The impact of climate policies on risk-return characteristics in the fund industry: a multidimensional perspective

Auteur : Richelle, Simon
Promoteur(s) : Artige, Lionel
Faculté : HEC-Ecole de gestion de l'Université de Liège
Diplôme : Master en ingénieur de gestion, à finalité spécialisée en Financial Engineering
Année académique : 2024-2025
URI/URL : http://hdl.handle.net/2268.2/22943

THE IMPACT OF CLIMATE POLICIES ON RISK-RETURN CHARACTERISTICS IN THE FUND INDUSTRY: A MULTIDIMENSIONAL PERSPECTIVE

Jury :
Supervisor :
Lionel ARTIGE
Reader(s) :
Patrick SCHWARZ

Master thesis presented by
Simon RICHELLE
To obtain the degree of
MASTER IN BUSINESS ENGINEERING
with a specialization in Financial Engineering
Academic year 2024/2025

Acknowledgment

I would like to express my sincere gratitude to all those who supported me throughout the development of this research thesis.

First of all, I would like to thank my thesis supervisor, Professor Lionel Artige, for his rigorous guidance, availability, and insightful advice. His academic expertise and valuable feedback were essential to the progress and quality of this work.

I would also like to express my deep appreciation to Mr. Schwarz for the help and support he provided throughout this journey. His thoughtful comments and suggestions greatly contributed to shaping my thinking and enriching this thesis.

Finally, I would like to extend my special thanks to Mr. Scivoletto for his assistance with the database, which was fundamental to this research.

Table of Contents

1.Introduction 10
1.1. Prelude 10
1.2. Problematic 10
1.3. Research objectives 11
1.4. Methodology 11
1.4. Relevance and contributions 13
1.5. Outline of the thesis 14
2. Literature review 16
2.1 Introduction to the problematic 16
2.1.1 The Climate change 16
2.1.3 The fund industry facing climate risks 17
2.2 Typology of climate risks and financial implications 18
2.2.1 The climate risk, definition 18
2.2.2 The factors of climate risks 18
2.3 Climate policies as a risk factor for financial markets 19
2.3.1 Impact of climate policies on financial markets 19
2.3.4 Climate policies and regulatory asymmetry between regions 20
2.4 Comparative analysis of ESG vs traditional funds 20
2.4.1 ESG funds vs. traditional funds: asymmetrical effects of climate policies 20
2.4.2 Lessons from Wiklund's study (2023) 22
2.5 Regional approach in the analysis of climate policies 23
2.6 Gaps in the literature and expected contribution 24
3. Methodology 26
3.1 Context 26
3.2 Econometric method 26
3.2.1 EGARCH (1,1) 26
3.2.2 Multiple linear regression 26
3.3 Climate policy score 27
4. Data 30
4.1 Data selection 30
4.2 Period analysis 31
4.3 Data features 33
4.4 Descriptive Statistics 33
4.5 Dynamic analysis of return and volatility 36

4.6 Robustness test of the differences in performance and volatility between ESG and non-ESG funds 36
4.7 Database for MLR....37
4.8 Climate policy score....38
5. Models....40
5.1 EGARCH (1,1)....40
5.2 GARCH (1,1) 40
5.3 Multiple linear regression (MLR) 41
5.3.1. Specifications of econometric models....41
6. Analysis....44
6.1 EGARCH (1,1)....44
6.2 Multi Linear regression (MLR)....49
6.2.1. Global choice as REF REGION....49
6.2.2. EXCLUSIONS CERTAIN POLICIES BASED ON THE YEAR....49
6.2.3. Volatility Regression – ESG and Climate Policy Effects 50
6.2.4. Monthly Performance Regression – ESG and Climate Policy Effects 51
6.3 Interaction Effects Analysis....52
6.3.1. Differential Sensitivity of ESG Funds to the Climate Policy Score....52
6.3.2. Limited Differential Impact of Individual Climate Policies on ESG Funds 53
6.3.3. Amplified Policy Effects in Regions of Implementation....54
6.3.4. Regional Policy Stringency and Its Uneven Impact on Fund Performance and Volatility 54
6.3.4. Regional Policy Stringency and Its Uneven Impact on Fund Performance and Volatility 56
6.4. Key Empirical results 56
7. Robustness Tests 60
7.1 Robustness Check: GARCH(1,1) vs EGARCH(1,1)....60
7.2 Risk-Adjusted Performance Ratios....61
7.3 OLS Assumption Testing 61
8. Study Limitations....64
9. Conclusion....66
Appendices 68
Bibliography 76

Table of tables and figures

Table 1: Average risk scores with a 95% confidence interval for the market (MSCI ACWI index) and three categories of sustainable funds........ 22
Table 2: Fund Selection Criteria........ 31
Table 3: Sample size of funds........ 31
Table 4: Major Climate Policies (2010–2024)........ 32
Table 5: Descriptive Statistics by Fund Category and Investment Region (2010-2023)........ 34
Table 6: Robustness Test Results on Monthly Returns (ESG vs. Non-ESG)........ 37
Table 7: Sample of Funds Selected for the GARCH Analysis (ESG Criteria, Region, Size)........ 45
Table 8: EGARCH(1,1) Estimation Results: Average Volatility and BIC........ 45
Table 9: Comparison of Average Conditional Volatility (EGARCH) Between ESG and Non-ESG Funds by Region (2010–2023) 46
Table 10: Volatility Regression – ESG and Climate Policy Effects (6-Month Rolling Volatility)........ 51
Table 11: Monthly Performance Regression – ESG and Climate Policy Effects........ **Erreur ! Signet non défini.**52
Table 12: Summary Statistics and Model Fit Indicators for GARCH(1,1) and EGARCH(1,1) Models Across ESG and Non-ESG . 70
Table 13: Sharpe and Sortino Ratios of ESG and Non-ESG Funds by Region........ 72
Table 14: Comparison of Sharpe and Sortino Ratios Before and After the COP21 Agreement Across ESG and Non-ESG Funds .... **Erreur ! Signet non défini.**73
Table 15: Diagnostic Tests for OLS Assumptions in Return and Volatility Models........ 73
Table 16: Multicollinearity Diagnostics: VIF Values for Explanatory Variables in Return and Volatility Models .... **Erreur ! Signet non défini.**74

Figure 1. Chronology of the major milestones in international climate governance (1979–2024)........ 17
Figure 2. Typology of climate risks and associated data........ 18
Figure 3. Estimated EPS scores by region (2020)........ 24
Figure 4. Morningstar sustainability rating........ 30
Figure 5. Monthly return and volatility by fund category........ 35
Figure 6. Skewness and Kurtosis comparison by fund category........ 35
Figure 7. Mean Rolling 12-Month volatility (ESG & Non-ESG)........ 68
Figure 8. Average monthly return (ESG & Non-ESG)........ 69
Figure 9. Estimated conditional volatility (EGARCH) by region: ESG vs Non-ESG funds (2010–2023)........ 47
Figure 10. Asymmetry in Volatility Responses — EGARCH θ Coefficients by Fund Type (ESG vs Non-ESG)........ 48
Figure 11. Conditional Volatility of ESG vs Non-ESG Funds Around COP21 (EGARCH Model, 2014–2017)........ 49
Figure 12. Moderating Effect of the Climate Policy Score on the Volatility and Return of ESG and Non-ESG Funds........ 53
Figure 13. Interaction Effects Between ESG and Climate Policy Indicators by Region on Monthly Returns and Volatility........54
Figure 14. Differential Effects of Climate Policies by Investment Region on Monthly Returns and Volatility........ 54
Figure 15. Marginal Effect of the Climate Policy Score on Predicted Returns by Investment Region........ 55
Figure 16. Marginal Effect of the Climate Policy Score on Predicted Volatility by Investment Region........ 56
Figure 17. Comparison of Conditional Volatility Estimates Using GARCH(1,1) and EGARCH(1,1) Models for Non-ESG Funds (Global and Europe)........ 71
Figure 18. Comparison of Conditional Volatility Estimates from GARCH(1,1) and EGARCH(1,1) Models Across ESG and Non-ESG Funds by Region........ 72

0. List of abbreviations and glossary

0.1. List of abbreviations

- COP: Conference of the Parties
- CPU: Climate Policy Uncertainty
- EGARCH: Exponential Generalized Autoregressive Conditional Heteroskedasticity
- EPS: Environmental Policy Stringency
- ESG: Environmental, social, governance
- ETF: Exchange-Traded Funds
- GARCH: Generalized Autoregressive Conditional Heteroskedasticity
- IPCC: Intergovernmental Panel on Climate Change
- IRA: Inflation Reduction Act
- MLR: Multiple Linear Regressions
- NAV: Net Asset Values
- OECD: Organisation for Economic Co-operation and Development
- OLS: Ordinary Least Squares
- SFDR: Sustainable Finance Disclosures Regulation
- SRI: Socially Responsible Investment
- UNFCCC: United Nations Framework Convention on Climate Change

0.2. Glossary

Student's t-test

The Student's t-test is a statistical method used to compare the means of two independent groups in order to determine whether their difference is statistically significant, taking into account sample size and variance. It is particularly suitable for testing mean differences when the variable of interest is approximately normally distributed (Ruxton, 2006).

Levene's test

Levene's test is a statistical procedure used to assess the homogeneity of variances across two or more groups. It tests the null hypothesis that the variances are equal, which is a key assumption for many parametric tests (such as the t-test). Levene's test is robust to departures from normality (Pallmann, Hothorn, & Djira, 2014).

Morningstar ESG Risk Rating for Funds

The Morningstar ESG Risk Rating for Funds provides an assessment of the overall ESG risk of a mutual fund portfolio, benchmarked against its peers within the same Morningstar category. The score is based on a bottom-up analysis of underlying holdings using ESG ratings provided by Sustainalytics, a Morningstar subsidiary (Sustainalytics, n.d.). Since 2021, the methodology also incorporates Country Risk Ratings to evaluate sovereign ESG risks. The results are expressed as relative scores using a globe rating scale (1 to 5 globes), where a higher number indicates lower ESG risk compared to peer funds (Morningstar, n.d.).

Morningstar Sustainalytics

Morningstar Sustainalytics is a leading provider of ESG research and ratings, supporting institutional investors for over 30 years in integrating environmental, social, and governance factors into responsible investment strategies (ESG risk ratings., n.d.).

1.Introduction

1.1. Prelude

Climate change represents one of the major systemic challenges of the 21st century, disrupting not only the natural environment but also global economic and financial balances. In response to this disruption, governments are intensifying their efforts to transition toward a low-carbon economy, notably through increasingly ambitious climate regulations. These policies impact the financial sector, particularly the investment fund industry, by reshaping risk perceptions, return dynamics, and allocation strategies. Consequently, understanding how these regulations influence the risk-return profile of funds, based on their ESG status and geographical exposure, has become a strategic priority.

1.2. Problematic

In the context of a global transition toward a greener economy, various factors come into play, each potentially impacting the financial sector to varying degrees. Climate change is emerging as an increasingly tangible threat, capable of influencing financial markets. At the same time, investor sentiment is shifting, encouraging a move toward more sustainable financing options and pushing fund managers to adapt to the evolving demands of the market. The study by Santi (2023) reinforces this observation by providing an empirical analysis of investor "climate sentiment", a behavioural measure of how investors perceive climate-related issues and how this perception affects stock market returns. The study also shows that an increase in climate sentiment is associated with lower returns on portfolios composed of high CO_2-emitting stocks, due to a gradual divestment from these assets by investors.

Currently, climate change constitutes a critical systemic challenge for numerous industries, exposing firms and investors to substantial and evolving risks. In this context, it is essential to distinguish between two primary categories of climate-related risks: physical risks and transition risks. On one hand, physical risks arise from the direct consequences of climate change, such as extreme weather events. On the other hand, transition risks come from the economic, regulatory, and technological adjustments required to facilitate the shift toward a low-carbon economy (Venturini, 2022).

Indeed, while numerous studies focus on the effects of physical climate risks on stock returns or risk exposure, few have thoroughly explored the impacts of transition risks related to climate policies or regulatory developments. Lanfear, Lioui, and Siebert (2019) are among the rare authors to specifically address this aspect by analysing how the announcement of restrictive climate policies can lead to a revaluation of assets in high-carbon sectors, highlighting the existence of a "transition risk premium". Their study demonstrates that these risks can be anticipated by the market and significantly affect asset prices, making it a key reference for understanding the financial implications of the shift toward a low-carbon economy. The article also points out a notable gap in research within this field.

