Brazilian stock market: a study about the corporate sustainability index (ISE). *Journal of business ethics* 117: 19-36.

Arora RK, Das H and Jain PK (2009) Stock returns and volatility: evidence from select emerging markets. *Review of Pacific Basin Financial Markets and Policies* 12(04): 567-592.

Arvidsson S and Dumay J (2022) Corporate ESG reporting quantity, quality and performance: Where to now for environmental policy and practice? *Business Strategy and the Environment* 31(3): 1091-1110.

Ashwin Kumar N, Smith C, Badis L, et al. (2016) ESG factors and risk-adjusted performance: a new quantitative model. *Journal of Sustainable Finance & Investment* 6(4): 292-300.

Asif M, Searcy C and Castka P (2023) ESG and Industry 5.0: The role of technologies in enhancing ESG disclosure. *Technological Forecasting and Social Change* 195: 122806.

Assoe K (1998) Regime-switching in emerging stock market returns. *Multinational Finance Journal* 2(2): 101-132.

Atenga EME and Mougoué M (2021) Return and volatility spillovers to African equity markets and their determinants. *Empirical Economics* 61(2): 883-918.

Atkins J, Doni F, Gasperini A, et al. (2023) Exploring the effectiveness of sustainability measurement: which ESG metrics will survive COVID-19? *Journal of business ethics* 185(3): 629-646.

Bachelier L (1900) Théorie de la spéculation. *Annales scientifiques de l'École normale supérieure.* 21-86.

Baddeley M (2018) *Behavioural economics and finance.* Routledge.

Baele L (2005) Volatility spillover effects in European equity markets. *Journal of financial and Quantitative Analysis* 40(2): 373-401.

Bagchi B (2017) Volatility spillovers between crude oil price and stock markets: evidence from BRIC countries. *International Journal of Emerging Markets* 12(2): 352-365.

Bagchi B, Bhunia A and Dandapat D (2019) Analysis of volatility and leverage effect in select stock markets. *Indian Accounting Review* 23(1): 33-46.

Baillie RT and DeGennaro RP (1990) Stock returns and volatility. *Journal of financial and Quantitative Analysis* 25(2): 203-214.

Baker HK, Nofsinger JR and Spieler AC (2020) Designing Your Portfolio: The Role of Asset Allocation, Diversification, and Rebalancing. *The Savvy Investor's Guide to Building Wealth Through Traditional Investments*. Emerald Publishing Limited, pp.89-123.

Baker M and Wurgler J (2006a) Investor sentiment and the cross-section of stock returns. *Journal of Finance* 61.

Baker M and Wurgler J (2006b) Investor sentiment and the cross-section of stock returns. *The Journal of finance* 61(4): 1645-1680.

Baker M and Wurgler J (2007a) Investor sentiment in the stock market. *Journal of economic perspectives* 21(2): 129-152.

Baker M and Wurgler J (2007b) Investor sentiment in the stock market. *Journal of economic perspectives* 21(2): 129-151.

Baker M and Wurgler J (2007c) Investor sentiment in the stock market. *Journal of economic perspectives* 21.

Bakken R (2021) What Is Sustainable Finance and Why Is It Important. *Retrieved March* 6: 2022.

Balcilar M, Bonato M, Demirer R, et al. (2017) The effect of investor sentiment on gold market return dynamics: Evidence from a nonparametric causality-in-quantiles approach. *Resources Policy* 51: 77-84.

Ball R (1978) Anomalies in relationships between securities' yields and yield-surrogates. *Journal of financial Economics* 6(2-3): 103-126.

Balli F, Hasan M, Ozer-Balli H, et al. (2021) Why do US uncertainties drive stock market spillovers? International evidence. *International Review of Economics & Finance* 76: 288-301.

Baloch MS, Saeed A, Ahmed I, et al. (2018) Role of domestic financial reforms and internationalization of non-financial transnational firms: Evidence from the Chinese market. *Sustainability* 10(11): 3847.

Banke M, Lenger S and Pott C (2022) ESG Ratings in the Corporate Reporting of DAX40 Companies in Germany: Effects on Market Participants. *Sustainability* 14(15): 9742.

Barber BM and Odean T (2001) The internet and the investor. *Journal of economic perspectives* 15(1): 41-54.

Barberis N and Huang M (2008) Stocks as lotteries: The implications of probability weighting for security prices. *American Economic Review* 98(5): 2066-2100.

Barberis N and Shleifer A (2003) Style investing. *Journal of financial Economics* 68(2): 161-199.

Barberis N and Thaler R (2003) A survey of behavioral finance. *Handbook of the Economics of Finance* 1: 1053-1128.

Baruník J and Křehlík T (2018) Measuring the frequency dynamics of financial connectedness and systemic risk. *Journal of Financial Econometrics* 16(2): 271-296.

Barunik J, Krehlik T and Vacha L (2016) Modeling and forecasting exchange rate volatility in time-frequency domain. *European Journal of Operational Research* 251(1): 329-340.

Bathia D, Bredin D and Nitzsche D (2016) International sentiment spillovers in equity returns. *International Journal of Finance & Economics* 21(4): 332-359.

Bauckloh T, Utz S, Zeile S, et al. (2019) UN PRI signatories' ethics: Walk the talk or talk the talk? Serious ethical first movers vs. Late free riders. *Serious Ethical First Movers vs. Late Free Riders (May 10, 2019)*.

Baur D and Jung RC (2006) Return and volatility linkages between the US and the German stock market. *Journal of International Money and finance* 25(4): 598-613.

BCG (2023) The Sustainability Imperative in Emerging Markets. Reportno. Report Number|, Date. Place Published|: Institution|.

Beer F and Zouaoui M (2013) Measuring stock market investor sentiment. *Journal of Applied Business Research (JABR)* 29(1): 51-68.

Bein MA and Tuna G (2016) COMPARING SPILLOVER EFFECTS AMONG EMERGING MARKETS WITH A HIGHER (LOWER) SHARE OF COMMODITY EXPORTS: EVIDENCE FROM THE TWO MAJOR CRISES. *Economic Computation & Economic Cybernetics Studies & Research* 50(3).

Bekaert G and Harvey CR (1997) Emerging equity market volatility. *Journal of financial Economics* 43(1): 29-77.

Bekaert G and Hodrick RJ (1993) On biases in the measurement of foreign exchange risk premiums. *Journal of International Money and finance* 12(2): 115-138.

Bekaert G and Hoerova M (2014) The VIX, the variance premium and stock market volatility. *Journal of Econometrics* 183(2): 181-192.

Beloskar VD and Rao SN (2023) Did ESG save the day? Evidence from India during the COVID-19 crisis. *Asia-Pacific Financial Markets* 30(1): 73-107.

Ben-David I, Li J, Rossi A, et al. (2022) What do mutual fund investors really care about? *The Review of Financial Studies* 35(4): 1723-1774.

Ben Ameur H and Louhichi W (2022) The Brexit impact on European market co-movements. *Annals of Operations Research* 313(2): 1387-1403.

Bennani L, Le Guenedal T, Lepetit F, et al. (2018) How ESG investing has impacted the asset pricing in the equity market. *Available at SSRN 3316862*.

Benschopa T and López Cabreraa B (2014) Volatility modelling of CO2 emission allowance spot prices with regime-switching GARCH models. Reportno. Report Number|, Date. Place Published|: Institution|.

Berge TJ (2015) Predicting recessions with leading indicators: Model averaging and selection over the business cycle. *Journal of Forecasting* 34(6): 455-471.

Berk K, Hoffmann A and Müller A (2017) Probabilistic forecasting of electricity load with inhomogeneous Markov switching models. *Available at SSRN 2954365*.

Betzer A and Theissen E (2009) Insider trading and corporate governance: The case of Germany. *European Financial Management* 15(2): 402-429.

Bhar R and Nikolova B (2007) Analysis of mean and volatility spillovers using BRIC countries, regional and world equity index returns. *Journal of Economic Integration*. 369-381.

Bhattacharjee N and De A (2022) Time-Varying Risks in ESG Equity Investments during the COVID-19 Pandemic. *Global Business Review* 23(6): 1388-1402.

Bhowmik R and Wang S (2020) Stock market volatility and return analysis: A systematic literature review. *Entropy* 22(5): 522.

Bildirici ME and Badur MM (2018) The effects of oil prices on confidence and stock return in China, India and Russia. *Quant. Financ. Econ* 2: 884-903.

BIS (2021) *Sustainable finance: trends, valuations and exposures*.

Black F (1976) Studies of stock market volatility changes. *Proceedings of the American Statistical Association, Business & Economic Statistics Section, 1976*.

Black F (1986) Noise. *The Journal of finance* 41(3): 528-543.

Black F and Scholes M (1973) The pricing of options and corporate liabilities. *Journal of Political Economy* 81(3): 637-654.

Blankenberg A-K and Gottschalk JF (2018) Is socially responsible investing (SRI) in stocks a competitive capital investment? A comparative analysis based on the performance of sustainable stocks.

Bloomberg (2024) Brexit Cost the UK Economy £140 Billion, London Mayor Says.

Boffo R and Patalano R (2020) ESG investing: practices, progress and challenges. *Éditions OCDE, Paris*.

Bollerslev T (1986) Generalized autoregressive conditional heteroskedasticity. *Journal of Econometrics* 31(3): 307-327.

Bollerslev T and Mikkelsen HO (1996) Modeling and pricing long memory in stock market volatility. *Journal of Econometrics* 73(1): 151-184.

Bollerslev T and Todorov V (2011) Tails, fears, and risk premia. *The Journal of finance* 66(6): 2165-2211.

Bollerslev T and Wooldridge JM (1992) Quasi-maximum likelihood estimation and inference in dynamic models with time-varying covariances. *Econometric reviews* 11(2): 143-172.

Bonga-Bonga L (2018) Uncovering equity market contagion among BRICS countries: An application of the multivariate GARCH model. *The Quarterly Review of Economics and Finance* 67: 36-44.

Borup D and Jakobsen JS (2019) Capturing volatility persistence: a dynamically complete realized EGARCH-MIDAS model. *Quantitative Finance* 19(11): 1839-1855.

Bouattour M and Martinez I (2019) Efficient market hypothesis: an experimental study with uncertainty and asymmetric information. *Finance Contrôle Stratégie*.(22-4).

Boubaker H and Raza SA (2017) A wavelet analysis of mean and volatility spillovers between oil and BRICS stock markets. *Energy Economics* 64: 105-117.

Bourghelle D, Grandin P, Jawadi F, et al. (2023) *Behavioral Finance and Asset Prices: The Influence of Investor's Emotions.* Springer Nature.

Bouri E and Harb E (2022) The size of good and bad volatility shocks does matter for spillovers. *Journal of International Financial Markets, Institutions and Money* 80: 101626.

Bouri E, Shahzad SJH, Raza N, et al. (2018) Oil volatility and sovereign risk of BRICS. *Energy Economics* 70: 258-269.

Bouteska A, Mefteh-Wali S and Dang T (2022) Predictive power of investor sentiment for Bitcoin returns: Evidence from COVID-19 pandemic. *Technological Forecasting and Social Change* 184: 121999.

Bouyé E, Klingebiel D and Ruiz M (2021) Environmental, social, and governance investing. *A primer for central banks' reserve managers. Washington, DC: World Bank* 10: 36285.

Broadstock DC, Chan K, Cheng LT, et al. (2021) The role of ESG performance during times of financial crisis: Evidence from COVID-19 in China. *Finance Research Letters* 38: 101716.

Brock WA, Scheinkman JA, Dechert WD, et al. (1996) A test for independence based on the correlation dimension. *Econometric reviews* 15(3): 197-235.

Brooks C (2019) *EViews guide for introductory econometrics for finance.* Cambridge University Press.

Brooks C and Oikonomou I (2018) The effects of environmental, social and governance disclosures and performance on firm value: A review of the literature in accounting and finance. *The British Accounting Review* 50(1): 1-15.

Brown GW and Cliff MT (2004) Investor sentiment and the near-term stock market. *Journal of Empirical Finance* 11(1): 1-27.

Brown GW and Cliff MT (2005) Investor sentiment and asset valuation. *The Journal of Business* 78(2): 405-440.

Brown SJ (2020) The efficient market hypothesis, the financial analysts journal, and the professional status of investment management. *Financial Analysts Journal* 76(2): 5-14.

Bry G and Boschan C (1971) Front matter to" Cyclical Analysis of Time Series: Selected Procedures and Computer Programs". *Cyclical analysis of time series: Selected procedures and computer programs*. NBEr, pp.-13--12.

Buckley RP, Avgouleas E and Arner DW (2020) Three major financial crises: What have we learned? *Regulation and the Global Financial Crisis*. Routledge, pp.19-43.

Busch T, Bauer R and Orlitzky M (2016) Sustainable development and financial markets: Old paths and new avenues. *Business & Society* 55(3): 303-329.

Bush R, Chen J and Legunn E (2020) E, S, or G-analyzing global ESG performance. *The Journal of Impact and ESG Investing*.

Câmara P (2022) The Systemic Interaction Between Corporate Governance and ESG. *The Palgrave Handbook of ESG and Corporate Governance*. Springer, pp.3-40.

Capannoli M (2019) A theoretical and empirical review of socially responsible investments.

Capelle-Blancard G, Desroziers A and Zerbib OD (2021) Socially responsible investing strategies under pressure: Evidence from the COVID-19 crisis. *The Journal of Portfolio Management* 47(9): 178-197.

Caporin M and McAleer M (2012) Do we really need both BEKK and DCC? A tale of two multivariate GARCH models. *Journal of Economic Surveys* 26(4): 736-751.

Carvalhal A and Nakao Nakahodo S (2022) Do Environmental, Social and Governance (ESG) Practices Affect Abnormal Returns During the COVID-19 Pandemic? Evidence from Brazil.

CBOE (2023) *VIX Index*.

Cerqueti R, Ciciretti R, Dalò A, et al. (2021) ESG investing: A chance to reduce systemic risk. *Journal of Financial Stability* 54: 100887.

Çevik Eİ, Korkmaz T and Atukeren E (2012) Business confidence and stock returns in the USA: a time-varying Markov regime-switching model. *Applied Financial Economics* 22(4): 299-312.

CFA (2017) *Handbook on sustainable investments: Background information and practical examples for institutional asset owners.* CFA Institute Research Foundation.

Chang C-L, McAleer M and Tian J (2019) Modeling and testing volatility spillovers in oil and financial markets for the USA, the UK, and China. *Energies* 12(8): 1475.

Charda M and Pendaraki K (2023) Investigating Causal Spillovers among International Stock Markets. *European Journal of Interdisciplinary Studies* 15(1): 81-92.

Chau F, Deesomsak R and Koutmos D (2016) Does investor sentiment really matter? *International Review of Financial Analysis* 48: 221-232.

Chauvet M and Potter S (2000) Coincident and leading indicators of the stock market. *Journal of Empirical Finance* 7(1): 87-111.

Chelawat H and Trivedi IV (2016) The business value of ESG performance: The Indian context. *Asian journal of business ethics* 5(1-2): 195-210.

Chen H-Y, Hsu C-H and Yang SS (2022) ESG momentum strategies: A comparison between Taiwanese and Japanese markets. *Advances in Pacific Basin Business, Economics and Finance*. Emerald Publishing Limited, pp.91-110.

Chen H, Chong TTL and She Y (2014) A principal component approach to measuring investor sentiment in China. *Quantitative Finance* 14(4): 573-579.

Chen J (2022) Impact Investing.

Chen M-P, Lee C-C and Hsu Y-C (2017) Investor sentiment and country exchange traded funds: Does economic freedom matter? *The North American Journal of Economics and Finance* 42: 285-299.

Chen S, Han X, Zhang Z, et al. (2023) ESG investment in China: Doing well by doing good. *Pacific-Basin Finance Journal* 77: 101907.

Cheng T, Liu J, Yao W, et al. (2022) The impact of COVID-19 pandemic on the volatility connectedness network of global stock market. *Pacific-Basin Finance Journal* 71: 101678.

Cheteni P (2016) Stock market volatility using GARCH models: Evidence from South Africa and China stock markets.

Chiang S-M, Chen H-F and Lin C-T (2013) The spillover effects of the sub-prime mortgage crisis and optimum asset allocation in the BRICV stock markets. *Global Finance Journal* 24(1): 30-43.

Chiang TC and Zheng D (2015) Liquidity and stock returns: Evidence from international markets. *Global Finance Journal* 27: 73-97.

Chkili W (2012) The dynamic relationship between exchange rates and stock returns in emerging countries: volatility spillover and portfolio management. *International Journal of Management Science and Engineering Management* 7(4): 253-262.

Chkili W, Aloui C and Nguyen DK (2012) Asymmetric effects and long memory in dynamic volatility relationships between stock returns and exchange rates. *Journal of International Financial Markets, Institutions and Money* 22(4): 738-757.

Chou RY (1988) Volatility persistence and stock valuations: Some empirical evidence using GARCH. *Journal of applied econometrics*. 279-294.

Chouaibi Y, Rossi M and Zouari G (2021) The effect of corporate social responsibility and the executive compensation on implicit cost of equity: Evidence from French ESG data. *Sustainability* 13(20): 11510.

Choudhry T (1996) Stock market volatility and the crash of 1987: evidence from six emerging markets. *Journal of International Money and finance* 15(6): 969-981.

Christensen BJ and Prabhala NR (1998) The relation between implied and realized volatility. *Journal of financial Economics* 50(2): 125-150.

Christie AA (1982) The stochastic behavior of common stock variances: Value, leverage and interest rate effects. *Journal of financial Economics* 10(4): 407-432.

Christoffersen PF and Diebold FX (2006) Financial asset returns, direction-of-change forecasting, and volatility dynamics. *Management Science* 52(8): 1273-1287.

Chuliá H, Guillén M and Uribe JM (2017) Spillovers from the United States to Latin American and G7 stock markets: A VAR quantile analysis. *Emerging Markets Review* 31: 32-46.

Claassen C (2019) *Connectedness of the African Equity Markets: A Time-Frequency Spillover Analysis*. Faculty of Commerce.

Clark GL, Feiner A and Viehs M (2015) From the stockholder to the stakeholder: How sustainability can drive financial outperformance. *Available at SSRN 2508281*.

Clementino E and Perkins R (2021) How do companies respond to environmental, social and governance (ESG) ratings? Evidence from Italy. *Journal of business ethics* 171: 379-397.

Coffie W and Chukwulobelu O (2014) Modelling stock return volatility: comparative evidence from selected emerging African and Western developed markets. *International Journal of Management Practice* 7(4): 366-379.

Çömlekçi İ and Özer A (2018) Behavioral finance models, anomalies, and factors affecting investor psychology. *Global Approaches in Financial Economics, Banking, and Finance*. 309-330.

Cont R (2001) Empirical properties of asset returns: stylized facts and statistical issues. *Quantitative Finance* 1(2): 223.

Cont R and Da Fonseca J (2002) Dynamics of implied volatility surfaces. *Quantitative Finance* 2(1): 45.

Contreras G, Bos JW and Kleimeier S (2019) Self-regulation in sustainable finance: The adoption of the Equator Principles. *World Development* 122: 306-324.

Cootner PH (1964) The random character of stock market prices. *(No Title)*.

Crifo P, Durand R and Gond J-P (2019a) Encouraging investors to enable corporate sustainability transitions: The case of responsible investment in France. *Organization & Environment* 32(2): 125-144.

Crifo P, Escrig-Olmedo E and Mottis N (2019b) Corporate governance as a key driver of corporate sustainability in France: The role of board members and investor relations. *Journal of business ethics* 159: 1127-1146.

Czerwińska T and Kaźmierkiewicz P (2015) ESG rating in investment risk analysis of companies listed on the public market in Poland. *Economic Notes: Review of Banking, Finance and Monetary Economics* 44(2): 211-248.

Da Z, Engelberg J and Gao P (2011) In search of attention. *The Journal of finance* 66(5): 1461-1499.

Daal E, Naka A and Yu J-S (2007) Volatility clustering, leverage effects, and jump dynamics in the US and emerging Asian equity markets. *Journal of banking & Finance* 31(9): 2751-2769.

Daniel K, Hirshleifer D and Subrahmanyam A (1998) Investor psychology and security market under-and overreactions. *The Journal of finance* 53(6): 1839-1885.

Das N, Chatterjee S, Sunder A, et al. (2018) ESG ratings and the performance of socially responsible mutual funds: A panel study. *Journal of Finance Issues* 17(1): 49-57.

Daugaard D, Jia J and Li Z (2023) Implementing corporate sustainability information in socially responsible investing: a systematic review of empirical research. *Journal of Accounting Literature*.

De Bondt WF, Muradoglu YG, Shefrin H, et al. (2015a) Behavioral finance: Quo vadis?

De Bondt WF, Muradoglu YG, Shefrin H, et al. (2015b) Behavioral finance: Quo vadis? *Journal of Applied Finance (Formerly Financial Practice and Education)* 18(2).

De Bondt WF and Thaler R (1985) Does the stock market overreact? *The Journal of finance* 40(3): 793-805.

De Bondt WF and Thaler RH (1987) Further evidence on investor overreaction and stock market seasonality. *The Journal of finance* 42(3): 557-581.

de Marco M and van Vuuren G (2022) Environmental, Social, and Governance Factors in Emerging Markets: a Volatility Study.

de Paula FH, Mendes S, Caldeira JF, et al. (2018) Evidence of bull and bear markets in the Bovespa index: An application of Markovian regime-switching models with duration dependence. *Brazilian Review of Econometrics* 38(1): 39-74.

De Santis G (1997) Stock returns and volatility in emerging financial markets. *Journal of International Money and finance* 16(4): 561-579.

Dean WG and Faff RW (2001) Asymmetric covariance, volatility and the impact of news. *Volatility and the Impact of News (undated)*.

Dedi L and Yavas BF (2016) Return and volatility spillovers in equity markets: An investigation using various GARCH methodologies. *Cogent Economics & Finance* 4(1): 1266788.

Deeney P, Cummins M, Dowling M, et al. (2015) Sentiment in oil markets. *International Review of Financial Analysis* 39: 179-185.

Degirmenci K (2020) Mobile users' information privacy concerns and the role of app permission requests. *International Journal of Information Management* 50: 261-272.

Demirer R, Ferrer R and Shahzad SJH (2020) Oil price shocks, global financial markets and their connectedness. *Energy Economics* 88: 104771.

Deng X and Cheng X (2019) Can ESG indices improve the enterprises' stock market performance?—An empirical study from China. *Sustainability* 11(17): 4765.

Dervishaj B (2021) Psychological biases, main factors of financial behaviour-A literature review. *European Journal of Medicine and Natural Sciences* 4(1): 27-44.

Dhasmana S, Ghosh S and Kanjilal K (2023) Does investor sentiment influence ESG stock performance? Evidence from India. *Journal of Behavioral and Experimental Finance* 37: 100789.

Diaye M-A, Ho S-H and Oueghlissi R (2022) ESG performance and economic growth: a panel co-integration analysis. *Empirica* 49(1): 99-122.

Díaz A and Escribano A (2020) Measuring the multi-faceted dimension of liquidity in financial markets: A literature review. *Research in International Business and Finance* 51: 101079.

Diebold FX, Lee J-H and Weinbach GC (1993) Regime switching with time-varying transition probabilities.

Diebold FX and Yilmaz K (2012) Better to give than to receive: Predictive directional measurement of volatility spillovers. *International Journal of Forecasting* 28(1): 57-66.

Diebold FX and Yılmaz K (2014) On the network topology of variance decompositions: Measuring the connectedness of financial firms. *Journal of Econometrics* 182(1): 119-134.

Dimpfl T and Jung RC (2012) Financial market spillovers around the globe. *Applied Financial Economics* 22(1): 45-57.

Ding Z, Granger CW and Engle RF (1993) A long memory property of stock market returns and a new model. *Journal of Empirical Finance* 1(1): 83-106.