Despite the intensification of climate policies worldwide, few rigorous studies have examined how these regulations affect the risk-return profiles of investment funds, particularly according to their ESG status and geographical exposure. This reveals a significant empirical gap in the analysis of transition risks in financial markets.

1.3. Research objectives

In response to the gaps identified in the literature, particularly regarding the effects of climate policies on financial markets, this thesis focuses on transition risks, specifically those related to government measures aimed at supporting a low-carbon economy. Within this framework, the study is organized around the central question: "What is the impact of climate policies on the risk-return characteristics of investment funds from a multidimensional perspective?"

To clarify the scope of analysis, climate policies are defined here as the set of institutional frameworks, regulatory initiatives, and multilateral agreements designed to reduce greenhouse gas emissions, foster adaptation to climate change, and support the achievement of global climate goals such as those established under the Paris Agreement. This definition encompasses both binding and non-binding instruments adopted at international, regional, and national levels, in line with the principles outlined in the IPCC's Special Report on Global Warming of 1.5°C (Masson-Delmotte, Zhai, Pörtner, Roberts, Skea, Shukla, Pirani, Moufouma-Okia, Péan, Pidcock, Connords, Matthews, Chen, Zhou, Gomis, Lonnoy, Maycock, Tignor, & Waterfield, 2020).

This thesis aims to analyse the differentiated effects of climate policies on the investment fund industry by comparing a sample of ESG funds with conventional funds. Investment funds are a key channel for capital allocation and reflect investors' environmental preferences. In this context, investors who choose ESG funds, compared to those who invest in conventional funds, tend to demonstrate a stronger commitment to environmental concerns and a greater willingness to incorporate sustainability criteria into their investment decisions. Consequently, studying these funds provides an accurate perspective to capture the effects of the climate transition on financial markets. ESG funds are, in particular, directly exposed to green regulations, especially in Europe (e.g., the EU Taxonomy and the SFDR regulation), making them privileged instruments for assessing the transmission of environmental policies. Based on this context, the analysis is structured around three axes: risk assessment through volatility, performance measurement via monthly returns, and examination of fund resilience to climate policy shocks. These dimensions were selected to provide a comprehensive evaluation of how climate policies affect investment funds. Volatility captures the changing risk profile and market uncertainty associated with climate-related factors. Monthly returns offer a granular perspective on fund performance, enabling the detection of short-term impacts. Finally, assessing resilience to climate policy shocks allows us to understand how funds endure sudden regulatory changes, which is critical in the context of an evolving low-carbon transition. In addition, special attention is given to geographic disparities to determine whether policy effects vary according to the funds' exposure regions. Accordingly, the study will focus on four major investment regions representing diverse regulatory frameworks and economic dynamics: Europe, North America, Asia, and a so-called 'Global' zone, encompassing funds with worldwide exposure.

1.4. Methodology

The study adopts a quantitative approach based on market data related to investment funds. It begins with the construction of a representative sample of ESG and conventional funds, allowing for a comparative analysis between these two investment universes. Fund identification is carried out using the Morningstar database, based on standardized criteria such as the Morningstar ESG Risk Rating for Funds, investment category, and geographical exposure. The criteria applied during the fund selection phase aim to enhance the comparability and robustness of the empirical analysis. By filtering for large and established funds, the methodology ensures sufficient liquidity and data reliability. Focusing on funds denominated in the same currency minimizes exchange rate distortions, while selecting only active funds eliminates survivorship bias. Geographic segmentation aligns with the study's comparative regional framework, and restricting fund inception to a pre-defined date ensures a consistent time horizon for evaluating responses to climate policies. Finally, categorizing funds by investment strategy helps control for differences in risk-return profiles that are unrelated to ESG considerations. Financial data, particularly monthly Net Asset Values (NAVs), are then extracted from the Refinitiv Eikon platform to compute log-returns. To structure the analysis over time, the sample is aligned with key milestones in international climate governance, such as COP21[1] in Paris (December 2015), the adoption of the European Green Deal[2] (December 2019), and COP26[3] in Glasgow (November 2021), in order to capture potential market dynamics influenced by these major policy frameworks.

The analysis continues with an examination of volatility and performance differences between ESG and non-ESG funds. Volatility is measured using a six-month rolling standard deviation of monthly log-returns, providing a dynamic view of risk evolution over time, particularly during periods of regulatory stress. Meanwhile, fund performance is assessed through monthly returns, enabling a direct comparison between the two fund categories. To deepen the analysis and capture asymmetric volatility responses particularly relevant in the context of climate-related shocks the EGARCH(1,1) model is employed as the main specification. Compared to traditional GARCH models, EGARCH offers greater flexibility by allowing for asymmetric effects and removing the need for non-negativity constraints on variance parameters. This makes it especially suitable for evaluating the potential "stress tests"[4] effects of major climate policy announcements, which are often perceived by financial markets as sources of abrupt and directional risk. Indeed, Engle and Ng (1993) introduced formal tests to detect asymmetric effects of shocks on volatility and demonstrated that models such as EGARCH are better suited than standard GARCH specifications for capturing these dynamics. These asymmetric effects are particularly critical in contexts where news such as climate policy announcements can trigger uneven market reactions, making EGARCH especially appropriate for analyzing volatility in response to climate-related shocks.

Building on this, linear regression models (OLS: Ordinary Least Square) are employed to explain variations in volatility and returns based on several explanatory variables: the ESG status of the fund, its regional allocation (Europe, North America, Asia, or Global), and an original Climate Policy Score. This score is constructed from an index that combines the density and stringency of climate policies by region and year, offering a temporal and geographical perspective on regulatory ambition, a dimension rarely incorporated quantitatively in the scientific literature. The models are further enriched with dummy variables representing major climate policy events (e.g., COP21, SFDR, EU Taxonomy, US IRA),

[1] COP21: International climate conference that led to the adoption of the Paris Agreement, a legally binding treaty aimed at limiting global warming to well below 2°C above pre-industrial levels (UNFCCC, 2016)

[2] European Green Deal: Growth strategy of the European Union aimed at achieving carbon neutrality by 2050, integrating environmental objectives across all public policies (European Council, 2025).

[3] COP26 : International climate conference which resulted in the Glasgow Climate Pact, reinforcing commitments to phase down coal, enhance climate finance, and accelerate action toward the goals of the Paris Agreement (Mazzanti, 2021)

[4] Stress testing is a simulation technique used to assess the resilience of financial institutions or systems under adverse scenarios by evaluating their performance and capital adequacy during severe economic and financial shocks (European Central Bank, 2024).

and interaction terms (notably ESG × Climate Policy Score) are included to test whether policy effects are amplified in ESG funds. This multidimensional modelling approach allows for a differentiated assessment of policy impacts across fund types and geographic exposures and follow the process developed by Ali, S., Badshah, I., Demirer, R., Hegde, P., & Rognone, L. (2024) where the authors utilize multiple linear regression models to assess the relationship between ESG ratings and fund returns, considering various control variables and interaction terms to capture the nuanced effects of climate-related factors on fund performance.

To ensure the robustness of results, several additional tests are conducted. First, a standard GARCH(1,1) model is employed as a complementary specification to verify the robustness of the results. This allows for cross-validation of volatility patterns and the consistency of estimated effects, particularly in terms of the direction and magnitude of climate policy shocks. While EGARCH better accommodates asymmetric behaviors, the GARCH model serves as a benchmark to assess whether findings hold under more conventional assumptions of volatility clustering and symmetric shock response (Mishra, Kumar, & Bal, 2023; Venturini, 2022). Second, fund performance is further assessed through risk-adjusted metrics: the Sharpe ratio, which relates excess returns to total risk, and the Sortino ratio, which refines this analysis by focusing solely on downside volatility. These indicators provide a complementary and more nuanced evaluation of relative performance in the context of increasing climate-related uncertainty.

This methodology combines a rigorous quantitative analysis of ESG and conventional funds with climate policy data to assess their impact on financial risk and performance. By integrating temporal, geographic, and regulatory dimensions, it provides a nuanced and innovative perspective on the differentiated effects of environmental regulation on financial markets.

1.4. Relevance and contributions

This thesis offers an original contribution to the literature by exploring the impact of climate policies on the risk-return characteristics of ESG and conventional funds through a multidimensional perspective. Specifically, it addresses a dual gap: firstly, the lack of clear evidence on the risk-adjusted performance of ESG funds, and secondly, the absence of analyses accounting for the geographical heterogeneity of regulatory frameworks.

While ESG funds are attracting increasing interest, their comparative advantage in terms of volatility and performance remains debated. The findings of Scacchi (n.d.) illustrate this ambiguity, suggesting that sustainable funds may outperform in the short term without necessarily sustaining this advantage over longer horizons. In this context, this approach aims to highlight these dynamics by introducing an original regional climate ambition indicator, constructed from regulatory density data (Climate Policy Database) and standards intensity (OECD EPS Index).

Beyond academic interest, the results are expected to guide asset managers’ strategies, inform responsible investors’ preferences, and contribute to policymakers’ reflections on the effectiveness of environmental policies.

1.5. Outline of the thesis

This thesis is organized into eight main sections, excluding the introduction and the conclusion. Section 2 provides a literature review on climate risks, policies, and their impact on ESG versus traditional funds, while identifying gaps. Section 3 outlines the methodological approach, including econometric techniques and the climate policy score. Section 4 details the data selection, characteristics, and preparation for model implementation. Section 5 presents the econometric models used EGARCH, GARCH, and MLR. Section 6 analyses the empirical results, while Section 7 tests their robustness. Section 8 discusses the study's limitations. Finally, Section 9 concludes with a summary of findings, implications, and future research directions.

2. Literature review

2.1 Introduction to the problematic

2.1.1 The Climate change

Climate change can be defined as a long-term alteration of climate statistics (e.g., means, extremes, variability) at the global or regional scale. According to Mike Hulme (2009), it is “not only a physical phenomenon related to interactions between the atmosphere, oceans, and land surfaces but also a political, cultural, and moral issue shaped by how we interpret and respond to these changes”.

Today, climate change has emerged as a major systemic challenge whose repercussions transcend environmental dimensions and profoundly affect the global financial sphere (Monasterolo, 2020; Battiston, Dafermos, & Monasterolo, 2021). Due to the interconnectedness of financial actors, even localized climatic events can trigger widespread contagion effects, threatening the resilience of the global economic system (Amzallag, 2022). It is therefore essential to undertake actions to address this growing challenge confronting our society.

To guide this transformation, many countries have adopted climate policies at national and supranational levels to tackle the challenges posed by global warming. By 2024, more than 6,000 active climate policies were recorded across 198 countries, confirming the existence of a coordinated global transition effort (Climate Policy Database, n.d.).

Seo (2017) offers a historical review of international climate negotiations over the past three decades, with a particular focus on the details of the Paris Agreement . The study traces the origins and evolution of global climate policies through key agreements and international institutions. This historical progression is summarized in Figure 1, which outlines major milestones in international climate negotiations from the first World Climate Conference to recent commitments related to COP29.

Understanding these institutional frameworks is essential for this analysis, especially the Paris Agreement, the European Green Deal, and COP26, which serve as critical temporal benchmarks in this study, given their comparatively greater influence on regulatory ambition, market expectations, and the acceleration of climate-aligned financial reforms, unlike other milestones which had more limited or diffuse effects. Their implementation enables the segmentation of the analysis sample into sub-periods, allowing for the assessment of whether these initiatives have had a measurable impact on the performance of investment funds before and after their introduction.