Ding Z, Liu Z, Zhang Y, et al. (2017) The contagion effect of international crude oil price fluctuations on Chinese stock market investor sentiment. *Applied energy* 187: 27-36.

Dong M, Chang C-P, Gong Q, et al. (2019) Revisiting global economic activity and crude oil prices: A wavelet analysis. *Economic Modelling* 78: 134-149.

Dong X and Yoon S-M (2019) What global economic factors drive emerging Asian stock market returns? Evidence from a dynamic model averaging approach. *Economic Modelling* 77: 204-215.

Doni F, Bianchi Martini S, Corvino A, et al. (2020) Voluntary versus mandatory non-financial disclosure: EU Directive 95/2014 and sustainability reporting practices based on empirical evidence from Italy. *Meditari Accountancy Research* 28(5): 781-802.

dos Santos MA, Fávero LPL, Brugni TV, et al. (2023) Adaptive markets hypothesis and economic-institutional environment: a cross-country analysis. *Revista de Gestão*.

Döttling R and Kim S (2021) ESG Investments and Investors' Preferences. *CESifo Forum.* München: ifo Institut-Leibniz-Institut für Wirtschaftsforschung an der …, 12-16.

Döttling R and Kim S (2022) Sustainability preferences under stress: Evidence from mutual fund flows during COVID-19. *Available at SSRN 3656756*.

Drysdale P (2011) The BRICS, the G-7 and deploying new global economic power. *European View* 10(2): 159-164.

Du D and Zhao X (2017) Financial investor sentiment and the boom/bust in oil prices during 2003–2008. *Review of Quantitative Finance and Accounting* 48: 331-361.

Duță V (2018) Uusing the symmetric models garch (1.1) and garch-m (1.1) to investigate volatility and persistence for the european and us financial markets. *Financial Studies* 22(1 (79)): 64-86.

Dwivedi YK, Hughes L, Kar AK, et al. (2022) Climate change and COP26: Are digital technologies and information management part of the problem or the solution? An editorial reflection and call to action. *International Journal of Information Management* 63: 102456.

Eccles RG, Ioannou I and Serafeim G (2014) The impact of corporate sustainability on organizational processes and performance. *Management Science* 60(11): 2835-2857.

Eccles RG, Lee L-E and Stroehle JC (2020) The social origins of ESG: An analysis of Innovest and KLD. *Organization & Environment* 33(4): 575-596.

Economist (2020) The Trouble with Climate Finance: The Financial System and

Climate Change. *Economist*.

Ederington LH (1979) The hedging performance of the new futures markets. *The Journal of finance* 34(1): 157-170.

Ehlers T and Packer F (2017) Green bond finance and certification. *BIS Quarterly Review September*.

El Ghoul S and Karoui A (2021) What's in a (green) name? The consequences of greening fund names on fund flows, turnover, and performance. *Finance Research Letters* 39: 101620.

Engelhardt N, Ekkenga J and Posch P (2021) ESG ratings and stock performance during the COVID-19 crisis. *Sustainability* 13(13): 7133.

Engle RF (1982) Autoregressive conditional heteroscedasticity with estimates of the variance of United Kingdom inflation. *Econometrica: Journal of the econometric society*. 987-1007.

Engle RF and Bollerslev T (1986) Modelling the persistence of conditional variances. *Econometric reviews* 5(1): 1-50.

Engle RF, Lilien DM and Robins RP (1987) Estimating time varying risk premia in the term structure: The ARCH-M model. *Econometrica: Journal of the econometric society*. 391-407.

Engle RF and Ng VK (1993) Measuring and testing the impact of news on volatility. *The Journal of finance* 48(5): 1749-1778.

Engle RF and Patton AJ (2001) What good is a volatility model? *Quantitative Finance* 1(2): 237.

Enow ST (2023) VOLATILITY PERSISTENCE IN INTERNATIONAL FINANCIAL MARKETS IN THE POST COVID-19 ERA. *International Journal of Banking and Finance* 18(2): 79-96.

Eratalay MH and Cortés Ángel AP (2022) The impact of ESG ratings on the systemic risk of European blue-chip firms. *Journal of Risk and Financial Management* 15(4): 153.

Erb CB and Harvey CR (2006) The strategic and tactical value of commodity futures. *Financial Analysts Journal* 62(2): 69-97.

Errunza VR and Losq E (1985) The behavior of stock prices on LDC markets. *Journal of banking & Finance* 9(4): 561-575.

Erten I, Tuncel MB and Okay N (2012) Volatility spillovers in emerging markets during the global financial crisis: diagonal BEKK approach.

ESL (2022) ESG Investments – Part One: An Introduction to and History of ESG Investing.

Eurosif (2023) Responsible Investment Strategies.

Fama EF (1965a) The behavior of stock-market prices. *The Journal of Business* 38(1): 34-105.

Fama EF (1965b) Random walks in stock market prices. *Financial Analysts Journal* 51(1): 75-80.

Fama EF (1970) Efficient capital markets: A review of theory and empirical work. *The Journal of finance* 25(2): 383-417.

Fama EF, Fisher L, Jensen MC, et al. (1969) The adjustment of stock prices to new information. *International economic review* 10(1): 1-21.

Fama EF and French KR (1988) Dividend yields and expected stock returns. *Journal of financial Economics* 22(1): 3-25.

Fattouh B, Kilian L and Mahadeva L (2013) The role of speculation in oil markets: What have we learned so far? *The Energy Journal*. 7-33.

Fender I, McMorrow M, Sahakyan V, et al. (2019) Green bonds: the reserve management perspective. *BIS Quarterly Review, September*.

Ferrer E, Salaber J and Zalewska A (2016) Consumer confidence indices and stock markets' meltdowns. *The European Journal of Finance* 22(3): 195-220.

Ferson WE and Schadt RW (1996) Measuring fund strategy and performance in changing economic conditions. *The Journal of finance* 51(2): 425-461.

Finter P, Niessen-Ruenzi A and Ruenzi S (2012) The impact of investor sentiment on the German stock market. *Zeitschrift für Betriebswirtschaft* 82: 133-163.

Fisher KL and Statman M (2003) Consumer confidence and stock returns. *Journal of Portfolio Management* 30(1): 115-127.

Flammer C (2015) Does corporate social responsibility lead to superior financial performance? A regression discontinuity approach. *Management Science* 61(11): 2549-2568.

Flores MC (2019) Challenges for Macroprudential Policy in the Euro Area: Cross-Border Spillovers and Governance Issues.

Folger-Laronde Z, Pashang S, Feor L, et al. (2022) ESG ratings and financial performance of exchange-traded funds during the COVID-19 pandemic. *Journal of Sustainable Finance & Investment* 12(2): 490-496.

Forbes KJ and Rigobon R (2002) No contagion, only interdependence: measuring stock market comovements. *The Journal of finance* 57(5): 2223-2261.

Ford JM, Gehricke SA and Zhang JE (2022) Option traders are concerned about climate risks: ESG ratings and short-term sentiment. *Journal of Behavioral and Experimental Finance* 35: 100687.

Fowowe B (2017) Return and volatility spillovers between oil and stock markets in South Africa and Nigeria. *African Journal of Economic and Management Studies* 8(4): 484-497.

Fowowe B and Shuaibu M (2016) Dynamic spillovers between Nigerian, South African and international equity markets. *International economics* 148: 59-80.

Freiberg D, Rogers J and Serafeim G (2020) How ESG issues become financially material to corporations and their investors. *Harvard Business School Accounting & Management Unit Working Paper*.(20-056).

French KR, Schwert GW and Stambaugh RF (1987) Expected stock returns and volatility. *Journal of financial Economics* 19(1): 3-29.

Friede G (2019) Why don't we see more action? A metasynthesis of the investor impediments to integrate environmental, social, and governance factors. *Business Strategy and the Environment* 28(6): 1260-1282.

Friede G, Busch T and Bassen A (2015) ESG and financial performance: aggregated evidence from more than 2000 empirical studies. *Journal of Sustainable Finance & Investment* 5(4): 210-233.

Gamba-Santamaria S, Gomez-Gonzalez JE, Hurtado-Guarin JL, et al. (2019) Volatility spillovers among global stock markets: measuring total and directional effects. *Empirical Economics* 56: 1581-1599.

Gao S, Meng F, Gu Z, et al. (2021) Mapping and clustering analysis on environmental, social and governance field a bibliometric analysis using Scopus. *Sustainability* 13(13): 7304.

Gasperini A (2020) Principles for Responsible Investment (PRI) and ESG Factors. *Climate Action*. 737-749.

Gavrilakis N and Floros C (2023) ESG performance, herding behavior and stock market returns: evidence from Europe. *Operational Research* 23(1): 3.

Geczy CC, Stambaugh RF and Levin D (2021) Investing in socially responsible mutual funds. *The Review of Asset Pricing Studies* 11(2): 309-351.

Geng J-B, Du Y-J, Ji Q, et al. (2021) Modeling return and volatility spillover networks of global new energy companies. *Renewable and Sustainable Energy Reviews* 135: 110214.

Gerster R (2011) Sustainable finance: Achievements, challenges, outlook. *Striking a balance ahead of Rio* 20.

Gibson G (1889) The stock markets of London. *Paris and New York, GP Putnam's Sons, New York.*

Giese G, Lee L-E, Melas D, et al. (2019a) Foundations of ESG investing: How ESG affects equity valuation, risk, and performance. *The Journal of Portfolio Management* 45(5): 69-83.

Giese G, Lee L-E, Melas D, et al. (2019b) Performance and risk analysis of index-based ESG portfolios. *The Journal of Beta Investment Strategies* 9(4): 46-57.

GIIN (2021) Global Impact Investing Network: Core Characteristics of Impact Investing.

Gilchrist D, Yu J and Zhong R (2021) The limits of green finance: A survey of literature in the context of green bonds and green loans. *Sustainability* 13(2): 478.

Giot P and Laurent S (2003) Market risk in commodity markets: a VaR approach. *Energy Economics* 25(5): 435-457.

Gkillas K, Tsagkanos A and Vortelinos DI (2019) Integration and risk contagion in financial crises: Evidence from international stock markets. *Journal of Business Research* 104: 350-365.

Glosten LR, Jagannathan R and Runkle DE (1993) On the relation between the expected value and the volatility of the nominal excess return on stocks. *The Journal of finance* 48(5): 1779-1801.

Goergen M, Renneboog L and Zhao Y (2019) Insider trading and networked directors. *Journal of Corporate Finance* 56: 152-175.

Golab A and Zamojska A (2019) Volatility spillovers between European financial markets: evidence since the Brexit. *International Journal of Business and Globalisation* 23(3): 345-366.

Goldstein M (1998) *The Asian financial crisis: Causes, cures, and systemic implications.* Peterson Institute.

Gong J, Wang G-J, Zhou Y, et al. (2023) Spreading of cross-market volatility information: Evidence from multiplex network analysis of volatility spillovers. *Journal of International Financial Markets, Institutions and Money* 83: 101733.

Gong X, Zhang W, Wang J, et al. (2022) Investor sentiment and stock volatility: New evidence. *International Review of Financial Analysis* 80: 102028.

Goulder LH, Hafstead MA, Kim G, et al. (2019) Impacts of a carbon tax across US household income groups: What are the equity-efficiency trade-offs? *Journal of Public Economics* 175: 44-64.

Goyal M and Aggarwal K (2014) ESG index is good for socially responsible investor in India. *Asian Journal of Multidisciplinary Studies* 2(11): 92-96.

Granger CW and Morgenstern O (1963) Spectral analysis of New York stock market prices 1. *Kyklos* 16(1): 1-27.

Grayson D (2019) Beyond BP: The Gulf of Mexico Deepwater Horizon Disaster 2010. *Managing Sustainable Business*. Springer, pp.21-33.

Gric Z, Bajzík J and Badura O (2023) Does sentiment affect stock returns? A meta-analysis across survey-based measures. *International Review of Financial Analysis* 89: 102773.

Grossman SJ and Stiglitz JE (1980) On the impossibility of informationally efficient markets. *The American economic review* 70(3): 393-408.

GSIA (2021) Global Sustainable Investment Review 2020.

GSIA (2022) Global Sustainable Investment Review 2022 (GSIR)

Gu Z (2022) Research on Stock Investment Strategies Under COVID-19—Based on Behavioral Finance. *2022 International Conference on Economics, Smart Finance and Contemporary Trade (ESFCT 2022).* Atlantis Press, 572-580.

Guidolin M and Timmermann A (2005) Economic implications of bull and bear regimes in UK stock and bond returns. *The Economic Journal* 115(500): 111-143.

Guidolin M and Timmermann A (2006) An econometric model of nonlinear dynamics in the joint distribution of stock and bond returns. *Journal of applied econometrics* 21(1): 1-22.

Gulzar S, Mujtaba Kayani G, Xiaofen H, et al. (2019) Financial cointegration and spillover effect of global financial crisis: A study of emerging Asian financial markets. *Economic Research-Ekonomska Istraživanja* 32(1): 187-218.

Gupta K (2021) The importance of financial liberalisation for economic growth: The case of Indonesia. *Bulletin of Indonesian Economic Studies* 57(2): 175-201.

Gürkaynak RS, Sack BP and Swanson ET (2007) Market-based measures of monetary policy expectations. *Journal of Business & Economic Statistics* 25(2): 201-212.

Habiba UE, Peilong S, Hamid K, et al. (2021) Stock returns and asymmetric volatility spillover dynamics between Asian emerging markets. *Global Business Review* 22(5): 1131-1145.

Hamid K, Ghafoor MM and Saeed MY (2020) Emerging Markets and Volatility Spillover Effects: Empirical Evidence from Regional Emerging Economies of Pakistan, China, India, and Bangladesh. *Global Economics Review* 1: 102-116.

Hamilton JD (1989) A new approach to the economic analysis of nonstationary time series and the business cycle. *Econometrica: Journal of the econometric society*. 357-384.

Hamilton JD and Susmel R (1994) Autoregressive conditional heteroskedasticity and changes in regime. *Journal of Econometrics* 64(1-2): 307-333.

Hamurcu Ç (2021) How consumer confidence index affects foreign investors' portfolio and equity security investments: a research on Turkey. *Celal Bayar Üniversitesi Sosyal Bilimler Dergisi* 19(02): 191-204.

Han KC, Lee SH and Suk DY (2009) Changes in Price and Trading Volume: Bull vs. Bear Markets. *The Journal of Trading* 4(4): 41-49.

Han X and Li Y (2017) Can investor sentiment be a momentum time-series predictor? Evidence from China. *Journal of Empirical Finance* 42: 212-239.

Hanna AJ (2018) A top-down approach to identifying bull and bear market states. *International Review of Financial Analysis* 55: 93-110.

Hanna AJ, Turner JD and Walker CB (2020) News media and investor sentiment during bull and bear markets. *The European Journal of Finance* 26(14): 1377-1395.

Hanna M (2020) The Impact of ESG-Related Industry Exclusions in Minimum-Volatility Portfolios. *The Journal of Impact and ESG Investing* 1(2): 87-103.

Harding D and Pagan A (2003) A comparison of two business cycle dating methods. *Journal of Economic Dynamics and Control* 27(9): 1681-1690.

Hassan SA (2017) A time series analysis of major indexes using GARCH model with regime shifts. *International Journal of Financial Research* 8(4): 127-133.

Hassani BK and Bahini Y (2022) Relationships between ESG disclosure and economic growth: A critical review. *Journal of Risk and Financial Management* 15(11): 538.

He Y, Qu L, Wei R, et al. (2022) Media-based investor sentiment and stock returns: a textual analysis based on newspapers. *Applied Economics* 54(7): 774-792.

He Z, Zhou F, Xia X, et al. (2019) Interaction between oil price and investor sentiment: nonlinear causality, time-varying influence, and asymmetric effect. *Emerging Markets Finance and Trade* 55(12): 2756-2773.

Henriques V, Yoshinaga CE and Júnior WE (2021) Does the ESG investment strategy generate alpha? Evidence from Brazilian stock market.

Herbert WE (1996) Investing in emerging markets: Emerging issues and trends. *Managerial Finance* 22(12): 3-7.

Hilliard JE (1979) The relationship between equity indices on world exchanges. *The Journal of finance* 34(1): 103-114.

Hirshleifer D (2015) Behavioral finance. *Annual Review of Financial Economics* 7: 133-159.

Ho KY (2006) Volatility dynamics of the greater China stock markets: a multivariate asymmetric approach. *9th Joint International Conference on Information Sciences (JCIS-06).* Atlantis Press.

Hoang K (2022) Silent but deadly: Political corruption and voluntary ESG disclosure in the United States. *Managerial and Decision Economics* 43(7): 2775-2793.

Hong H and Kacperczyk M (2009) The price of sin: The effects of social norms on markets. *Journal of financial Economics* 93(1): 15-36.

Hossenidoust E, Janor H, Yusefi M, et al. (2013) Volatility spillovers across commodity and stock markets among ASEAN countries. *Prosiding Perkem VIII, JILID* 3: 1401-1412.

Hu J, Sui Y and Ma F (2021) The measurement method of investor sentiment and its relationship with stock market. *Computational Intelligence and Neuroscience* 2021: 1-11.

Hung NT (2019) Return and volatility spillover across equity markets between China and Southeast Asian countries. *Journal of Economics, Finance and Administrative Science* 24(47): 66-81.

Hung NT (2021) Directional spillover effects between BRICS stock markets and economic policy uncertainty. *Asia-Pacific Financial Markets* 28(3): 429-448.

Huo R (2018) *Modelling dynamic financial linkages, spillover effects and volatility transmissions: empirical evidence from China and international financial markets*. RMIT University.

Ibragimov M and Khamidov R (2010) Heavy-Tailedness and Volatility in Emerging Foreign Exchange Markets: Theory and Empirics. Reportno. Report Number|, Date. Place Published|: Institution|.

ICMA (2020) Sustainable Finance HighLevel Definitions. *International Capital Market Association*.

Inderst G and Stewart F (2018) Incorporating environmental, social and governance (ESG) factors into fixed income investment. *World Bank Group publication, April*.

Ioana-Cristina S and Gheorghe C (2014) Characteristics of the emerging market economies-BRICS, from the perspective of stock exchange markets. *The Annals of the University of Oradea* 39(1): 40-49.

Isah KO and Ekeocha P (2023) Modelling exchange rate volatility in turbulent periods: The role of oil prices in Nigeria. *Scientific African* 19: e01520.

Izadi S (2015) Two Essays in Finance and Economics:"Investment Opportunities in Commodity and Stock Markets for G7 Countries" And "Global and Local Factors Affecting Sovereign Yield Spreads".

Jain M, Sharma GD and Srivastava M (2019) Can sustainable investment yield better financial returns: A comparative study of ESG indices and MSCI indices. *Risks* 7(1): 15.

Jain P and Sehgal S (2019) An examination of return and volatility spillovers between mature equity markets. *Journal of Economics and Finance* 43: 180-210.

Jakobsson RJM and Lundberg L (2018) The effect of ESG performance on share price volatility.

Jaye N (2017) The Adaptive Markets Hypothesis: A Financial Ecosystems Survival Guide. *Obtenido de https://blogs. cfainstitute. org/investor/2017/12/18/the-adaptive-markets-hypothesis-a-financialecosystems-survival-guide*.

Jegadeesh N (1990) Evidence of predictable behavior of security returns. *The Journal of finance* 45(3): 881-898.

Jensen NE (1967) An introduction to Bernoullian utility theory: I. Utility functions. *The Swedish journal of economics*. 163-183.

Jha PK (2016) Investors' Irrationality: Insights from Behavioral Finance. *Wealth: International Journal of Money, Banking & Finance* 5(1).

Jinga P (2021) The increasing importance of environmental, social and governance (ESG) investing in combating climate change. *Environmental Management-Pollution, Habitat, Ecology, and Sustainability*.

Johnson R, Erasmus PD and Mans-Kemp N (2019) Assessing the business case for environmental, social and corporate governance practices in South Africa. *South African Journal of Economic and Management Sciences* 22(1): 1-13.

Jones S (2022) ESG Risk in Times of Crisis: Evidence from the COVID-19 Pandemic. *Journal of Finance Issues* 20(2): 25-34.

Joshi P (2011) Return and volatility spillovers among Asian stock markets. *Sage Open* 1(1): 2158244011413474.

Kahneman D and Tversky A (1979) Prospect theory: An analysis of decision under risk. *Handbook of the fundamentals of financial decision making: Part I*. World Scientific, pp.99-127.

Kahneman D and Tversky A (2013) Prospect theory: An analysis of decision under risk. *Handbook of the fundamentals of financial decision making: Part I*. World Scientific, pp.99-127.

Kamoune A and Ibenrissoul N (2022) Traditional versus Behavioral Finance Theory. *International Journal of Accounting, Finance, Auditing, Management and Economics* 3(2-1): 282-294.

Kanas A (2000) Volatility spillovers between stock returns and exchange rate changes: International evidence. *Journal of business finance & accounting* 27(3-4): 447-467.

Kang W, Tang K and Wang N (2023) Financialization of commodity markets ten years later. *Journal of Commodity Markets*. 100313.

KARĞIN S, KAYALIDERE K, GÜLEÇ TC, et al. (2018) Spillovers of stock return volatility to Turkish equity markets from Germany, France, and America. *Dokuz Eylül Üniversitesi Sosyal Bilimler Enstitüsü Dergisi* 20(2): 171-187.

Karmakar M (2007) Asymmetric Volatility and Risk-Return Relationship in International Stock Markets. *Metamorphosis* 6(2): 136-150.

Karolyi GA, Lee K-H and Van Dijk MA (2012) Understanding commonality in liquidity around the world. *Journal of financial Economics* 105(1): 82-112.

Karwowski M and Raulinajtys-Grzybek M (2021) The application of corporate social responsibility (CSR) actions for mitigation of environmental, social, corporate governance (ESG) and reputational risk in integrated reports. *Corporate Social Responsibility and Environmental Management* 28(4): 1270-1284.

Kasman A (2009) The impact of sudden changes on the persistence of volatility: Evidence from the BRIC countries. *Applied Economics Letters* 16(7): 759-764.

Kayral IE, Alagoz HM and Tandogan NS (2020) The asymmetry effect and volatility persistence in stock market returns: evidence from Brazil, China, Mexico and Turkey. *Emerging Market Finance: New Challenges and Opportunities*. Emerald Publishing Limited, pp.149-163.

Kelikume I, Olaniyi E and Iyohab FA (2020) Efficient market hypothesis in the presence of market imperfections: Evidence from selected stock markets in Africa. *International Journal of Management, Economics and Social Sciences (IJMESS)* 9(1): 37-57.

Kempster S, Maak T and Parry K (2019) *Good dividends: Responsible leadership of business purpose*. Routledge.

Kenett DY, Perc M and Boccaletti S (2015) Networks of networks–an introduction. *Chaos, Solitons & Fractals* 80: 1-6.

Khan I (2023) An analysis of stock markets integration and dynamics of volatility spillover in emerging nations. *Journal of Economic and Administrative Sciences*.

King MA and Wadhwani S (1990) Transmission of volatility between stock markets. *The Review of Financial Studies* 3(1): 5-33.

Kirchler M and Huber J (2009) An exploration of commonly observed stylized facts with data from experimental asset markets. *Physica A: Statistical Mechanics and its Applications* 388(8): 1631-1658.

Kole E and Van Dijk D (2017) How to identify and forecast bull and bear markets? *Journal of applied econometrics* 32(1): 120-139.

Korinth F and Lueg R (2022) Corporate sustainability and risk management—The u-shaped relationships of disaggregated esg rating scores and risk in the German capital market. *Sustainability* 14(9): 5735.

Korkmaz T, Çevik Eİ and Atukeren E (2012) Return and volatility spillovers among CIVETS stock markets. *Emerging Markets Review* 13(2): 230-252.

Kotsantonis S and Serafeim G (2019) Four things no one will tell you about ESG data. *Journal of Applied Corporate Finance* 31(2): 50-58.