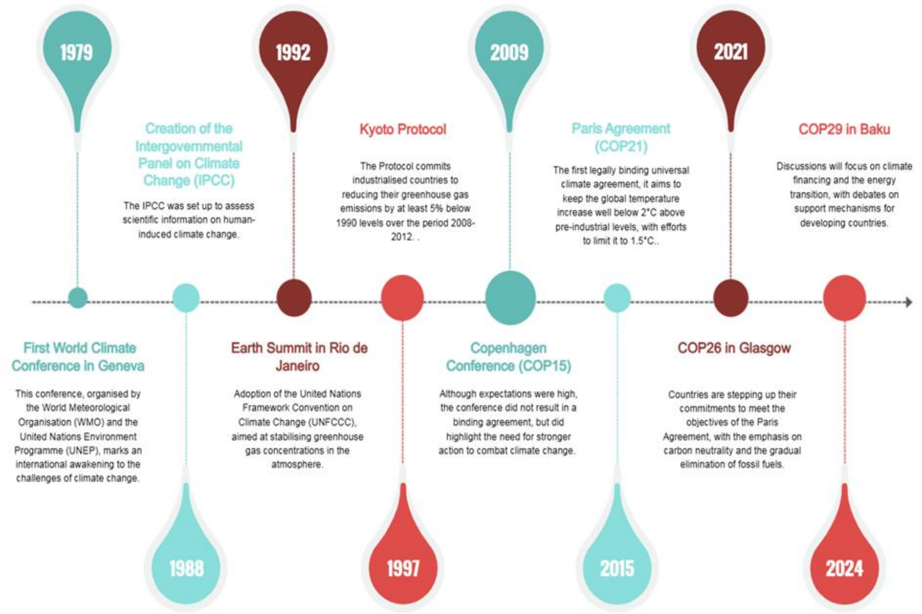


Figure 1. Chronology of the major milestones in international climate governance (1979–2024)

Source: Personal development, (Dupont, Moore, Boasson, Gravey, Jordan, Kivimaa, Kulovesi, Kuzemko, Oberthür, Panchuk, Rosamond, Torney, Tosun, & von Homeyer, 2024; Seo, 2017)

2.1.3 The fund industry facing climate risks

In the context of the ecological transition, the investment fund industry occupies a strategic position as a key channel for capital allocation. By directing financial flows, fund managers become central actors in decarbonization dynamics, a role increasingly recognized by regulators (Commission européenne, 2019a; Commission européenne, 2019b). This influence is further strengthened by the rise of ESG funds, driven by evolving regulations and growing demand for responsible investments (Benedetti, Biffis, Chatzimichalakis, Fedele, & Simm, 2021; Wiklund, 2023; Ali, Badshah, Demirer, Hegde, & Rognone, 2024).

However, the transition within the industry remains heterogeneous, raising critical questions about the actual effectiveness of climate policies in reshaping portfolios and the resilience of sustainable funds in the face of regulatory shocks. Indeed, transition risks, more indirect and complex to model, remain underexplored despite their potentially significant impact on asset valuation (Benedetti, Biffis, Chatzimichalakis, Fedele, & Simm, 2021).

From this perspective, investment funds serve as useful barometers of market perceptions. The shifting flows toward ESG funds can be interpreted as a signal of investors' strategic repositioning in response to regulatory changes (Santi, 2023). As such, they constitute a relevant object of study not only for academic research but also for policymakers, providing empirical insights into the transmission of climate policies to allocation decisions.

2.2 Typology of climate risks and financial implications

2.2.1 The climate risk, definition

Climate risk refers to the uncertainty associated with the potentially significant negative impacts that climate change may have on the financial, social, and environmental spheres. It depends on several factors, including exposure to extreme weather events, the vulnerability of affected systems, and the adaptive capacity of economic and institutional actors (Krueger, Sautner, & Starks, 2020).

2.2.2 The factors of climate risks

The scientific literature generally identifies two main categories of climate risks (Figure 2): physical risks and transition risks[5] (Venturini, 2022). However, as pointed out by Lanfear, Lioui, and Siebert (2020), transition risks have occupied a secondary position in academic work.

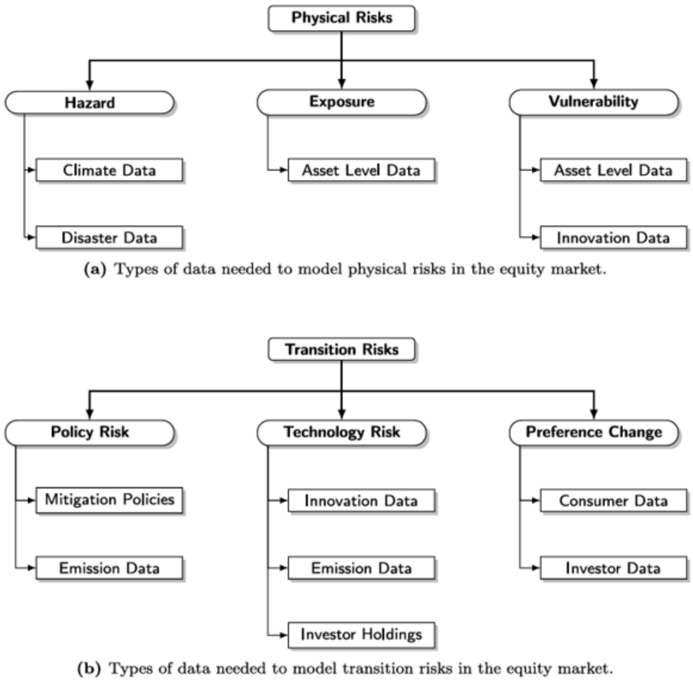


Figure 2. Typology of climate risks and associated data
Source: (Venturini, 2022)

This work aims to fill this gap by focusing on the analysis of "policy risk", a subset of transition risks. Although understudied, these risks are increasingly impacting global financial markets. Transition risks arise from the combination of three factors: *Transition risks = f(policy risk, technological risk, preference shifts).* These risks can profoundly affect the valuation of financial assets in the context of the transition toward a low-carbon economy. Among them, policy risk, defined as the risks and opportunities related to the implementation of climate policies (e.g., regulations, carbon taxes, ESG standards), constitutes the core focus of this study. The objective is to understand how these policies influence allocation behaviours and the risk-return characteristics of investment funds (Venturini, 2022).

Within this dynamic, climate policies generally rely on two main types of mechanisms. On one hand, market-based instruments, such as carbon pricing (e.g., carbon taxes, cap-and-trade systems), which

[5] See section *1.2. Problematic* for the definitions of these terms

aim to internalize the environmental cost into economic decisions. On the other hand, non-market instruments, such as environmental regulations, subsidies, or voluntary commitments, which directly regulate or incentivize the behaviour of economic actors (Bolton & Kacperczyk, 2021).

Empirical research on climate risks in finance is organized around two main approaches: top-down and bottom-up. The top-down approach aims to assess how climate risks systematically influence asset returns, relying on macro-financial models. Two perspectives coexist: one views risk as an extreme event, while the other models it as a stochastic process dependent on aggregate consumption. Although this approach offers theoretical and practical insights, questions remain about its long-term predictive capacity. Conversely, the bottom-up approach starts from the behaviour of economic agents and the individual characteristics of firms. It is based on microeconomic analyses, event studies, or empirical surveys. While more granular, this approach should complement the top-down analysis to provide a coherent overall view (Giglio, Kelly, & Stroebel, 2020; Huynh & Xia, 2021; Weitzman, 2009).

This thesis primarily adopts a top-down approach, aligned with the objective of analysing the systemic effects of climate policies on investment funds. This macroeconomic perspective, inspired notably by the work of Wiklund (2023), allows for a structured comparison across regions and captures the influence of broad regulatory factors on the risk-return profile.

2.3 Climate policies as a risk factor for financial markets

2.3.1 Impact of climate policies on financial markets

Among recent studies examining financial markets' responses to climate policies, two provide complementary insights into the immediate and structural nature of these effects.

On one hand, the empirical analysis by Nevatia (2025) highlights a strong market reaction to the announcement of the Inflation Reduction Act (IRA), considered one of the most ambitious climate policies in the United States. The study shows that companies in the renewable energy sector experienced significant cumulative abnormal returns in the short term, reflecting initial investor optimism. However, these effects gradually diminished, signalling a market reassessment under uncertainties related to the policy's concrete implementation (e.g., economic frictions, regulatory instability, political reversals).

On the other hand, the study by Bauer, Offner, and Rudebusch, (2023) corroborates these findings using a macroeconomic approach. Applying an event study methodology to stock indices, the authors demonstrate that so-called "green" stocks react positively to the announcement of credible climate policies (such as the IRA), while "brown" assets (highly carbon-intensive) are penalized. The authors also emphasize that the real impact of climate policies heavily depends on their credibility, clarity, and alignment with macroeconomic conditions.

Although differing in scope and academic status, these two contributions converge in illustrating the adaptive nature of financial markets in response to climate policies. In this context, analysing investment funds becomes particularly relevant: as vehicles holding underlying assets, funds aggregate market dynamics while reflecting investor preferences. Funds exposed to sectors sensitive to climate policies, especially ESG funds, thus emerge as privileged vectors for observing transition effects.

2.3.4 Climate policies and regulatory asymmetry between regions

The European Union stands out for its particularly stringent environmental regulations, notably through the European Green Deal, which aimed at achieving carbon neutrality by 2050 (European Council, 2025). This ambitious target significantly contrasts with the approaches adopted in other regions worldwide.

At COP26 in Glasgow in 2021, although an ambitious declaration was proposed to accelerate the transition to zero-emission vehicles, major countries such as the United States, China, and Germany did not sign the agreement, casting doubt on the initiative's effective scope (Mazzanti, 2021). Furthermore, following Brexit, the United Kingdom has undertaken reforms that weaken some of its environmental protections, notably through the Planning and Infrastructure Bill[6], which could relax ecological requirements for developers (Horton, 2025). A recent analysis confirms that the UK is now falling behind the EU in nearly all areas of environmental regulation, threatening crucial protections for health and the environment (Caine, 2023).

In the United States, the adoption of the Inflation Reduction Act marked a major turning point in support of green technologies. However, political polarization undermines regulatory stability, creating uncertainty about the durability of these policies (Nevatia, 2025).

In Asia, climate policies remain highly heterogeneous. Some countries are progressing rapidly (such as Japan, Singapore, Hong Kong), while others still struggle to establish ambitious frameworks (Liu, Dong, & Fang, 2023).

These disparities highlight the European Union's position as a global leader in climate regulation, with policies that are stricter than those adopted in other regions. These regulatory asymmetries create uneven investment environments, potentially leading to significant differences in risk and return for funds exposed to various geographic areas. A more stringent regulatory framework, like that of the EU, may exert increased pressure on high-carbon-intensive companies, thereby raising their financial risk but potentially fostering the growth of ESG funds. Conversely, more permissive regulations (such as those in post-Brexit UK or certain Asian economies) could slow the transition and increase the risk of stranded assets.

2.4 Comparative analysis of ESG vs traditional funds

2.4.1 ESG funds vs. traditional funds: asymmetrical effects of climate policies

Traditional funds show significant exposure to high-carbon assets, making them particularly vulnerable to shifts in climate policy. As highlighted by Amzallag (2022), although these funds appear diversified, they often hold similarly structured portfolios heavily concentrated in carbon-intensive sectors, thereby facing an underestimated systemic risk. The author notably shows that such "brown funds" generate losses twice as large as green funds under climate stress scenarios. Conversely, ESG funds appear less sensitive to environmental shocks, suggesting their potential role as stabilizing instruments in an increasingly stringent regulatory environment.

Furthermore, although traditional funds may deliver relatively stable financial performance in the short term, they are likely to be more exposed in the long run to the impact of intensifying environmental regulations, such as those introduced by the European Union under the Green Deal (Dupont, Moore, Boasson, Gravey, Jordan, Kivimaa, Kulovesi, Kuzemko, Oberthür, Panchuk,

[6] The Planning and Infrastructure Bill is a UK legislative proposal aiming to simplify planning procedures and accelerate infrastructure development (Horton, 2025).

Rosamond, Torney, Tosun, & von Homeyer, 2024). This increased exposure is largely due to the still-incomplete adaptation of these funds to sustainability requirements. Benedetti, Biffis, Chatzimichalakis, Fedele, and Simm (2021) emphasize that institutional investors face a combination of physical and transition risks across their portfolios and are developing various strategies to mitigate them, particularly for transition risks. However, the literature indicates that such strategies are more systematically integrated within ESG funds, whereas traditional funds tend to fall behind in adjusting to evolving regulatory frameworks (Kölbel, Heeb, Paetzold, & Busch, 2020).

Similarly, Ali, Badshah, Demirer, Hegde, and Rognone (2024) show that periods of heightened climate uncertainty tend to amplify the negative effects on returns of carbon-intensive assets, disproportionately affecting the financial stability of traditional funds. These findings highlight the importance of improving transition risk anticipation among fund managers, especially in a context where climate policies are progressively intensifying on a global scale.