Koy A and Akkaya M (2017) The role of consumer confidence as a leading indicator on stock returns: A Markov switching approach. *Available at SSRN 2985299*.

Krause T and Tse Y (2013) Volatility and return spillovers in Canadian and US industry ETFs. *International Review of Economics & Finance* 25: 244-259.

Kula V and Baykut E (2017) BIST banka endeksi'nin (XBANK) volatilite yapısının markov rejim değişimi GARCH modeli (MSGARCH) ile analizi. *Bankacılar Dergisi* 102: 89-110.

Kumar AS and Kamaiah B (2017) Returns and volatility spillover between Asian equity markets: A wavelet approach. *Economic Annals* 62(212): 63-83.

Kumar M (2013) Returns and volatility spillover between stock prices and exchange rates: Empirical evidence from IBSA countries. *International Journal of Emerging Markets* 8(2): 108-128.

Kumar M and Thenmozhi M (2012) Causal effect of volume on stock returns and conditional volatility in developed and emerging market. *American Journal of Finance and Accounting* 2(4): 346-362.

Kumar R, Dayaramani N and Rocha J (2018) Understanding & Comparing ESG Terminology.

Kumari J and Mahakud J (2015) Does investor sentiment predict the asset volatility? Evidence from emerging stock market India. *Journal of Behavioral and Experimental Finance* 8: 25-39.

Kunjal D, Peerbhai F and Muzindutsi P-F (2021) The performance of South African exchange traded funds under changing market conditions. *Journal of Asset Management* 22(5): 350-359.

LaBella MJ, Sullivan L, Russell J, et al. (2019) The devil is in the details: the divergence in ESG data and implications for responsible investing. *New York: QS Investors*.

Leal Filho W, Tripathi SK, Andrade Guerra J, et al. (2019) Using the sustainable development goals towards a better understanding of sustainability challenges. *International Journal of Sustainable Development & World Ecology* 26(2): 179-190.

Lee DD, Fan JH and Wong VS (2021) No more excuses! Performance of ESG-integrated portfolios in Australia. *Accounting & Finance* 61: 2407-2450.

Lee MT, Raschke RL and Krishen AS (2022) Signaling green! firm ESG signals in an interconnected environment that promote brand valuation. *Journal of Business Research* 138: 1-11.

Lehmann BN (1990) Fads, martingales, and market efficiency. *The Quarterly Journal of Economics* 105(1): 1-28.

Lei H, Xue M, Liu H, et al. (2023) Precious metal as a safe haven for global ESG stocks: Portfolio implications for socially responsible investing. *Resources Policy* 80: 103170.

Leković M (2018) Evidence for and against the validity of efficient market hypothesis. *Economic themes* 56(3): 369-387.

Leković M (2020) Behavioral finance as an answer to the limitations of standard finance. *Bankarstvo* 49(3): 36-76.

Leogrande A and Costantiello A (2023) The Role of GDP Growth in the ESG Approach at World Level. *Available at SSRN 4434206*.

Lerner JS, Li Y, Valdesolo P, et al. (2015) Emotion and decision making. *Annual review of psychology* 66: 799-823.

Levin SA and Lo AW (2021) Introduction to PNAS special issue on evolutionary models of financial markets. *Proceedings of the National Academy of Sciences* 118(26): e2104800118.

Li M and Yen S (2011) Re-examining covariance risk dynamics in international stock markets using quantile regression analysis. *Acta Oeconomica* 61(1): 33-59.

Li X and Zakamulin V (2020) Stock volatility predictability in bull and bear markets. *Quantitative Finance* 20(7): 1149-1167.

Li Y and Giles DE (2015) Modelling volatility spillover effects between developed stock markets and Asian emerging stock markets. *International Journal of Finance & Economics* 20(2): 155-177.

Li Z, Feng L, Pan Z, et al. (2022) ESG performance and stock prices: evidence from the COVID-19 outbreak in China. *Humanities and Social Sciences Communications* 9(1): 1-10.

Liao T-L, Huang C-J and Wu C-Y (2011) Do fund managers herd to counter investor sentiment? *Journal of Business Research* 64(2): 207-212.

Liow KH (2015) Volatility spillover dynamics and relationship across G7 financial markets. *The North American Journal of Economics and Finance* 33: 328-365.

Liston DP and Huerta D (2012) Does investor sentiment affect Mexican stock market returns and volatility? *The Global Journal of Finance and Economics* 9(2): 121-132.

Liu X, Liu B and Han X (2019) Analysis of herd effect of investor's behavior from the perspective of behavioral finance. *2019 International Conference on Management, Education Technology and Economics (ICMETE 2019).* Atlantis Press, 559-563.

Liu Z, Wang S, Liu S, et al. (2022) Volatility Risk Premium, Return Predictability, and ESG Sentiment: Evidence from China's Spots and Options' Markets. *Complexity* 2022.

Ljungqvist A and Qian W (2016) How constraining are limits to arbitrage? *The Review of Financial Studies* 29(8): 1975-2028.

Lo AW (2004) The adaptive markets hypothesis: Market efficiency from an evolutionary perspective. *Journal of Portfolio Management, Forthcoming*.

Lo AW (2005) Reconciling efficient markets with behavioral finance: the adaptive markets hypothesis. *Journal of investment consulting* 7(2): 21-44.

Lo AW (2007) Efficient markets hypothesis.

Lo AW (2012) Adaptive markets and the new world order (corrected May 2012). *Financial Analysts Journal* 68(2): 18-29.

Lo AW and MacKinlay AC (1988) Stock market prices do not follow random walks: Evidence from a simple specification test. *The Review of Financial Studies* 1(1): 41-66.

Lo AW and MacKinlay AC (2011) *A non-random walk down Wall Street.* Princeton University Press.

Loang OK (2022) Overreaction, investor sentiment and market sentiment of COVID-19. *Vision*. 09722629221087386.

Loorbach D, Frantzeskaki N and Avelino F (2017) Sustainability transitions research: transforming science and practice for societal change. *Annual review of environment and resources* 42: 599-626.

Lopez C, Contreras O and Bendix J (2020) ESG ratings: The road ahead. *Available at SSRN 3706440*.

López Vargas RA (2022) *Combination of ESG and momentum: evidence of the Canadian market*.

Lorenzi A (2023) Sustainable Investments and ESG Financial Framework.

Lubys J and Panda P (2021) US and EU unconventional monetary policy spillover on BRICS financial markets: an event study. *Empirica* 48: 353-371.

Lunde A and Timmermann A (2004) Duration dependence in stock prices: An analysis of bull and bear markets. *Journal of Business & Economic Statistics* 22(3): 253-273.

Luo D (2022) ESG, liquidity, and stock returns. *Journal of International Financial Markets, Institutions and Money* 78: 101526.

Lux T (1996) The stable Paretian hypothesis and the frequency of large returns: an examination of major German stocks. *Applied Financial Economics* 6(6): 463-475.

Lyu C and Scholtens B (2024) Integration of the international carbon market: A time-varying analysis. *Renewable and Sustainable Energy Reviews* 191: 114102.

Ma Y, Wang Z and He F (2022) How do economic policy uncertainties affect stock market volatility? Evidence from G7 countries. *International Journal of Finance & Economics* 27(2): 2303-2325.

Mahapatra S and Bhaduri SN (2019) Dynamics of the impact of currency fluctuations on stock markets in India: Assessing the pricing of exchange rate risks. *Borsa Istanbul Review* 19(1): 15-23.

Maheu JM and McCurdy TH (2000) Identifying bull and bear markets in stock returns. *Journal of Business & Economic Statistics* 18(1): 100-112.

Maheu JM, McCurdy TH and Song Y (2012) Components of bull and bear markets: bull corrections and bear rallies. *Journal of Business & Economic Statistics* 30(3): 391-403.

Mahmoudinia D and Mostolizadeh SM (2023) (A) symmetric interaction between house prices, stock market and exchange rates using linear and nonlinear approach: the case of Iran. *International Journal of Housing Markets and Analysis* 16(4): 648-671.

Malkiel BG (2003) The efficient market hypothesis and its critics. *Journal of economic perspectives* 17(1): 59-82.

Manaswi K, Singh A and Gupta V (2023) Building a Better Future with Sustainable Investments: Insights from Recent Research. *Indian Journal of Human Development* 17(2): 320-343.

Mandacı PE, Taşkın FD and Ergün ZC (2019) Adaptive market hypothesis. *International Journal of Economics and Business Administration* 7(4): 84-101.

Mandal R and Murthy A (2021) CSR in the post pandemic era: the dual promise of ESG investment and investor stewardship. *Indian Law Review* 5(2): 229-249.

Mandelbrot BB and Mandelbrot BB (1963) *The variation of certain speculative prices.* Springer.

Mandelbrot BB and Mandelbrot BB (1997) *The variation of certain speculative prices.* Springer.

Manex Y (2011) Stock market co-movement and volatility spillover between USA and South Africa. *M. Sc. Theses submitted to UMEA University available online at* http://googlescholar. *com*.

Maraqa B and Bein M (2020) Dynamic interrelationship and volatility spillover among sustainability stock markets, major European conventional indices, and international crude oil. *Sustainability* 12(9): 3908.

Markowitz H (1952) The utility of wealth. *Journal of Political Economy* 60(2): 151-158.

Martini A (2021) Socially responsible investing: from the ethical origins to the sustainable development framework of the European Union. *Environment, Development and Sustainability* 23(11): 16874-16890.

Matthews J (2023) COP28: Key takeaways and opportunities. *SUSTAINABLE INVESTING*.

Mbanga C, Darrat AF and Park JC (2019) Investor sentiment and aggregate stock returns: the role of investor attention. *Review of Quantitative Finance and Accounting* 53: 397-428.

McNeil AJ and Frey R (2000) Estimation of tail-related risk measures for heteroscedastic financial time series: an extreme value approach. *Journal of Empirical Finance* 7(3-4): 271-300.

Meher BK, Hawaldar IT, Mohapatra L, et al. (2020) The effects of environment, society and governance scores on investment returns and stock market volatility. *International Journal of Energy Economics and Policy* 10(4): 234-239.

Mehra R and Prescott EC (1985) The equity premium: A puzzle. *Journal of monetary Economics* 15(2): 145-161.

Menicucci E and Paolucci G (2022) Board Diversity and ESG Performance: Evidence from the Italian Banking Sector. *Sustainability* 14(20): 13447.

Menicucci E and Paolucci G (2023) ESG dimensions and bank performance: an empirical investigation in Italy. *Corporate Governance: The International Journal of Business in Society* 23(3): 563-586.

Mensi W, Beljid M, Boubaker A, et al. (2013) Correlations and volatility spillovers across commodity and stock markets: Linking energies, food, and gold. *Economic Modelling* 32: 15-22.

Mensi W, Hammoudeh S, Nguyen DK, et al. (2016) Global financial crisis and spillover effects among the US and BRICS stock markets. *International Review of Economics & Finance* 42: 257-276.

Mensi W, Nekhili R, Vo XV, et al. (2023) Good and bad high-frequency volatility spillovers among developed and emerging stock markets. *International Journal of Emerging Markets* 18(9): 2107-2132.

Mensi W, Shafiullah M, Vo XV, et al. (2021) Volatility spillovers between strategic commodity futures and stock markets and portfolio implications: Evidence from developed and emerging economies. *Resources Policy* 71: 102002.

Migliorelli M (2021) What do we mean by sustainable finance? Assessing existing frameworks and policy risks. *Sustainability* 13(2): 975.

Moalla M and Dammak S (2023) Corporate ESG performance as good insurance in times of crisis: lessons from US stock market during COVID-19 pandemic. *Journal of Global Responsibility*.

Mohanty MS (2013) Market Volatility and Foreign Exchange Intervention in EMEs: What Has Changed?-An Overview. *An Overview (October 2013). BIS Paper*.(73a).

Morawakage P (2015) Volatility Modeling and its Impact on Risk premium in Emerging markets.

Moreira A and Muir T (2017) Volatility-managed portfolios. *The Journal of finance* 72(4): 1611-1644.