Finally, several authors emphasize the necessity for investment funds to adapt their strategies in order to enhance financial resilience while supporting ecological transition goals. According to these studies, the absence of explicit integration of ESG criteria in management practices could lead to increased risks of losses over the medium to long term, particularly in highly regulated environments (Benedetti, Biffis, Chatzimichalakis, Fedele, & Simm, 2021).

However, despite the claimed advantages in sustainability and risk management, ESG funds do not enjoy unanimous support in the academic literature. Several recent studies highlight that these funds do not systematically outperform traditional funds in the long run. For instance, Chang, Fu, Jin, & Liem (2022) show that "socially responsible investment (SRI) funds, including ESG funds, do not generate higher risk-adjusted returns than non-SRI funds over the long term", thus questioning their comparative advantage in terms of profitability. Similarly, Curtis, Fisch, and Robertson (2021) demonstrate significant heterogeneity in ESG fund performance depending on asset selection methodologies and national regulatory contexts, underlining the importance of considering the specifics of each sustainable investment strategy. These findings call for a nuanced approach to ESG investing, stressing the need to analyse the actual quality of portfolios and the rigor of applied criteria. In particular, the risk of “greenwashing,” or the misleading attribution of sustainable characteristics to certain financial products, remains a critical issue that could undermine the credibility and actual impact of ESG funds among investors (Kölbel, Heeb, Paetzold, & Busch, 2020).

Even more nuanced, some recent research also highlight the limitations of ESG funds in the face of market uncertainties. Ali, Badshah, Demirer, Hegde, and Rognone (2024) show that climate uncertainty can disrupt the relationship between performance and investment flows, especially for funds poorly rated in terms of sustainability. These results emphasize that the ESG label does not provide absolute protection against market risks, and investor behaviour remains largely driven by short-term dynamics despite an expressed intent to integrate responsible criteria into decision-making.

Ultimately, the analysis of differentiated exposures of traditional and ESG funds to climate risks reveals specific vulnerabilities but also inherent limitations in each approach. While ESG funds appear to offer greater resilience to evolving environmental regulations, their long-term effectiveness depends on the actual quality of their sustainable commitments and their ability to resist short-term market pressures. In an increasingly stringent regulatory environment, increased vigilance, both in fund selection and in critical analysis of environmental strategies, thus appears essential for investors and portfolio managers.

2.4.2 Lessons from Wiklund's study (2023)

ESG-labelled investment funds are frequently highlighted as key drivers in supporting the transition to a low-carbon economy. Their approach is based on a more responsible allocation of capital, favouring companies with a reduced carbon footprint and more sustainable governance practices. This perspective is supported by several studies, including Venturini (2022), who emphasizes that “ESG funds represent a potential lever to redirect capital flows towards sectors more aligned with global climate goals”, by contributing to the internalization of environmental risks within traditional financial assessments.

Table 7. Average risk score with 95% confidence interval for the market and the three groups of sustainable funds.

	5 year	10 year
Market (MSCI ACWI)	15.4	21.0
Morningstar	14.6	20.0
	$[14.1, 15.0]_{95\%}$	$[19.4, 20.7]_{95\%}$
	$[9.2, 20.3]_{min\ /\ max}$	$[13.0, 28.5]_{min\ /\ max}$
YourSRI	14.9	20.4
	$[14.1, 15,0]_{95\%}$	$[19.3, 20,6]_{95\%}$
	$[13.0, 16.5]_{min\ /\ max}$	$[17.8, 23.0]_{min\ /\ max}$
Nordic Swan Ecolabel	14.0	19.5
	$[13.5, 14.4]_{95\%}$	$[18.9, 20.1]_{95\%}$
	$[12.2, 15.5]_{min\ /\ max}$	$[16.9, 21.7]_{min\ /\ max}$

Table 1: Average risk scores with a 95% confidence interval for the market (MSCI ACWI index) and three categories of sustainable funds

Source: (Wiklund, 2023)

In her study, Sofia Wiklund (2023) demonstrates that sustainable funds show, on average, a lower level of physical climate risk compared to the global market, represented here by the MSCI ACWI index[7] (see Table 1). This statistically significant difference is particularly pronounced over a ten-year horizon. Attribution analysis reveals that this relative performance is explained both by advantageous sectoral and geographical selection, as well as by a choice of companies less exposed to physical risk within these categories. Furthermore, Wiklund (2023) observes that ESG funds show increased resilience during periods of crisis, confirming their potential role as stabilizers in an unstable economic environment. However, the study notes that this reduced exposure to risk is not guaranteed for every individual fund and largely depends on the selection methodology employed.

Nevertheless, it would be naive not to highlight certain structural limitations of these investment vehicles. A recurring criticism concerns the heterogeneity of ESG criteria used by asset managers, complicating any rigorous attempt at comparison. This issue is also reflected in Wiklund’s methodological approach (2023), which recommends cross-referencing several ESG classification sources to mitigate this heterogeneity.

In summary, while it is convincing that ESG funds play a structuring role in accelerating the ecological transition, it is essential to maintain a critical perspective on their actual effectiveness. The relevance of these funds will only be fully revealed through more rigorous standardization of ESG criteria and greater transparency regarding selection methods. The ESG label alone cannot guarantee the expected impact.

[7] The MSCI ACWI (Morgan Stanley Capital International All Country World Index) is a global stock index that measures the performance of equity markets around the world, including developed and emerging markets (Wiklund, 2023).

2.5 Regional approach in the analysis of climate policies

The effects of climate policies on investment funds vary significantly across regions, reflecting differences in regulation, the maturity of financial markets, and political commitment to ecological transition. In Europe, where ambitious policies such as the European Green Deal have been implemented, ESG funds generally achieve better risk-adjusted performance. According to Krueger, Sautner, and Starks (2020), European investors incorporate more systematically climate risks into their investment decisions, thereby enhancing the resilience of sustainable funds. Furthermore, the introduction of stricter climate regulations in Europe has significantly accelerated capital flows into ESG funds. These increasing inflows, by boosting the relative attractiveness of these funds, can help improve their performance compared to traditional funds, especially during periods of regulatory transition (Dupont, Moore, Boasson, Gravey, Jordan, Kivimaa, Kulovesi, Kuzemko, Oberthür, Panchuk, Rosamond, Torney, Tosun, & von Homeyer, 2024).

In North America, the situation is more mixed. While initiatives like the Inflation Reduction Act have strengthened support for green investments, climate policy remains more fragmented and less stringent than in Europe. Bolton and Kacperczyk (2021) emphasize that the integration of climate risks in the United States depends heavily on sectoral and state-level factors, leading to increased volatility for funds exposed to transition risks. Thus, despite their growth, North American ESG funds remain subject to increased political uncertainty due to the absence of a unified federal regulatory framework. This institutional instability may hinder the long-term valuation of these funds by introducing additional volatility and limiting the predictability of medium-term returns.

In Asia, dynamics are even more heterogeneous. While economies such as Japan and South Korea have adopted ambitious carbon neutrality targets, other emerging markets still operate under weaker regulatory frameworks. Although Asian climate policies are progressing, they often lack institutional robustness, resulting in a more tempered financial market response. As a result, the impact of climate policies on investment funds in the region is less systematic and heavily dependent on national context and the degree of governmental commitment to the energy transition (Liu, Dong, & Fang, 2023).

To compare the stringency of climate policies across different world regions, the Organisation for Economic Co-operation and Development (OECD) has developed the Environmental Policy Stringency Index (EPS). This index assesses the intensity of environmental measures based on the costs they impose on polluting activities, on a scale from 0 (least stringent) to 6 (most stringent). For this research, EPS scores for the year 2020 were extracted from OECD publications. Since the data were presented graphically rather than in tabular form, approximate values were visually estimated. To facilitate comparative analysis, the scores were converted to a 0–100 scale.

The resulting chart (Figure 3) displays the estimated EPS scores by region. Europe registers the highest level of environmental policy stringency, with a score of approximately 69.29 out of 100. North America follows with a score of 54.17, while Asia records a lower score of 50. These results highlight significant regional disparities in climate policy ambition. Europe's leading position reflects its long-standing commitment to stringent climate regulation. In contrast, the lower scores for North America and Asia suggest generally more permissive environmental frameworks, although notable differences exist within each region (Composite Indicators and Scoreboards, n.d.).

This comparative analysis underscores the importance of factoring in regional regulatory environments when assessing the financial sector's exposure to climate transition risks. Regions with more stringent environmental policies are likely to foster greater low-carbon investment, which can in turn affect the performance and risk profile of investment funds.

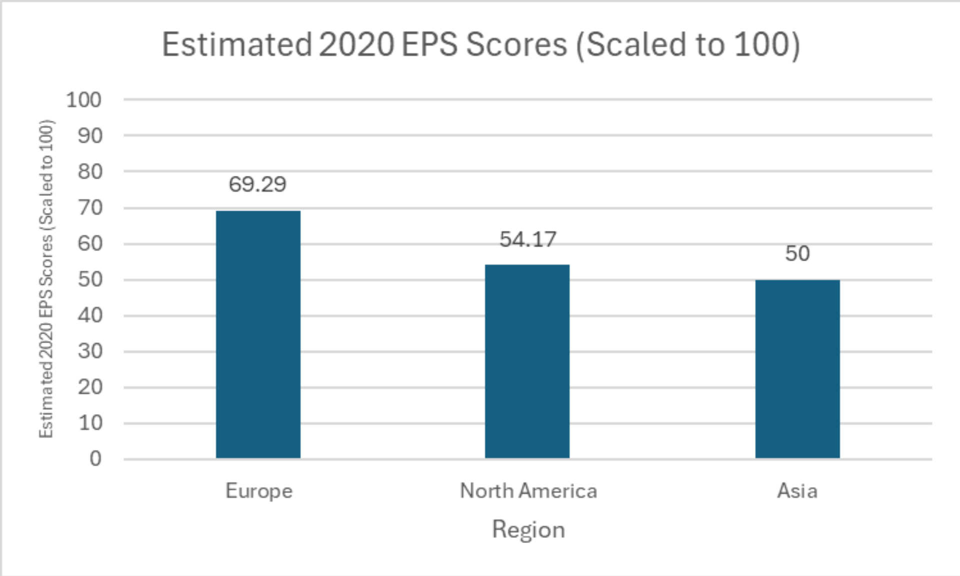


Figure 3. Estimated EPS scores by region (2020)
Source: (Composite Indicators and Scoreboards, n.d.)

2.6 Gaps in the literature and expected contribution

Despite growing attention to the consequences of climate change on the financial sector, academic literature still presents significant gaps, particularly concerning transition risks related to climate policies. While physical risks, such as natural disasters have been extensively studied, the economic impacts associated with the transition to a low-carbon economy remain relatively underexplored (Lanfear, Lioui & Siebert, 2019).

Among these transition risks, policy-related risks, coming from new climate regulations (e.g., carbon taxes, environmental standards, green financial regulations), generate increasing uncertainty for investors (Benedetti, Biffis, Chatzimichalakis, Fedele, & Simm, 2021). However, the ability of traditional economic models to account for these risks remains limited due to a lack of appropriate tools to quantify their differentiated impacts on financial assets.

Specifically regarding the investment fund industry, robust empirical studies are still limited. Although institutional investor engagement is progressing, few studies isolate the effect of climate regulations on fund performance and volatility (Krueger, Sautner & Starks, 2020).

Recent methodological advances aim to fill these gaps. For instance, Crisostomo (2022) proposes an analytical framework that integrates geographic, sectoral, and firm-level data to assess transition risk within investment portfolios. His study finds that, under a high-transition scenario, investment funds could face an average loss of 5.7%, with traditional funds being more exposed than sustainable ones.

Moreover, Lavigne and Tankov (2023) develop a mean-field game model to simulate interactions between firms and investors in a climate transition context. Their approach highlights that uncertainty over future climate policies may lead to increased global emissions and valuation disparities between ‘green’ and ‘brown’ firms. However, these studies are not without limitations: on one hand, they rely on specific assumptions that may not capture the full complexity of market dynamics; on the other hand, they often do not clearly distinguish the impact of climate policies across different types of investment funds, particularly between ESG and traditional funds.

In this context, this thesis sits at the intersection of sustainable finance and public policy analysis, offering fresh insights into how investment funds respond to regulatory developments in the field of climate change. By employing advanced econometric methods and leveraging granular data, the study provides a comparative empirical analysis of the performance and volatility of ESG versus traditional funds in response to climate policy announcements. The current literature still suffers from several major limitations: an underestimation of transition risks relative to physical risks, a partial understanding of the channels through which climate policies affect financial stability, and a scarcity of empirical studies specifically focused on the fund management industry. This thesis aims to address these gaps by analysing, at the regional level, the multidimensional impact of climate policies on the risk-return profiles of funds, while providing actionable recommendations for asset managers and policymakers to strengthen financial resilience in the face of ecological transition challenges.

3. Methodology

3.1 Context

The integration of Environmental, Social, and Governance (ESG) criteria into investment decision-making has become a central trend in contemporary finance, particularly in response to growing concerns about climate change. Several studies have shown that uncertainty surrounding climate policies can affect the financial performance of companies, especially those focused on sustainability. During regulatory transitions, ESG-oriented firms may encounter increased constraints, particularly regarding reporting and compliance, which can lead to strategic adjustments that impact short-term performance (Krueger, Sautner & Starks, 2020).

At the same time, the financial volatility observed around major policy announcements suggests that markets respond to environmental regulatory shifts, potentially affecting ESG funds differently than traditional ones (Engle, Giglio, Kelly, Lee, & Stroebel, 2020). This thesis, therefore, contributes to an emerging body of literature aiming to understand how climate policies influence returns and financial risk in investment funds, with particular attention to the regional heterogeneity of climate governance frameworks (Delis, Greiff, Iosifidi, & Ongena, 2024).

3.2 Econometric method

The chosen approach relies on two main econometric tools: the EGARCH model, to capture the conditional volatility of ESG and non-ESG funds under evolving climate policy regimes, and multiple linear regressions, to assess the structural effects of regulatory intensity on average performance and volatility across regions

3.2.1 EGARCH (1,1)

To investigate volatility dynamics more precisely, particularly during periods of regulatory stress, this study employs the EGARCH(1,1) model as its primary specification. Introduced by Nelson, D. B. (1991) and extended by Engle and Ng (1993) EGARCH does not require non-negativity constraints on variance parameters and can model the so-called leverage effects, where negative shocks (such as stringent regulations or carbon pricing mechanisms) may have a stronger impact on volatility than positive ones. This flexibility makes EGARCH particularly well-suited for analyzing "stress test" scenarios, as it captures asymmetric volatility responses to shocks an essential feature when examining financial reactions to climate policy announcements.

3.2.2 Multiple linear regression

Multiple Linear Regressions (MLR) are commonly employed in the literature to examine the effects of structural factors on the financial performance of funds or firms. Their popularity comes from their ability to simultaneously incorporate multiple explanatory variables and to assess interaction effects (such as those between climate policy ambition and a fund's ESG orientation). For instance, Pástor, Stambaugh, and Taylor (2021) use regression models to compare the performance of ESG and non-ESG funds, controlling for geographic and sectoral exposure. They also demonstrate that sustainable funds are influenced by macroeconomic variables and internal ESG factors, with MLR models allowing for the disentanglement of category-specific effects. Moreover, this approach makes it possible to introduce interaction terms (e.g., ESG × climate policy) to empirically test hypotheses such as the greater sensitivity of ESG funds to regulatory changes, a recommendation also made by Delis, Greiff, Iosifidi, and Ongena (2024) in their research on energy transition and finance.

The objective of this section is to model the structural determinants of volatility and performance for ESG and non-ESG funds, while accounting for the influence of climate policy ambition at the regional level. To this end, multiple linear regression models are implemented to test two primary hypotheses: (i) that climate policies have a differential effect on ESG funds compared to conventional funds in terms of both volatility and performance; and (ii) that the magnitude of these effects varies with the regulatory stringency of climate policies across the studied regions.

This approach offers an empirical perspective to explore the links between climate governance and financial market behaviour through the lens of investment funds. In line with the stated methodological objectives, this section adopts a quantitative approach based on linear regression models to test the impact of climate policies on fund performance and volatility, distinguishing between ESG and non-ESG strategies.

The first hypothesis assumes that climate policies have a significant effect on fund volatility, with potentially stronger sensitivity for ESG funds due to their direct exposure to environmental developments and sustainability reporting obligations. This is consistent with the idea that ESG-integrated funds may be more vulnerable to changes in environmental regulatory frameworks (Delis, Greiff, Iosifidi, & Ongena, 2024), resulting in a differential impact compared to conventional funds.

The second hypothesis suggests that climate policies also influence fund performance in a differentiated manner depending on ESG orientation. While ESG strategies may generate long-term outperformance, they could be more frequently adjusted in response to restricting regulation, thereby affecting short-term returns. Furthermore, it is anticipated that the intensity of these effects on volatility and performance varies with the level of regulatory ambition in different regions, indicating that more stringent climate policy environments amplify these differentiated dynamics.

These hypotheses align with an emerging literature on the interaction between climate regulation and financial market dynamics, particularly regarding the distinction between ESG and non-ESG funds. While several studies have examined the relative performance of sustainable funds (Ali, Badshah, Demirer, Hegde, & Rognone, 2024; Leite, & Cortez, 2015), few have explicitly modelled the structural effect of climate policies while accounting for fund type and regulatory context. This research seeks thus to fill a key empirical gap by exploring how climate regulatory constraints shape the risk-return profile of portfolios according to their level of ESG integration.

3.3 Climate policy score

One of the central methodological objectives of this thesis is to model the structural effects of climate policies on the volatility and performance of investment funds. Achieving this goal requires a rigorous indicator, differentiated by region and sensitive to temporal changes in environmental governance. To meet this requirement, an original composite index has been constructed: the $\text{Climate Policy Score}_{r,t}$ designed to quantify the level of climate ambition by region and year.

This indicator is based on the integration of two fundamental dimensions of climate governance. The first corresponds to the density of climate policies, i.e., the volume of measures adopted in each region during a given year. The second reflects the regulatory stringency of these policies, in terms of legal constraint and effective scope. Together, these dimensions capture the quantitative extent and the qualitative severity of public climate action.

The score was constructed using two publicly available and reputable databases. The first, the Climate Policy Database (*Climate Policy Database*, n.d.-c), provides detailed data on the number of climate policies in force, proposed, or adopted, by country and year. It allows for assessing regulatory density by aggregating the number of policies at the regional level. The second source is the Environmental Policy Stringency (EPS) Index developed by the OECD, which assigns each country an annual score ranging from 0 (non-binding) to 6 (highly stringent), reflecting the legal intensity of environmental policy instruments.

The raw data were aggregated at the regional level (Europe, Asia, North America) to correspond with the investment zones of the fund panel. The regional average EPS score is computed as a simple (unweighted) arithmetic mean of the available national scores, by dividing the sum of EPS scores for the countries with data by the number of those countries.

To allow comparability and integration into a single index, each dimension is normalized on the interval [0, 1]:

$$\text{Pol\_Density}_{r,t} = \frac{\text{Nb\_Policies}_{r,t}}{\text{Nb\_Total\_Policies}_{t}}$$

$$\text{Stringency}_{r,t} = \frac{\text{EPS}_{r,t}}{6}$$

- *Pol_Density*$_{r,t}$ *captures the proportion of policies attributable to each region over time t.*
- *Stringency*$_{r,t}$ *captures the average intensity of the policies in region r at the date t.*

The Climate Policy Score is defined as a weighted average of the two components:

$$\text{Climate\_Policy\_Score}_{r,t} = w_1 \cdot \text{Pol\_Density}_{r,t} + w_2 \cdot \text{Stringency}_{r,t}$$

In this study, equal weights were assigned to the two dimensions ($w_1 = w_2 = 0.5$), reflecting an equal importance given to the quantity and rigor of policies.

The $\text{Climate Policy Score}_{r,t}$ indicator constitutes an original and personal contribution to this thesis. It uniquely combines the density and stringency of climate policies into a single composite index based on publicly available and verifiable empirical data. This methodological construction allows the climate ambition to be captured temporally and regionally, thus offering sufficient granularity to align it precisely, month by month, with the observations in the investment fund panel. Moreover, it fills a gap in the empirical literature, which rarely proposes dynamic indicators of climate governance that can be integrated into linear econometric models, despite recommendations made in recent studies such as those by Delis, Greiff, Iosifidi, and Ongena (2024) and Engle, Giglio, Kelly, Lee, and Stroebel (2020).

4. Data

4.1 Data selection

The first approach consists of selecting a database of investment funds based on specific criteria aligned with the research objectives. For this approach, the primary data source will be the Morningstar platform, a specialized tool offering comprehensive, high-quality data on investment funds, stocks, bonds, and other financial instruments. A major objective of this thesis is to compare the performance of ESG funds with that of ‘traditional’ funds over a defined time period. The fund selection process requires rigor and precise criteria to correspond to the desired profiles.

To differentiate ESG funds from traditional ones, a recognized indicator will be used to establish a precise selection specific to each category. For this study, the initial fund selection will rely on the Morningstar ESG Risk Rating for Funds.

The *Morningstar ESG Risk Rating for funds*[8] assesses how well a fund manages ESG risks compared to other funds in its peer group. Based on Sustainalytics[9]’ ESG assessments, this indicator measures a fund’s exposure to unmanaged material ESG risks. In other words, it reflects the extent to which the assets held by a fund are likely to be affected by ESG risks that could impact their future financial performance (Morningstar, n.d.; Sustainalytics, n.d.).

To ensure a sufficient sample size and an objective differentiation between fund profiles, the sample was split according to Morningstar’s ESG score (see Figure 4). ESG funds are defined as those receiving 4 or 5 globes, indicating a low level of ESG risk and rigorous management of these issues. Traditional funds comprise those rated 3 globes or below, corresponding to portfolios less aligned with ESG standards or only partially integrating them. This segmentation criterion, based on an internationally recognized indicator, allows for a rigorous comparison between the two groups.

Figure 4. Morningstar sustainability rating
Source: (Hale, 2016)

Next, to build a coherent, representative sample suited for analysing the return and volatility dynamics of investment funds, a rigorous selection was carried out using Morningstar Direct’s advanced search tool. The sampling was structured around four major regions to capture potential regional disparities in market responses to climate policies. For each region, funds were filtered according to several consistent criteria (see Table 2). These criteria are particularly relevant as they enable the construction

---

[8] The *Morningstar ESG Risk Rating for Funds* provides an analytical framework that enables investors to assess the ESG risks of investment portfolios, whether mutual funds or exchange-traded funds (ETFs). Initially launched in 2016, this indicator aims to measure the financial materiality of ESG risks within a portfolio, relative to those of similar funds in the same Morningstar Global category (Morningstar, n.d.).

[9] A Morningstar subsidiary (Sustainalytics, n.d.).

of a homogeneous and comparable sample of funds, based on equivalent characteristics, while ensuring a sufficiently broad time coverage to include the key phases of the evolution of international climate governance.

Criterion	Applied Value
Geographic region	Europe, North America, Asia, Global
Morningstar categories	Ex: Equity Income, US Large-Cap
Minimum size	≥100 million EUR
Currency	Euro
Inception date	< 01/01/2010
Status	Only surviving funds
Domicile	All countries

Table 2: Fund Selection Criteria
Source: Personal development

At the end of this step, a sample of 230 funds was selected, comprising 44 ESG funds and 186 traditional funds (see Table 3), distributed evenly across the studied investment regions. This initial dataset was established while ensuring diversity and a clear scientific rationale in the fund selection. This classification will serve as the foundation for the empirical analyses conducted later in the thesis, focusing in particular on performance, volatility, and sensitivity to climate policies. These variables were chosen because they, together, provide a comprehensive view of the funds' risk-return profile under the influence of climate policies. Indeed, performance captures the financial returns, volatility reflects the risk or uncertainty associated with these returns, and sensitivity to climate policies measures how funds react to regulatory changes. This multidimensional approach enables a nuanced understanding of how climate policies impact the stability and profitability of ESG and traditional funds across different regions.