Morone A (2008) Financial markets in the laboratory: an experimental analysis of some stylized facts. *Quantitative Finance* 8(5): 513-532.

Moser T (2003) What is international financial contagion? *International Finance* 6(2): 157-178.

Moskovics P, Wanke P, Tan Y, et al. (2023) Market structure, ESG performance, and corporate efficiency: Insights from Brazilian publicly traded companies. *Business Strategy and the Environment*.

MSCI (2023) *MSCI ESG Leaders Indexes*.

Muguto HT, Muguto L, Bhayat A, et al. (2022) The impact of investor sentiment on sectoral returns and volatility: Evidence from the Johannesburg stock exchange. *Cogent Economics & Finance* 10(1): 2158007.

Muguto L (2021) *Analysis of stock return volatility and its response to investor sentiment: An examination of emerging and developed markets*. University of KwaZulu-Natal, South Africa.

Muguto L and Muzindutsi P-F (2021) *Analysis of stock return volatility and its response to investor sentiment:*

An examination of emerging and developed markets

Muguto L and Muzindutsi P-F (2022) A comparative analysis of the nature of stock return volatility in BRICS and G7 markets. *Journal of Risk and Financial Management* 15(2): 85.

Muhammad A and Shuguang Z (2015) Impact of structural shifts on variance persistence in asymmetric GARCH models: Evidence from emerging Asian and European markets. *Romanian Statistical Review* 63(1): 57-70.

Mukhodobwane RM, Sigauke C, Chagwiza W, et al. (2020) Volatility modelling of the BRICS stock markets. *Statistics, Optimization & Information Computing* 8(3): 749-772.

Muzindutsi P-F, Apau R, Muguto L, et al. (2023) The Impact of Investor Sentiment on Housing Prices and the Property Stock Index Volatility in South Africa. *Real Estate Management and Valuation* 31(2): 1-17.

Nam K, Kim S-W and Arize AC (2006) Mean reversion of short-horizon stock returns: Asymmetry property. *Review of Quantitative Finance and Accounting* 26: 137-163.

Nartea GV, Bai H and Wu J (2020) Investor sentiment and the economic policy uncertainty premium. *Pacific-Basin Finance Journal* 64: 101438.

Nasdaq (2019) Does ESG Investing Produce Better Stock Returns?

Nelson DB (1991) Conditional heteroskedasticity in asset returns: A new approach. *Econometrica: Journal of the econometric society*. 347-370.

Nevitt M (2023) Assessing COP28: The New Global Climate Deal in Dubai. *Just Security*.

Nisar S and Hanif M (2012) Testing weak form of efficient market hypothesis: empirical evidence from South Asia. *World Applied Sciences Journal* 17(4): 414-427.

Nogueira E, Gomes S and Lopes JM (2022) The key to sustainable economic development: a triple bottom line approach. *Resources* 11(5): 46.

Nogueira MC and Madaleno M (2022) Are Sustainability Indices Infected by the Volatility of Stock Indices? Analysis before and after the COVID-19 Pandemic. *Sustainability* 14(22): 15434.

Nor FM, Ibrahim I and Rashid M (2013) Exposure to investor sentiment in Malaysia: Services versus manufacturing stocks. *Global Business & Economics Anthology* 1: 239-248.

Ntantamis C and Zhou J (2015) Bull and bear markets in commodity prices and commodity stocks: Is there a relation? *Resources Policy* 43: 61-81.

Nyakurukwa K and Seetharam Y (2023) Investor reaction to ESG news sentiment: evidence from South Africa. *EconomiA*.

Nyopa T and Khumalo SA (2022) Volatility spillovers in equity and foreign exchange markets: Evidence from emerging economies. *Journal of Economic and Financial Sciences* 15(1): 713.

Obeng G (2020) Behavioural finance; a concept or catalyst explaining distortions in investment decision. *European Journal of Business and Management Research* 5(1).

Öcal H and Kamil AA (2021) The impact of risk indicators on sustainability (ESG) and broad-based indices: an empirical analysis from Germany, France, Indonesia and Turkey. *International Journal of Sustainable Economy* 13(1): 18-54.

Odell J and Ali U (2016) ESG investing in emerging and frontier markets. *Journal of Applied Corporate Finance* 28(2): 96-101.

OECD (2023) *Business confidence index (BCI)*.

Olkiewicz M (2022) The impact of economic indicators on the evolution of business confidence during the COVID-19 pandemic period. *Sustainability* 14(9): 5073.

Ono S (2011) Oil price shocks and stock markets in BRICs. *The European Journal of Comparative Economics* 8(1): 29-45.

Onyele O and Nwadike C (2021) Modelling stock returns volatility and asymmetric news effect: A global perspective. *Financial Risk and Management Reviews* 7(1): 1-15.

Oredegbe A and Abioye O (2022) Stock Market Volatility and Persistence: Evidence from High-Income and Middle-Income Economies. *International Journal of Economics and Finance* 14(8): 1-56.

Ortas E, Moneva JM and Salvador M (2012) Does socially responsible investment equity indexes in emerging markets pay off? Evidence from Brazil. *Emerging Markets Review* 13(4): 581-597.

Osabuohien-Irabor O (2023) Revisiting the sudden changes and volatility persistence in European capital markets: Some empirical evidence. *The European Journal of Applied Economics* 20(1): 150-166.

Ouchen A (2022) Is the ESG portfolio less turbulent than a market benchmark portfolio? *Risk Management* 24(1): 1-33.

Ozili PK (2021) Making Sustainble Finance Sustainable. *Financial Internet Quarterly* 17(3): 64-70.

Ozili PK (2022) Theories of sustainable finance. *Managing Global Transitions, March*.

Padungsaksawasdi C (2020) On the dynamic relationship between gold investor sentiment index and stock market: A sectoral analysis. *International Journal of Managerial Finance* 16(3): 372-392.

Pagan AR and Sossounov KA (2003) A simple framework for analysing bull and bear markets. *Journal of applied econometrics* 18(1): 23-46.

Panda AK and Nanda S (2017) Market linkages and conditional correlation between the stock markets of South and Central America. *Journal of Financial Economic Policy* 9(02): 174-197.

Panda AK, Nanda S and Paital RR (2019) An empirical analysis of stock market interdependence and volatility spillover in the stock markets of Africa and Middle East region. *African Journal of Economic and Management Studies* 10(3): 314-335.

Panda P and Thiripalraju M (2018) Return and volatility spillovers among stock markets: BRICS countries experience. *Afro-Asian Journal of Finance and Accounting* 8(2): 148-166.

Pandey P and Sehgal S (2019) Investor sentiment and its role in asset pricing: An empirical study for India. *IIMB Management Review* 31(2): 127-144.

Patel RJ (2019) BRICS Emerging Markets Linkages. *The Journal of Private Equity* 22(4): 42-59.

Patev P (2004) Modelling and forecasting the volatility of the Central European stock market. *Modelling and Forecasting the Volatility of the Central European Stock Market: Patev, Plamen*. [Sl]: SSRN.

Pearson K (1905) The problem of the random walk. *Nature* 72(1865): 294-294.

Perino MA (2020) Real insider trading. *Wash. & Lee L. Rev.* 77: 1647.

Perrigo B (2023) Sam Altman Returns as OpenAI CEO. Here's How It Happened. *Time Magazine*.

Phan Tran Trung D and Pham Quang H (2019) Adaptive market hypothesis: Evidence from the Vietnamese stock market. *Journal of Risk and Financial Management* 12(2): 81.

Pinho C and Maldonado I (2022) Commodity and equity markets: Volatility and return spillovers. *Commodities* 1(1): 18-33.

Pisani F and Russo G (2021) Sustainable finance and COVID-19: The reaction of ESG funds to the 2020 crisis. *Sustainability* 13(23): 13253.

Plattek DN and Figueiredo OH (2023) Sustainable and Governance Investment Funds in Brazil: A Performance Evaluation. *Sustainability* 15(11): 8517.

Polasek W and Ren L (1999) A multivariate GARCH-M model for exchange rates in the US, Germany and Japan. *Classification and Information Processing at the Turn of the Millennium: Proceedings of the 23rd Annual Conference of the Gesellschaft für Klassifikation eV, University of Bielefeld, March 10–12, 1999.* Springer, 355-363.

Poon S-H and Granger CWJ (2003) Forecasting volatility in financial markets: A review. *Journal of economic literature* 41(2): 478-539.

Poterba JM and Summers LH (1984) The persistence of volatility and stock market fluctuations. Reportno. Report Number|, Date. Place Published|: Institution|.

Preqin (2022) History of ESG.

Qadan M and Nama H (2018) Investor sentiment and the price of oil. *Energy Economics* 69: 42-58.

Rahman ML and Shamsuddin A (2019) Investor sentiment and the price-earnings ratio in the G7 stock markets. *Pacific-Basin Finance Journal* 55: 46-62.

Rao A, Dagar V, Sohag K, et al. (2023) Good for the Planet, Good for the Wallet: The ESG Impact on Financial Performance in India. *Finance Research Letters*. 104093.

Raquib M and Alom K (2015) Are the emerging capital markets weak form efficient? Evidence from the model of the Dhaka stock exchange. *Universal Journal of Accounting and Finance* 3(1): 1-8.

Rasche A (2020) The United Nations Global Compact and the sustainable development goals. *Research handbook of responsible management*. Edward Elgar Publishing, pp.228-241.

Rasche A, Morsing M, Moon J, et al. (2023) *Corporate sustainability: Managing responsible business in a globalised world.* Cambridge University Press.

Rashid Sabri N (2004) Stock return volatility and market crisis in emerging economies. *Review of Accounting and Finance* 3(3): 59-83.

Rask N (2022) An intersectional reading of circular economy policies: towards just and sufficiency-driven sustainabilities. *Local Environment* 27(10-11): 1287-1303.

Rau PR and Yu T (2023) A survey on ESG: investors, institutions and firms. *China Finance Review International*.

Ravitch SM and Carl NM (2019) *Qualitative research: Bridging the conceptual, theoretical, and methodological.* Sage Publications.

Razek YHA (2011) An Overview of Behavioral Finance and Revisiting the Behavioral Life Cycle Hypothesis. *IUP Journal of Behavioral Finance* 8(3).

Reber B, Gold A and Gold S (2022) ESG disclosure and idiosyncratic risk in initial public offerings. *Journal of business ethics* 179(3): 867-886.

Rehman S, Abro AA, Mustafa ARU, et al. (2021) AN ANALYSIS OF STOCK MARKET INTEGRATION IN THE ASIAN DEVELOPED AND EMERGING MARKETS.

Reis PMN and Pinho C (2020a) The causal relationship between sentiment proxies and stock returns. *XXX Jornadas Luso-Espanholas de Gestão Científica: cooperação transfronteiriça. Desenvolvimento e coesão territorial. Livro de resumos.* Instituto Politécnico de Bragança, 82.

Reis PMN and Pinho C (2020b) A new European investor sentiment index (EURsent) and its return and volatility predictability. *Journal of Behavioral and Experimental Finance* 27: 100373.

Reuters (2021) Analysis: How 2021 became the year of ESG investing.

Rizvi SKA, Mirza N, Naqvi B, et al. (2020) Covid-19 and asset management in EU: A preliminary assessment of performance and investment styles. *Journal of Asset Management* 21: 281-291.

Roberts H (1967) Statistical versus clinical prediction of the stock market. *Unpublished manuscript* 252.

Rohilla A (2023) EVALUATION OF PERFORMANCE OF SELECTED INDIAN ESG FUNDS. *Sachetas* 2(1): 18-26.

Romero AA and Kasibhatla KM (2013) Volatility Dynamics and Volatility Forecasts of Equity Returns in BRIC Countries. *Journal of business & economic studies* 19(1).

Roni B, Abbas G and Wang S (2018) Return and volatility spillovers effects: Study of Asian emerging stock markets. *Journal of Systems Science and Information* 6(2): 97-119.

Ross SA (1989) Information and volatility: The no-arbitrage martingale approach to timing and resolution irrelevancy. *The Journal of finance* 44(1): 1-17.