Type de fond	Plateforme	Indicateur	Score	taille de l'échantillon	Total échantillon
ESG	Morningstar	Morningstar ESG Risk Rating for funds	>4	44	230
Non-ESG	Morningstar	Morningstar ESG Risk Rating for funds	<=3	186	

Table 3: Sample size of funds
Source: Personal development

4.2 Period analysis

The analysis covers the period from 2010 to 2023, allowing for the integration of a significant set of structural events in climate governance[10]. This temporal framework is particularly relevant as it

[10] See Figure 1 in section *2.1.1. The Climate change*

encompasses several major institutional milestones likely to have influenced investment behaviour. Among these are notably the Paris Agreement adopted at COP21 in 2015, the launch of the European Green Deal in 2019, and the renewed commitments made at COP26 in Glasgow in 2021. These initiatives have contributed to strengthening the integration of climate issues into financial actors' strategies, notably through regulation, the green taxonomy, and the growing prominence of ESG products (Commission européenne, 2020; UNFCCC, 2016). By selecting this period, the study positions itself within a coherent historical dynamic aligned with the rise of climate policies on an international scale.

The climate policies implemented between 2010 and 2024 (see Table 4) represent key structural levers likely to significantly influence financial dynamics, particularly in asset management. The introduction of normative frameworks (see Table 4) has reinforced the progressive internalization of climate issues by financial actors, encouraging a reassessment of risks related to the energy transition and a reallocation of capital towards assets compatible with a low-carbon trajectory. According to Krueger, Sautner, and Starks (2020), institutional investors are increasingly integrating environmental factors into their allocation decisions in response to regulatory, reputational, and economic pressures. Similarly, Bolton and Kacperczyk (2021) show that carbon-related risks are now perceived as well-established financial risks, affecting both asset valuation and volatility.

Thus, recent climate policies are not only exogenous regulatory instruments but catalysts for market transformation, potentially impacting the risk-adjusted performance of ESG and traditional funds. The consideration of these regulatory milestones as temporal reference points in the empirical analysis is fully justified given their capacity to structure the decision-making environment of asset managers. Each selected event (see Table 4) represents a normative inflection likely to trigger significant portfolio adjustments. This approach aligns with the work of Delis, Greiff, Iosifidi, and Ongena (2022), who emphasize that regulatory changes in sustainable finance induce asymmetric responses depending on the region and type of fund. Furthermore, Engle, Giglio, Kelly, Lee, and Stroebel (2020) stress the need to model the effects of climate policies as structural exogenous shocks when assessing risk. By integrating these milestones as inflection points in the modelling, the study seeks to capture structural differences between ESG and non-ESG funds and to highlight the dynamic effects of regulation on risk-return equilibria in a context of accelerated ecological transition.

Multilateral Events (COP / UN)	
2015 – COP21 / Paris Agreement (France)	First time 195 countries committed to limiting global warming "well below 2°C," with an ambition to reach 1.5°C. (Source: UNFCCC, 2015)
2021 – COP26 (Glasgow)	Acceleration of climate commitments: net zero pledges, coal phase-out, and mobilization of climate finance. (Source: UNFCCC, 2021)
2023 – COP28 (Dubai)	First global stocktake of the Paris Agreement; call to triple renewable energy capacity. (Source: UNFCCC, 2023)
European Union	
2019 – European Green Deal	Roadmap toward climate neutrality by 2050. Aims to mobilize over €1 trillion in sustainable investments. (Source: European Commission, 2019)
2020 – EU Taxonomy Regulation	Classification system for environmentally sustainable economic activities; central tool for green finance.
2021 – SFDR (Sustainable Finance Disclosure Regulation)	Mandates asset managers to classify financial products based on ESG criteria (Articles 6, 8, and 9).
2021 – Fit for 55 Package	Legislative package to cut EU greenhouse gas emissions by at least 55% by 2030.
United States	
2022 – Inflation Reduction Act (IRA)	Major U.S. climate legislation allocating $370 billion for clean energy, green technologies, and tax incentives. (Source: The White House, 2022)
2017 – U.S. withdrawal from the Paris Agreement (Trump Administration)	Symbolic political disengagement from multilateral climate efforts (rejoined by the Biden Administration in 2021).
Other Notable Policies	
2020 – China: Carbon neutrality target by 2060	Major announcement at the UN General Assembly to reach net-zero emissions by 2060. (Source: Xinhua, 2020)
2021 – Japan and South Korea: Net-zero pledges by 2050	Both countries formally committed to reaching carbon neutrality by mid-century.

Table 4: Major Climate Policies (2010–2024)
Source: Personal development

4.3 Data features

The database includes the monthly net asset values (NAV) of each fund, from which the monthly returns have been calculated using the following formula:

$$\text{Return}_t = \left(\frac{\text{NAV}_t - \text{NAV}_{t-1}}{\text{NAV}_{t-1}}\right) \times 100$$

This formula allows measuring the relative performance of a fund from one month to the next, based on the evolution of its net asset value. Additionally, historical volatility has been estimated using a moving average over a rolling one-year window (i.e., 12 monthly observations), allowing the tracking of market risk evolution over time. The formula applied for the moving average volatility is as follows:

$$\sigma_t^{(12)} = \sqrt{\frac{1}{12}\sum_{i=t-11}^{t}\left(R_i - \overline{R}_{12}\right)^2}$$

$\sigma_t^{(12)}: 12\ month\ rolling\ volatility\ calculated\ at\ time\ t$

$R_i: Monthly\ return\ of\ the\ fund\ at\ period\ i$

$\overline{R_{12}}: Average\ of\ the\ monthly\ returns\ over\ the\ previous\ 12\ periods$

The dataset is organized within an Excel file structured around several thematic sheets. A 'NAV' sheet contains the monthly net asset values of all selected funds, while a 'Return' sheet compiles the calculated monthly returns. The 'Metadata' sheet consolidates descriptive information for each fund, including ISIN[11], currency, inception date, assets under management, ESG rating, domicile, and Morningstar category. Additional sheets classify the funds based on their ESG profile (ESG vs. conventional funds) and their investment region (Europe, North America, Asia, Global).

This methodological structure ensures data consistency and comparability across funds, while enabling a differentiated analysis based on environmental and geographic criteria. It provides a robust foundation for an econometric approach focused on assessing the dynamic effects of climate policies on risk-adjusted fund performance across distinct segments.

4.4 Descriptive Statistics

Descriptive analysis serves as a crucial first step in exploring the fundamental statistical characteristics of the monthly returns of investment funds. It aims to establish initial comparisons between fund

[11] The ISIN (International Securities Identification Number) is a unique 12-character alphanumeric code used to standardized identify investment funds.

categories, particularly ESG and non-ESG funds, as well as across different geographic regions, over the period from January 2010 to December 2023.

To ensure the comparability of indicators across funds, descriptive statistics were computed in two stages. First, for each fund, five key metrics were calculated over the study period: average monthly return, standard deviation, skewness, kurtosis, and the Sharpe ratio. These metrics were selected to provide a comprehensive statistical profile of each fund's performance and risk characteristics. The average monthly return summarizes the profitability, while the standard deviation measures the volatility or risk level. Skewness and kurtosis capture the distribution shape of returns, indicating asymmetry and the presence of extreme events, which are crucial for understanding downside risks. Finally, the Sharpe ratio integrates return and risk into a single risk-adjusted performance measure, facilitating a meaningful comparison across funds with different risk profiles.

Second, these results were aggregated by category (see Table 5) using the simple average of each indicator within the group. This method preserves individual fund heterogeneity while offering a synthetic view of their average characteristics. A similar approach is adopted by Leite and Cortez (2015), Renneboog, Ter Horst, and Zhang (2008), and Nofsinger and Varma (2014) in their analyses comparing ESG and conventional fund performance.

Mean Indicator	ESG	NON ESG	Europe	N.A	Asia	Global
Monthly average return	0.72%	0.71%	0.60%	1.03%	0.56%	0.77%
Standard deviation	4.03%	3.99%	4.08%	4.18%	4.42%	3.62%
Skewness	-0.623	-0.577	-0.777	-0.538	-0.617	-0.439
Kurtosis	3.928	3.618	5.162	3.216	5.141	1.827
Sharpe Ratio	0.157	0.159	0.127	0.237	0.109	0.185

Table 5: Descriptive Statistics by Fund Category and Investment Region (2010–2023)
Source: Personal development

The aggregated average results indicate that ESG funds exhibit a mean monthly return of 0.72%, very close to that of non-ESG funds (0.71%), but with slightly higher volatility (4.03% vs. 3.99%), suggesting a negligible difference between the two categories (see Figure 5). The Sharpe ratio is also similar (0.157 vs. 0.159), pointing to a comparable risk-adjusted performance on average. The shape of the return distribution, as measured by kurtosis, is higher for ESG funds (3.93 vs. 3.61), indicating a greater presence of extreme return events (see Figure 6). Furthermore, ESG funds exhibit slightly more negative skewness (-0.623 vs. -0.577), suggesting a more pronounced left-skewed distribution, that is, a higher likelihood of extreme negative returns.

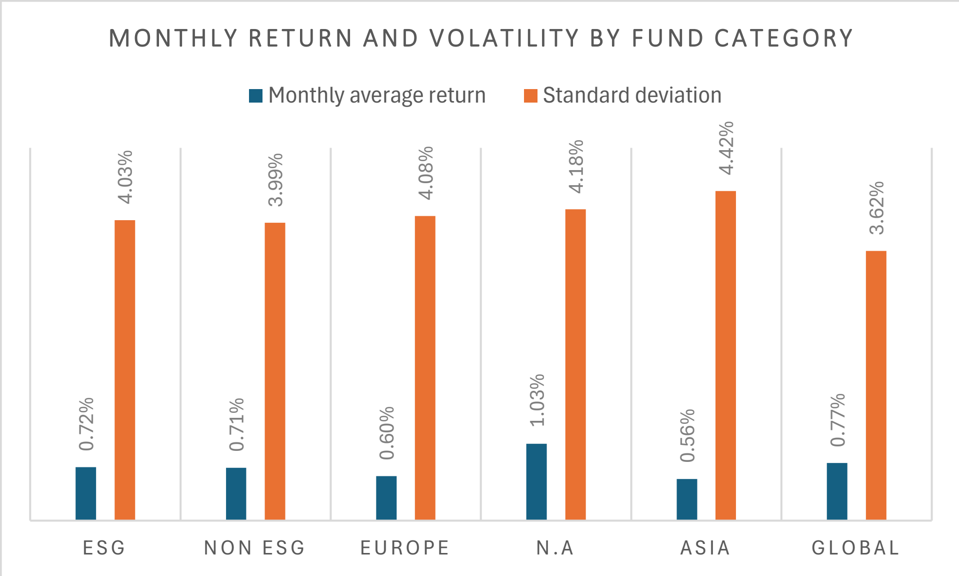


Figure 5. Monthly return and volatility by fund category
Source: Personal excel computation (database : Refinitiv eikon, n.d.)

From a geographical perspective, North American funds stand out with a higher average return (1.03%) and a Sharpe ratio of 0.237, indicating greater risk-adjusted efficiency. In contrast, Asian funds exhibit higher volatility (4.42%) and a lower Sharpe ratio (0.109), reflecting weaker performance relative to risk. European funds, meanwhile, display a particularly high kurtosis (5.162), suggesting a strongly leptokurtic return distribution, i.e., one that is highly concentrated around the mean but prone to more frequent extreme events (see Figure 6).

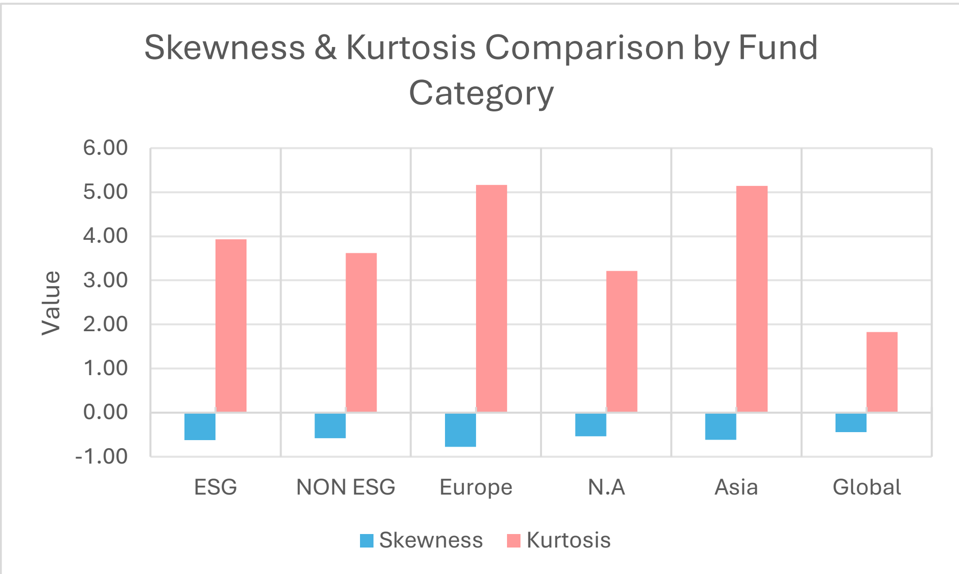


Figure 6. Skewness and Kurtosis comparison by fund category
Source: Personal excel computation (database : Refinitiv eikon, n.d.)