Rossi M (2015) The efficient market hypothesis and calendar anomalies: a literature review. *International Journal of Managerial and Financial Accounting* 7(3-4): 285-296.

Roy R and Shijin S (2020) A tripartite inquiry into financial liberalisation–volatility–information asymmetry nexus: Global panel approach. *IIMB Management Review* 32(1): 39-58.

Ruggie JG, Rees C and Davis R (2020) Making 'Stakeholder Capitalism'Work: Contributions from Business & Human Rights.

Rupande L, Muguto HT and Muzindutsi P-F (2019) Investor sentiment and stock return volatility: Evidence from the Johannesburg Stock Exchange. *Cogent Economics & Finance* 7(1): 1600233.

Ryszawska B (2016) Sustainability transition needs sustainable finance. *Copernican Journal of Finance & Accounting* 5(1): 185-194.

Sabbaghi O (2022) The impact of news on the volatility of ESG firms. *Global Finance Journal* 51: 100570.

Sabbaghi O (2023) ESG and volatility risk: International evidence. *Business Ethics, the Environment & Responsibility* 32(2): 802-818.

Sahut J-M and Pasquini-Descomps H (2015) ESG impact on market performance of firms: International evidence. *Management international* 19(2): 40-63.

Sakthivel P (2012) Interlinkages among Asian, European and the US stock markets: A multivariate cointegration analysis. *Journal of Economics and Behavioral Studies* 4(3): 129-141.

Salem N and Hussein S (2019) Data dimensional reduction and principal components analysis. *Procedia Computer Science* 163: 292-299.

Salisu AA (2011) Modelling and forecasting exchange rate volatility in Nigeria: does one model fit all?

Salisu AA, Akanni LO and Vo XV (2021) Volatility spillovers and hedging effectiveness between health and tourism stocks: Empirical evidence from the US. *International Review of Economics & Finance* 74: 150-159.

Salisu AA and Oloko TF (2015) Modelling spillovers between stock market and FX market: evidence for Nigeria. *Journal of African Business* 16(1-2): 84-108.

Samer A. M. Al-Rjoub KA-Z, Morad Autair (2010) Stock Market Returns, Volatility and Volatility Persistence: Evidence from Emerging Markets.

Samitas A, Kampouris E and Polyzos S (2022) Covid-19 pandemic and spillover effects in stock markets: A financial network approach. *International Review of Financial Analysis* 80: 102005.

Samouilhan N (2007) The persistence of SA equity volatility: A Component ARCH perspective. *Studies in Economics and Econometrics* 31(1): 99-118.

Samuelson PA (1965) Proof that properly anticipated prices fluctuate randomly. *The world scientific handbook of futures markets*. World Scientific, pp.25-38.

Samuelson PA (1973) Proof that properly discounted present values of assets vibrate randomly. *The Bell Journal of Economics and Management Science*. 369-374.

Sandu D-M (2023) THE IMPACT OF ESG CONTROVERSIES AND ESG PERFORMANCE ON STOCK RETURN VOLATILITY.

Savi A and Ostrovnaya A (2023) ESG Regulatory Framework for Asset Managers in the EU, UK, US and Singapore: the Role of Social Knowledge and Value Judgement in the Asset Managers ESG Business Strategy. *UK, US and Singapore: the Role of Social Knowledge and Value Judgement in the Asset Managers ESG Business Strategy (December 17, 2023)*.

Schmeling M (2009) Investor sentiment and stock returns: Some international evidence. *Journal of Empirical Finance* 16(3): 394-408.

Schmidt AB (2022) Optimal ESG portfolios: an example for the Dow Jones Index. *Journal of Sustainable Finance & Investment* 12(2): 529-535.

Schoenmaker D and Schramade W (2018) *Principles of sustainable finance.* Oxford University Press.

Schueth S (2003) Socially responsible investing in the United States. *Journal of business ethics* 43: 189-194.

Schumacher K, Chenet H and Volz U (2020) Sustainable finance in Japan. *Journal of Sustainable Finance & Investment* 10(2): 213-246.

Schwert GW (1989) Why does stock market volatility change over time? *The Journal of finance* 44(5): 1115-1153.

Segnon M and Thomas L (2015) Modeling and Forecasting Emission Allowance Multifractal vs. GARCH.

Sehgal S, Jain P and Deisting F (2018) Information transmission between mature and emerging equity markets during normal and crisis periods: an empirical examination. *Journal of Quantitative Economics* 16: 185-225.

Sehgal S, Sood G and Rajput N (2010) Developing an investor sentiment index for India. *Osmania Journal of International Business Studies* 5(1and2): 49-55.

Sepetis A (2019) Sustainable Finance in Sustainable Health Care System. *Open Journal of Business and Management* 8(01): 262.

Serafeim G (2020) Public sentiment and the price of corporate sustainability. *Financial Analysts Journal* 76(2): 26-46.

Sewraj D, Gebka B and Anderson RD (2018) Identifying contagion: A unifying approach. *Journal of International Financial Markets, Institutions and Money* 55: 224-240.

Seyhun HN (1986) Insiders' profits, costs of trading, and market efficiency. *Journal of financial Economics* 16(2): 189-212.

Shahzad SJH, Raza N, Balcilar M, et al. (2017) Can economic policy uncertainty and investors sentiment predict commodities returns and volatility? *Resources Policy* 53: 208-218.

Shakulashvili N and Talic S (2023) Comparison of High ESG Portfolio Performance in Germany and Switzerland.

Sharma A and Kumar A (2019) A review paper on behavioral finance: study of emerging trends. *Qualitative Research in financial markets*.

Sharpe WF (1964) Capital asset prices: A theory of market equilibrium under conditions of risk. *The Journal of finance* 19(3): 425-442.

Shefrin H (2008) *A behavioral approach to asset pricing.* Elsevier.

Shefrin H and Statman M (1985) The disposition to sell winners too early and ride losers too long: Theory and evidence. *The Journal of finance* 40(3): 777-790.

Shefrin H and Statman M (2000) Behavioral portfolio theory. *Journal of financial and Quantitative Analysis* 35(2): 127-151.

Sherwood MW and Pollard JL (2018) The risk-adjusted return potential of integrating ESG strategies into emerging market equities. *Journal of Sustainable Finance & Investment* 8(1): 26-44.

Shi K (2021) Spillovers of stock markets among the BRICS: new evidence in time and frequency domains before the outbreak of COVID-19 pandemic. *Journal of Risk and Financial Management* 14(3): 112.

Shiller RC (2000) Irrational exuberance. *Philosophy and Public Policy Quarterly* 20(1): 18-23.

Shiller RJ (1981) Do stock prices move too much to be justified by subsequent changes in dividends?

Shiller RJ (2015) Irrational exuberance. *Irrational exuberance*. Princeton university press.

Shin J (2005) Stock returns and volatility in emerging stock markets. *International Journal of Business and economics* 4(1): 31.

Shleifer A (2000) *Inefficient markets: An introduction to behavioural finance.* Oup Oxford.

Singh A and Singh M (2017) Co-movement and spillovers: empirical evidence from BRIC equity markets. *China Economic Journal* 10(3): 341-361.

Singh AK and Maurya S (2021) Analysis of Historical Trend and Determinants of ESG Index Performance in India. *Corporate Governance* 3(2).

Singh JE, Babshetti V and Shivaprasad H (2021a) Efficient market hypothesis to behavioral finance: A review of rationality to irrationality. *Materials Today: Proceedings*.

Singh NP, Makhija P and Chacko E (2021b) Sustainable investment and the COVID-19 effect-volatility analysis of ESG index. *International Journal of Sustainable Economy* 13(4): 357-368.

Singh S, Bahl S, Sharma J, et al. (2023) Performance Evaluation of ESG Mutual Funds in India. *Journal of Survey in Fisheries Sciences* 10(3S): 1133-1143.

Sironi P (2016) *FinTech innovation: from robo-advisors to goal based investing and gamification.* John Wiley & Sons.

Smales LA (2017) The importance of fear: investor sentiment and stock market returns. *Applied Economics* 49(34): 3395-3421.

Sosa M, Ortiz E and Cabello A (2022) ESG Green Equity Finance Risk and Links in Mexico: Conditional Volatility and Markov Switching Vector Analyses. *Revista Mexicana de Economía y Finanzas Nueva Época REMEF* 17(4): 788.

Spulbar C, Trivedi J and Birau R (2020) Investigating abnormal volatility transmission patterns between emerging and developed stock markets: A case study. *Journal of Business Economics and Management* 21(6): 1561-1592.

Spulbar C, Trivedi J, Birau R, et al. (2019) ESTIMATING VOLATILITY SPILLOVERS, DYNAMIC CAUSAL LINKAGES AND INTERNATIONAL CONTAGION PATTERNS BETWEEN DEVELOPED STOCK MARKETS: AN EMPIRICAL CASE STUDY FOR USA, CANADA, FRANCE AND UK. *Annals of'Constantin Brancusi'University of Targu-Jiu. Economy Series*.(3).

Statman M (2014) Behavioral finance: Finance with normal people. *Borsa Istanbul Review* 14(2): 65-73.

Statman M (2019) *Behavioral finance: The second generation.* CFA Institute Research Foundation.

Statman M (2020) ESG as waving banners and as pulling plows. *The Journal of Portfolio Management* 46(3): 16-25.

Stoyanov S, Loh L and Fabozzi FJ (2017) How fat are the tails of equity market indices? *International Journal of Finance & Economics* 22(3): 181-200.

Straetmans S and Candelon B (2013) Long-term asset tail risks in developed and emerging markets. *Journal of banking & Finance* 37(6): 1832-1844.

Strelchenko OS, Strelchenko EA and Kot VV (2022) EMERGING MARKETS: CONCEPTS AND DETERMINANTS OF DEVELOPMENT.

Su X (2020) Dynamic behaviors and contributing factors of volatility spillovers across G7 stock markets. *The North American Journal of Economics and Finance* 53: 101218.

Swadia B (2020) Impact of Behavioural Finance in The Financial Market. *An International Bilingual Peer Reviewed Refereed Research Journal* 10(39): 123-128.

Syriopoulos T, Makram B and Boubaker A (2015) Stock market volatility spillovers and portfolio hedging: BRICS and the financial crisis. *International Review of Financial Analysis* 39: 7-18.

Teresiene D, Keliuotyte-Staniuleniene G, Liao Y, et al. (2021) The impact of the COVID-19 pandemic on consumer and business confidence indicators. *Journal of Risk and Financial Management* 14(4): 159.

Thaler R (1980) Toward a positive theory of consumer choice. *Journal of economic behavior & organization* 1(1): 39-60.

Thaler RH (1987) Anomalies: the January effect. *Journal of economic perspectives* 1(1): 197-201.

Thaler RH and Benartzi S (2004) Save more tomorrow™: Using behavioral economics to increase employee saving. *Journal of Political Economy* 112(S1): S164-S187.

Thampanya N and Pornpikul C (2020) Indicator for Describing Bull and Bear Markets: Asymmetry and Persistence Perspective. *SOUTHEAST ASIAN JOURNAL OF ECONOMICS* 8(1): 39-81.

Tiwari AK, Nasreen S, Ullah S, et al. (2021) Analysing spillover between returns and volatility series of oil across major stock markets. *International Journal of Finance & Economics* 26(2): 2458-2490.

Trinh VTN (2018) Return and volatility spillover effects among Vietnam, Singapore and Thailand stock markets–A multivariate GARCH analysis.

Tripathy N (2017) Do BRIC countries stock market volatility move together? An empirical analysis of using multivariate GARCH models. *International Journal of Business and Emerging Markets* 9(2): 104-123.

Tripathy N and Garg A (2013) Forecasting stock market volatility: Evidence from six emerging markets. *Journal of International Business and Economy* 14(2): 69-93.

Trisnowati Y, Achsani NA, Sembel R, et al. (2022) The effect of ESG score, financial performance, and macroeconomics on stock returns during the pandemic era in Indonesia. *International Journal of Energy Economics and Policy* 12(4): 166-172.

Trivedi J (2013) Modeling return volatility of BRIC emerging stock markets using GARCH family models. *Indian Journal of Applied Research*. 119-121.

Trivedi J, Spulbar C, Birau R, et al. (2021) Modelling volatility spillovers, cross-market correlation and co-movements between stock markets in European Union: an empirical case study. *Business, Management and Economics Engineering* 19(1): 70-90.

Tse YK and Tsui AKC (2002) A multivariate generalized autoregressive conditional heteroscedasticity model with time-varying correlations. *Journal of Business & Economic Statistics* 20(3): 351-362.

Tsuji C (2018) Return transmission and asymmetric volatility spillovers between oil futures and oil equities: New DCC-MEGARCH analyses. *Economic Modelling* 74: 167-185.

Turkson J (2021) *ESG investing in uncertainty: Analyzing the returns of ESG within various states of investor sentiment*.

Turner CM, Startz R and Nelson CR (1989) A Markov model of heteroskedasticity, risk, and learning in the stock market. *Journal of Financial Economics* 25(1): 3-22.

UNEP (2017) "Roadmap to Sustainable Financial System". Executive Summary.

UNEPFI (2024) The UN-convened network of banks, insurers and investors accelerating sustainable development.

UnitedNations (2015) Transforming our world: The 2030 agenda for sustainable development. *New York: United Nations, Department of Economic and Social Affairs*.

UnitedNations (2020) Climate Change Is an Increasing Threat to Africa.

UnitedNations (2023) COP28 Agreement Signals “Beginning of the End” of the Fossil Fuel Era.

UNPRI (2021) PRINCIPLES FOR RESPONSIBLE INVESTMENT: AN INVESTOR INITIATIVE IN PARTNERSHIP WITH UNEP FINANCE INITIATIVE AND THE UN GLOBAL COMPACT. Reportno. Report Number|, Date. Place Published|: Institution|.

UNPRI (2023) Definitions for responsible investment approaches.

Urquhart A (2013) *An empirical analysis of the adaptive market hypothesis and investor sentiment in extreme circumstances*. Newcastle University.

Uyaebo SO, Atoi VN and Usman F (2015) Nigeria stock market volatility in comparison with some countries: Application of asymmetric GARCH models. *CBN Journal of Applied Statistics* 6(2): 133-160.

Uygur U and Taş O (2014) The impacts of investor sentiment on different economic sectors: Evidence from Istanbul Stock Exchange. *Borsa Istanbul Review* 14(4): 236-241.

Van Horne JC and Parker GG (1967) The random-walk theory: an empirical test. *Financial Analysts Journal* 23(6): 87-92.

van Zanten JA and van Tulder R (2021) Analyzing companies' interactions with the Sustainable Development Goals through network analysis: Four corporate sustainability imperatives. *Business Strategy and the Environment* 30(5): 2396-2420.

Vardar G, Coşkun Y and Yelkenci T (2018) Shock transmission and volatility spillover in stock and commodity markets: Evidence from advanced and emerging markets. *Eurasian Economic Review* 8: 231-288.

Velte P (2017) Does ESG performance have an impact on financial performance? Evidence from Germany. *Journal of Global Responsibility* 8(2): 169-178.

Velte P (2019) The bidirectional relationship between ESG performance and earnings management–empirical evidence from Germany. *Journal of Global Responsibility* 10(4): 322-338.

Virigineni M and Rao MB (2017) Contemporary developments in behavioural finance. *International Journal of Economics and Financial Issues* 7(1): 448-459.

Vuong N and Suzuki Y (2021) The motivating role of sentiment in ESG performance: evidence from Japanese companies. *East Asian Economic Review* 25(2): 125-150.

Výrost T, Lyócsa Š and Baumöhl E (2015) Granger causality stock market networks: Temporal proximity and preferential attachment. *Physica A: Statistical Mechanics and its Applications* 427: 262-276.

Wang J, Wang X, Yang J, et al. (2020) Impact of investor sentiment on mutual fund risk taking and performance: evidence from China. *Enterprise Information Systems* 14(6): 833-857.

Wang W, Su C and Duxbury D (2021) Investor sentiment and stock returns: Global evidence. *Journal of Empirical Finance* 63: 365-391.

Wang W, Su C and Duxbury D (2022) The conditional impact of investor sentiment in global stock markets: A two-channel examination. *Journal of banking & Finance* 138: 106458.

Wang W, Sun Z, Wang W, et al. (2023) The impact of environmental uncertainty on ESG performance: Emotional vs. rational. *Journal of Cleaner Production* 397: 136528.

Wang X (2022) The Impact of Investor Sentiment on Stock Yield. *Proceedings of the International Conference on Information Economy, Data Modeling and Cloud Computing, ICIDC 2022, 17-19 June 2022, Qingdao, China.*

Weber O (2014) Environmental, social and governance reporting in China. *Business Strategy and the Environment* 23(5): 303-317.

Weber O, Mansfeld M and Schirrmann E (2011) The financial performance of RI funds after 2000. *Responsible investment in times of turmoil*. 75-91.

Wendeberg A (2015) Can Investor Sentiment Help Explain Stock Market Crises?

Were JO (2020) *Analysis of volatility spillover from market to market in the East Africa capital markets*. Strathmore University.

Wibowo A (2023) Enhancing economic growth for the achievement of sustainable development goals through digital era fundraising schemes for sustainable community development: A policy analysis from the islamic economic perspective. *Proceeding of international conference on Islamic Philantrophy*. 26-37.

Widyawati L (2020) A systematic literature review of socially responsible investment and environmental social governance metrics. *Business Strategy and the Environment* 29(2): 619-637.

Woo K-Y, Mai C, McAleer M, et al. (2020) Review on efficiency and anomalies in stock markets. *Economies* 8(1): 20.

Wouassom A (2017) *Momentum and contrarian trading strategies: implication for risk-sharing and informational efficiency of security markets*. Queen Mary University of London.

WRI (2022) World Investment Report : International Tax Reforms and Sustainable Investment. Reportno. Report Number|, Date. Place Published|: Institution|.

Wu J, Lodorfos G, Dean A, et al. (2017) The market performance of socially responsible investment during periods of the economic cycle–Illustrated using the case of FTSE. *Managerial and Decision Economics* 38(2): 238-251.

Xaba D, Moroke ND and Rapoo I (2019) Modeling stock market returns of BRICS with a Markov-switching dynamic regression model. *Journal of Economics and Behavioral Studies* 11(3 (J)): 10-22.

Xu X (2023) Has ESG Performance Reduced Stock Price Volatility. *Journal of Innovation and Development* 3(1): 59-66.

Yarovaya L (2016) *Return and Volatility Transmission in Emerging and Developed Stock Markets.* University of Northumbria at Newcastle (United Kingdom).

Yarovaya L, Brzeszczyński J, Goodell JW, et al. (2022) Rethinking financial contagion: information transmission mechanism during the COVID-19 pandemic. *Journal of International Financial Markets, Institutions and Money* 79: 101589.

Yasmine B and Kooli M (2022) Smart beta ESG disclosure. *Journal of Asset Management* 23(7): 567-580.

Yavas BF and Dedi L (2016) An investigation of return and volatility linkages among equity markets: A study of selected European and emerging countries. *Research in International Business and Finance* 37: 583-596.

Ye Z, Hu C, He L, et al. (2020) The dynamic time-frequency relationship between international oil prices and investor sentiment in China: A wavelet coherence analysis. *The Energy Journal* 41(5).

Yildirim H (2017) Behavioral finance or efficient market hypothesis? *International Journal of Academic Value Studies* 3(11): 156.

Yin X-N, Li J-P and Su C-W (2023) How does ESG performance affect stock returns? Empirical evidence from listed companies in China. *Heliyon* 9(5).

Yu G, Liu Y, Cheng W, et al. (2022) Data analysis of ESG stocks in the Chinese Stock Market based on machine learning. *2022 2nd International Conference on Consumer Electronics and Computer Engineering (ICCECE).* IEEE, 486-493.

Zarafat H, Liebhardt S and Eratalay MH (2022) Do ESG Ratings Reduce the Asymmetry Behavior in Volatility? *Journal of Risk and Financial Management* 15(8): 320.

Zegadło P (2022) Identifying bull and bear market regimes with a robust rule-based method. *Research in International Business and Finance* 60: 101603.

Zhang J, De Spiegeleer J and Schoutens W (2021a) Implied tail risk and ESG ratings. *Mathematics* 9(14): 1611.

Zhang J, Zhang D, Wang J, et al. (2013) Volatility spillovers between equity and bond markets: Evidence from G7 and BRICS. *Romanian Journal of Economic Forecasting* 16(4): 205-217.

Zhang P, Sha Y and Xu Y (2021b) Stock market volatility spillovers in G7 and BRIC. *Emerging Markets Finance and Trade* 57(7): 2107-2119.

Zhang X, Zhao X and He Y (2022) Does it pay to be responsible? The performance of ESG investing in China. *Emerging Markets Finance and Trade* 58(11): 3048-3075.

Zhang X, Zhao X and Qu L (2021c) Do green policies catalyze green investment? Evidence from ESG investing developments in China. *Economics Letters* 207: 110028.

Zhao X, Nan D, Chen C, et al. (2023) Bibliometric study on environmental, social, and governance research using CiteSpace. *Frontiers in Environmental Science* 10: 2534.

Zhong J, Wang M, Drakeford B, et al. (2019) Spillover effects between oil and natural gas prices: Evidence from emerging and developed markets. *Green Finance* 1(1): 30-45.

Zhou D and Zhou R (2021) ESG performance and stock price volatility in public health crisis: evidence from COVID-19 pandemic. *International Journal of Environmental Research and Public Health* 19(1): 202.

Zhou G (2018) Measuring investor sentiment. *Annual Review of Financial Economics* 10: 239-259.

Ziadat SA, Herbst P and McMillan DG (2020) Inter-and intra-regional stock market relations for the GCC bloc. *Research in International Business and Finance* 54: 101292.

Zik-Rullahi A, Jide I and Onuh E (2023) Behavioural Finance: Exploring the Psychology and Economic Aspects of Financial Decision-Making. *European Review in Accounting and Finance, 7 (3), 50-64. DOI: https://doi. org/10.5281/zenodo* 8320116.

Zouaoui M, Nouyrigat G and Beer F (2011) How does investor sentiment affect stock market crises? Evidence from panel data. *Financial Review* 46(4): 723-747.

Zumente I and Bistrova J (2021) ESG importance for long-term shareholder value creation: Literature vs. practice. *Journal of Open Innovation: Technology, Market, and Complexity* 7(2): 127.

APPENDIX

Appendix 1: Ethical Clearance Letter

UNIVERSITY OF KWAZULU-NATAL
INYUVESI YAKWAZULU-NATALI

16 Oct 2023

Mr Damilola Muyiwa Aboluwodi (216069196)
School Of Acc Economics&Fin
Westville

Dear Mr Damilola Muyiwa Aboluwodi,

Original application number: 00021866
Project title: Investor sentiments and performance of ESG funds in emerging and developed markets

Exemption from Ethics Review

In response to your application received on 9 Oct 2023, your school has indicated that the protocol has been granted **EXEMPTION FROM ETHICS REVIEW.**

Any alteration/s to the exempted research protocol, e.g., Title of the Project, Location of the Study, Research Approach and Methods must be reviewed and approved through an amendment/modification prior to its implementation. The original exemption number must be cited.

For any changes that could result in potential risk, an ethics application including the proposed amendments must be submitted to the relevant UKZN Research Ethics Committee. The original exemption number must be cited.

In case you have further queries, please quote the above reference number.

PLEASE NOTE:
Research data should be securely stored in the discipline/department for a period of 5 years.

I take this opportunity of wishing you everything of the best with your study.

Yours sincerely,

[redacted]

Prof Josue Mbonigaba
Academic Leader Research
School Of Acc Economics&Fin

UKZN Research Ethics Office
Westville Campus, Govan Mbeki Building
Postal Address: Private Bag X54001, Durban 4000
Website: http://research.ukzn.ac.za/Research-Ethics/

Founding Campuses: Edgewood Howard College Medical School Pietermaritzburg Westville

INSPIRING GREATNESS