These findings are consistent with the existing literature: according to Leite and Cortez (2015), European ESG funds do not systematically achieve superior risk-adjusted performance, but tend to demonstrate slightly lower volatility during stable periods, an effect that reverses in the presence of exogenous shocks. In line with Renneboog, Ter Horst, and Zhang (2008), the differences between ESG and conventional funds lie less in average returns than in the distribution of returns and their resilience to market shocks .

4.5 Dynamic analysis of return and volatility

Temporal analysis provides insights into the evolution of risk and return dynamics around three major climate policy milestones: COP21 (2015), the European Green Deal (2019), and COP26 (2021). As shown in the graphs (see Appendices, Figure 7), the 12-month rolling volatility tends to temporarily increase around these events, particularly for ESG funds, which appear more sensitive to climate-related regulatory announcements. This observation supports the hypothesis that environmental regulations can function as "stress tests"[12] for portfolios integrating sustainability criteria. This idea is reinforced by Engle, Giglio, Kelly, Lee, and Stroebel (2020), who argue that returns demonstrate greater sensitivity to climate policy shocks in the case of strongly ESG-oriented assets.

Regarding returns, the monthly average performance curves (see Appendices, Figure 8) demonstrate marked variability before and after each regulatory shift. In particular, an increase in return dispersion is observed following the launch of the European Green Deal, suggesting heterogeneous market adjustment responses across fund managers. However, this finding must be interpreted with caution, as the Green Deal timeline coincides with the outbreak of the COVID-19 pandemic, which had a major impact on global financial markets. Indeed, a study by Khan, Fifield, and Power (2024) demonstrated that the pandemic significantly amplified market volatility, thereby affecting the performance of investment funds.

In conclusion, no significant difference appears between the mean rolling volatility and the average return of ESG and non-ESG funds. The graphics presented in the appendix (see Appendices, Figures 7 and 8) reveal broadly similar patterns across both fund categories. This finding is consistent with the academic literature, which often presents nuanced results. A study conducted by the European Central Bank (2022) confirms this trend, emphasizing that, on a monthly basis, ESG and non-ESG fund performances are generally equivalent, with no statistically significant advantage in risk-adjusted returns attributed to either group.

4.6 Robustness test of the differences in performance and volatility between ESG and non-ESG funds

To ensure robustness and reliability in assessing the statistical significance of differences between ESG and traditional funds, this study employed two complementary tests: a Student's t-test (Welch Two Sample t-test) and a Levene's test. The Student's t-test was conducted on the average monthly returns (see Table 6). This test was used because it is a powerful parametric test that efficiently detects mean differences between two groups when the data approximately meets the assumptions of normality and homoscedasticity (equal variances). However, financial data, such as fund returns or volatility, often deviate from normal distribution, which can invalidate the t-test results. To address this limitation, a

[12] See the definition of this term in section *1.4. Methodology*

Levene's test was performed to compare variances between groups, aiming to detect any structural differences in volatility (see Table 6), (Pallmann, Hothorn, & Djira, 2014).

The t-test results (t = 0.098; p-value = 0.922) indicate that the difference in average monthly returns between ESG funds (0.715%) and non-ESG funds (0.710%) is not statistically significant at the 5% significance level. The 95% confidence interval for the difference in means ([-0.00099; 0.00109]) includes zero, confirming the absence of a significant gap. Overall, this stability in returns suggests that the gross average performance of ESG and non-ESG funds was nearly equivalent over the period from January 2010 to December 2023.

This finding aligns with academic literature. For example, Renneboog, Ter Horst, and Zhang (2008), in a study covering more than 440 socially responsible funds across 17 countries, conclude that ESG funds do not systematically outperform traditional funds once adjusted for risk and investment styles. Similarly, Nofsinger and Varma (2014) show that sustainable funds tend to underperform during normal market conditions but demonstrate greater resilience during market stress periods, such as the 2008 financial crisis. These results suggest that performance differences between ESG and non-ESG funds are more contextual than structural, underscoring the importance of a temporal and event-based approach.

Moreover, the Levene's test on the monthly return series yields an F-statistic of 0.6003 with a p-value of 0.4385. This indicates no significant difference in variance between the two groups, implying that the average volatility of ESG funds (4.03%) and non-ESG funds (3.99%) is also very similar throughout the entire period. This homogeneity in standard deviations validates the statistical comparability of the groups and ensures the consistency of estimates derived from econometric models such as GARCH and EGARCH.

In summary, these empirical results strengthen the robustness of the descriptive analysis by demonstrating that neither average monthly returns nor volatility levels show significant differences between ESG and non-ESG funds from 2010 to 2023. They provide a solid foundation for more detailed dynamic analyses centred on major climate regulation milestones.

Statistical Test	Test Statistic	Distribution	p-value	Interpretation
Welch t-test	0.098	t	0.9219	No significant difference between means
Levene's test	0.6003	F	0.4385	Homogeneous variances between the two groups

Table 6: Robustness Test Results on Monthly Returns (ESG vs. Non-ESG)
Source: Author's computations (through RStudio with the Refinitiv Eikon Database)

4.7 Database for MLR

To empirically analyse the impact of climate policies on the volatility and performance of investment funds, a balanced panel dataset was constructed. It comprises a total of 230 funds, divided between ESG funds (coded as 1) and non-ESG funds (coded as 0), over the period from January 2010 to April 2024, with monthly frequency. Each observation corresponds to a unique {fund, month} combination, allowing the capture of both temporal dynamics (within-fund) and structural differences between funds (between-funds).

Fund size is transformed using the natural logarithm (*Fund_Size_log*) to reduce skewness in the distribution and mitigate the influence of extreme values. This transformation is widely used in financial literature, as it enables better comparability across funds with highly heterogeneous sizes. Similarly, monthly returns are expressed in logarithmic terms (*Log_Return*), defined as $\ln(R_t / R_{t-1})$, to ensure temporal additivity of returns and improve the statistical properties of the series—particularly the normality of residuals and the reduction of heteroskedasticity. These improvements facilitate estimation via ordinary least squares (OLS) in linear models, and enhance the robustness of maximum likelihood estimation in conditional volatility models such as EGARCH, which rely on strong assumptions about the distribution of standardized residuals and the dynamics of conditional variance (Pástor, Stambaugh, & Taylor, 2021).

Monthly volatility (Vol_Moyenne) is calculated as the standard deviation of logarithmic monthly returns over a rolling six-month window. This measure of historical volatility captures recent risk dynamics without resorting to conditional models, while smoothing short-term fluctuations often considered noise.

A major contribution of the dataset lies in the explicit integration of climate policies. Key environmental governance frameworks (such as the Green Deal, the EU Taxonomy, the SFDR, and national carbon neutrality announcements) are encoded as dummy variables, taking the value 1 from the date of policy implementation from the date of implementation and 0 beforehand. This event-based modelling enables the identification of the specific temporal impact of each regulatory framework on market behaviour, an approach inspired by methods for handling regulatory shocks in institutional economics and climate finance (Krueger, Sautner & Starks, 2020).

4.8 Climate policy score

The Climate Policy Score$_{r,t}$ is integrated into the monthly panel dataset by assigning each fund the score corresponding to its investment region and the year of the observation. As a result, each {fund, month} observation is enriched with a region-specific, time-varying indicator of climate policy stringency, aligned with the regulatory environment the fund is exposed to at the given date.

5. Models

5.1 EGARCH (1,1)

To better capture the asymmetric nature of volatility responses in financial markets especially in the context of climate-related regulatory events this study also employs the Exponential Generalized Autoregressive Conditional Heteroskedasticity model, EGARCH(1,1), introduced by Nelson, D. B. (1991). Unlike the standard GARCH model, EGARCH models the logarithm of the conditional variance, thereby eliminating the need for non-negativity constraints on the variance parameters and allowing for more flexible dynamics. This feature makes EGARCH particularly well-suited for capturing leverage effects, whereby negative shocks tend to increase volatility more than positive shocks of the same magnitude. In the context of ESG and non-ESG funds, this is especially relevant, as regulatory announcements like COP21 or the implementation of the EU Taxonomy may trigger asymmetric market reactions depending on the portfolio's sensitivity to environmental risk. By including a policy dummy variable D_t, the model also enables the estimation of structural breaks in volatility associated with major climate policy shifts.

The EGARCH(1,1) model was specified using a Student-t distribution to account for excess kurtosis in daily return data. Volatility was modelled as:

$$\log(h_t) = \omega + \beta \log(h_{t-1}) + \gamma \left| \frac{\varepsilon_{t-1}}{\sqrt{h_{t-1}}} \right| + \theta \frac{\varepsilon_{t-1}}{\sqrt{h_{t-1}}} + \delta D_t$$

Where:

- h_t is the conditional variance,
- $\omega, \beta, \gamma, \theta$ are model parameters,
- ε_{t-1} is the lagged innovation (residual),
- D_t is a dummy variable equal to 1 in the post $-$ policy period and 0 before

This formulation allows capturing both the asymmetric response of volatility to past shocks (via θ) and the structural impact of climate policy events (via δ).

5.2 GARCH (1,1)

In order to evaluate the temporal dynamics of volatility associated with ESG and non-ESG investment funds, particularly around key climate policy announcements (COP21, European Green Deal, COP26), this study employs a Generalized Autoregressive Conditional Heteroskedasticity (GARCH) model. Originally introduced by (Bollerslev, 2023) as an extension of the ARCH model developed by (Engle, 1982), GARCH models are widely used in financial econometrics to capture the phenomenon of volatility clustering, where large shocks tend to be followed by further large shocks of either sign.

The baseline model specified is a GARCH(1,1), which assumes that the conditional variance of returns at time *t* depends on both the lagged squared residual and the lagged conditional variance:

$$r_t = \mu + \varepsilon_t, \quad \varepsilon_t \sim \mathcal{N}(0, h_t)$$
$$h_t = \omega + \alpha\varepsilon_{t-1}^2 + \beta h_{t-1}$$

Where:

- r_t is the return of the fund at time t
- h_t is the conditional variance
- $\omega, \alpha,$ and β are parameters to be estimated

5.3 Multiple linear regression (MLR)

5.3.1. Specifications of econometric models

The objective of this section is to formalize the impact of climate policies on rolling volatility and investment fund performance, distinguishing between the differential effects on ESG and non-ESG funds. Two families of linear models are proposed: one explaining 6-month rolling volatility, and the other the average monthly return. Each model incorporates structural variables (fund characteristics), temporal variables (year), regional factors, as well as specific regulatory indicators.

5.3.1.1. Main model: 6-month rolling volatility

The first model estimates the rolling volatility over 6 months (Vol_6M) for each fund, based on fund-specific variables *i*, at month *t*, and the regulatory context:

$$\mathrm{Vol\_6M}_{it} = \alpha + \beta_1 \cdot \mathrm{ESG}_i + \beta_2 \cdot \mathrm{Region}_i + \beta_3 \cdot \mathrm{ClimatePolicyScore}_{rt} + \beta_4 \cdot \log(\mathrm{FundSize}_{it}) + \sum_{k=1}^{K} \delta_k \cdot \mathrm{PolicyDummy}_{kt} + \varepsilon_{it}$$

Where :

- ESG_i is a binary variable ($1 = $ ESG funds, $0 = $ Non $-$ ESG funds);
- $Region_i$ *represents the geographical exposure of the fund;*
- $ClimatePolicyScore_{rt}$ *designates the climate ambition score for region r of the fund at date t;*
- $\log(\mathrm{FundSize}_{it})$ *is the logarithm of the size of fund i at time t, used to capture the scale effects (fund size) on volatility or performance;*
- $PolicyDummy_{kt}$ *represents the specific regulatory dummies taking the value 1 if policy k is in effect in month t, and 0 otherwise;*
- ε_{it} *is the term of error.*

This model does not aim to estimate volatility itself but rather to explain its observed monthly variations (calculated over a rolling 6-month window) based on fund characteristics and the regulatory environment. The rolling volatility (Vol_6M) is used here as the dependent variable, capturing the dynamic risk level of funds over time.

To control for fund-specific characteristics that may influence volatility and returns, a control variable for fund size (log-transformed) is included in both model specifications. Larger funds tend to benefit from more diversified portfolios, lower transaction costs, and more stable inflows, which can reduce exposure to short-term volatility. This approach is consistent with previous studies such as Bollen and Busse (2005), which highlight the role of fund size in moderating performance dispersion and volatility.

This specification allows testing the direct effects of each major climate policy event on fund volatility, while controlling for ESG status and geographic exposure.

To assess whether ESG funds respond more strongly in ambitious climate policy contexts, a specification including an interaction term between the ESG variable and the Climate Policy Score is estimated, using the 6-month rolling volatility as the dependent variable:

$$\mathrm{Vol\_6M}_{it} = \alpha + \beta_1 \cdot \mathrm{ESG}_i + \beta_2 \cdot \mathrm{ClimatePolicyScore}_{rt} + \beta_3 \cdot (\mathrm{ESG}_i \times \mathrm{ClimatePolicyScore}_{rt}) + \beta_4 \cdot \log(\mathrm{FundSize}_{it}) + \sum_{k=1}^{K} \delta_k \cdot \mathrm{PolicyDummy}_{kt} + \varepsilon_{it}$$

This specification allows capturing a moderating effect of the regulatory context on sustainable funds. It builds on the work of Engle, Giglio, Kelly, Lee, and Stroebel (2020), Broadstock, Chan, Cheng, Wang (2021), and Reboredo (2015), who demonstrate that climate-sensitive assets tend to react more strongly to major policy announcements.

5.3.1.2. Alternative model: Monthly performance

A similar regression is applied with the monthly performance of the fund, measured by the monthly log-return calculated from the net asset values (NAV), as the dependent variable:

$$\mathrm{LogReturn}_{it} = \alpha + \beta_1 \cdot \mathrm{ESG}_i + \beta_2 \cdot \mathrm{ClimatePolicyScore}_{rt} + \beta_3 \cdot (\mathrm{ESG}_i \times \mathrm{ClimatePolicyScore}_{rt}) + \beta_4 \cdot \log(\mathrm{FundSize}_{it}) + \sum_{k=1}^{K} \delta_k \cdot \mathrm{PolicyDummy}_{kt} + \varepsilon_{it}$$

Where :

- ESG_i *is a binary variable (1 = ESG funds, 0 = non-ESG);*
- $ESG_i \times ClimatePolicyScore_{rt}$ *is a term of interaction testing whether the ESG effect depends on political ambition;*
- $ClimatePolicyScore_{rt}$ *designates the climate ambition score for region r of the fund at date t;*

- $\log(\text{FundSize}_{it})$ *is the logarithm of the size of fund i at time t, used to capture the scale effects (fund size) on volatility or performance;*
- $PolicyDummy_{kt}$ *represents the specific regulatory dummies taking the value 1 if policy k is in effect in month t, and 0 otherwise;*
- ε_{it} *is the term of error.*

This specification allows testing whether ESG funds react differently to climate policies in terms of monthly financial performance, measured here through monthly log-returns. It continues the work of Pástor, Stambaugh, and Taylor (2021), which analyse the differential impact of the climate transition on risk-adjusted ESG performance.

6. Analysis

To assess the impact of climate policies on the financial characteristics of investment funds, this dissertation is based on the general hypothesis that such policies significantly influence the risk-return profiles of funds, with effects that vary depending on their ESG orientation and geographical exposure. This central hypothesis is articulated through four specific sub-hypotheses, each tested using appropriate econometric techniques on a sample of 230 funds, covering both ESG-labelled and non-ESG strategies across Europe, North America, Asia-Pacific, and Global markets over the period 2010-2023. Data are sourced from Morningstar (for ESG labelling) and Refinitiv Eikon (for NAVs), enriched with a composite Climate Policy Score built from international regulatory sources.

The first hypothesis (H1) posits that ESG funds exhibit lower volatility than traditional funds, particularly in contexts of tightening climate regulations. This assumption is grounded in the idea that ESG integration enhances risk management and anticipatory capacity toward regulatory shifts, as suggested by Wiklund (2023), Venturini (2022) and Mishra, Kumar, and Bal (2023). To test this, fund volatility is modelled using an EGARCH(1,1) specification, which captures asymmetric responses to market shocks especially those associated with major regulatory announcements.

The second hypothesis (H2) explores the performance gap between ESG and non-ESG funds, suggesting that ESG strategies deliver higher or at least more resilient risk-adjusted returns following significant climate policy events such as COP21 or the European Green Deal. This is supported by recent literature (e.g., Renneboog, Ter Horst, & Zhang, 2008; Santi, 2023) emphasizing the progressive repricing of low-carbon portfolios and their growing attractiveness to institutional investors. This hypothesis is tested using a multiple linear regression (MLR) model applied to monthly returns, including regional fixed effects and macroeconomic controls.

Hypothesis (H3) posits that the effects of climate policies on fund performance and volatility differ across regions, due to substantial regulatory asymmetries. Europe, with more advanced ESG regulation, is expected to produce more stabilizing effects, while other regions like Asia or North America may show delayed or more volatile reactions. This spatial dimension is incorporated into the models through interaction terms between the policies studied (e.g., EU Taxonomy, COP21) and regional dummies, following the regional frameworks and OECD reports.

Finally, Hypothesis (H4) suggests that the impact of climate policies is amplified in ESG funds, depending on the strength of regional climate regulations as measured by the Climate Policy Score. This mechanism is captured by an interaction term (ESG × Climate Policy Score) in the MLR model, allowing for an analysis of whether sustainable strategies, already aligned with climate goals, respond differently to policy intensification. This approach aims to test a non-linear differential effect, shedding light on potential pre-alignment or early absorption mechanisms within ESG portfolios.

Together, these hypotheses structure the empirical investigation presented in this section, which aims to determine whether ESG funds truly offer a more robust risk-return profile in the context of climate transition and to what extent this advantage is conditional on public policy and regional factors.

6.1 EGARCH (1,1)

The EGARCH(1,1) model was applied to eight selected funds, equally split between ESG and non-ESG categories, and representing diverse geographical zones (see Table 7). This model was chosen over the traditional GARCH(1,1) following persistent convergence and interpretability issues encountered in the latter for most funds. EGARCH, by construction, allows for asymmetric volatility dynamics and relaxes the positivity constraints on variance parameters, making it particularly suitable for financial series with leverage effects or short observation windows.

Group	Fund	Region	Globes (Morningstar)	Size (EUR)
ESG	Capital Group Euro G&I (LUX) C	Europe	🌍🌍🌍🌍🌍	€135 M
ESG	Fidelity Pacific A-Acc-EUR	Asia	🌍🌍🌍🌍🌍	€704 M
ESG	JPM America Equity D (acc) EUR	N. America	🌍🌍🌍🌍	€7,848 M
ESG	Orbis SICAV Global Equity Inv	Global	🌍🌍🌍🌍🌍	€749 M
Non-ESG	Amundi Fds Nt Zr Ambt Top EurPlyrsI2EURC	Europe	🌍	€619 M
Non-ESG	JPM Pacific Equity D (acc) EUR	Asia	🌍	€1,521 M
Non-ESG	GS US Equity Income I Cap EUR	N. America	🌍	€448 M
Non-ESG	MFS Inv Global Concentrated Equity Euro	Global	🌍	€118 M

Table 7: Sample of Funds Selected for the GARCH Analysis (ESG Criteria, Region, Size)
Source: Author's work (through Excel with the Refinitiv Eikon Database)

Table 8 summarizes the results, presenting average conditional volatility and BIC values per fund. A graphical representation of volatility over time for each fund is included below to better illustrate volatility dynamics across ESG and non-ESG categories.

Fund	Average Volatility	BIC
Capital Group Euro G&I (ESG -Europe)	0.037875	-3.6149
Fidelity Pacific A-Acc (ESG-Asia)	0.042322	-3.3612
JPM America Equity (ESG - N.America)	0.040503	-3.458
Orbis SICAV Global (ESG - Global)	0.038191	-3.6427
Amundi Fds Top Eur (Non-ESG - Europe)	0.040119	-3.5081
JPM Pacific Equity (Non-ESG - Asia)	0.03811	-3.5956
GS US Equity Income (Non-ESG - N.America)	0.034303	-3.8428
MFS Global Concentrated (Non-ESG - Global)	0.03622	-3.695

Table 8: EGARCH(1,1) Estimation Results: Average Volatility and BIC
Source: Author's computation (through Rstudio with the Refinitiv Eikon Database)

On average, ESG funds exhibit slightly higher volatility than their non-ESG counterparts across regions (mean ESG funds 0.0397 vs 0.0371 for Non-ESG funds), though the differences remain modest. These results contrast with studies who found that European ESG indices were up to 12% less volatile than comparable non-ESG indices. Similarly, ETFs with high ESG scores had slightly higher conditional variance but better downside protection. In a related context, stronger spillover and leverage effects in ESG ETFs indicate that such funds may exhibit more reactive volatility patterns than their non-ESG peers (Iannone, Duttilo, & Gattone, 2025;Doğan, Ben Jabeur, Tiwari, & Abakah, 2025).

These findings suggest that the slightly higher volatility observed in ESG funds may reflect their greater exposure to regulatory risks, particularly in the context of evolving climate policies. ESG portfolios often incorporate sectors more sensitive to policy shifts such as clean energy, technology, or sustainable infrastructure which may react more sharply to political or macroeconomic uncertainty. It is therefore important to analyze volatility differences by region, as the regulatory climate, policy implementation, and investor expectations can vary significantly across markets factors that materially influence ESG fund behavior and volatility. Zhang, Feng, Zhou, Chen, and Liu (2024) highlight that climate policy uncertainty has a more pronounced negative impact on ESG performance in certain regions, due to differences in policy enforcement and local economic structures.

Indeed, a closer look at the regional results reveals that ESG funds are not consistently less volatile (Table 9). In Europe, ESG funds exhibit slightly lower average volatility compared to their non-ESG counterparts (−5.5%), which aligns with the findings of Iannone, Duttilo, and Gattone (2025), who observed up to 12% lower volatility for European ESG indices. In contrast, in North America and the Asia-Pacific region, ESG funds display higher volatility (up to +18% in the United States), consistent with the work of Doğan, Ben Jabeur, Tiwari, and Abakah (2025), who argue that ESG constraints may limit diversification or increase sensitivity to market shocks.

Region	ESG Fund	Non-ESG Fund	Difference
Europe	0.0379 (Capital Group Euro G&I)	0.0401 (Amundi Top Eur)	-5.5% (ESG <)
Asia Pacific	0.0423 (Fidelity Pacific ESG)	0.0381 (JPM Pacific Equity)	+11.0% (ESG >)
USA	0.0405 (JPM ESG US Equity)	0.0343 (GS US Income)	+18.1% (ESG >)
Global	0.0382 (Orbis ESG Global)	0.0362 (MFS Global)	+5.5% (ESG >)

Table 9: Comparison of Average Conditional Volatility (EGARCH) Between ESG and Non-ESG Funds by Region (2010–2023)
Source: Author's elaboration based on EGARCH results (RStudio, Refinitiv Eikon)

The temporal analysis of conditional volatility over the 2010–2023 period, based on EGARCH(1,1) estimates, reveals regional disparities between ESG and non-ESG funds (see Figure 9) While both categories follow broadly similar market dynamics, key spikes in ESG fund volatility tend to coincide with major climate-related regulatory milestones such as the COP21 agreement in 2015 and the implementation of the EU SFDR in 2021. In the "Global" and "USA" panels, ESG funds show slightly higher average volatility and more pronounced reactions to these policy events, supporting the argument by Engle, Giglio, Kelly, Lee, and Stroebel (2020) and Broadstock, Chan, Cheng, and Wang (2021), that sustainable portfolios are more exposed to policy-induced volatility. These findings indicate that ESG investment strategies do not necessarily reduce market risk, but rather increase exposure to climate policy uncertainty particularly in regions with more aggressive regulatory frameworks.

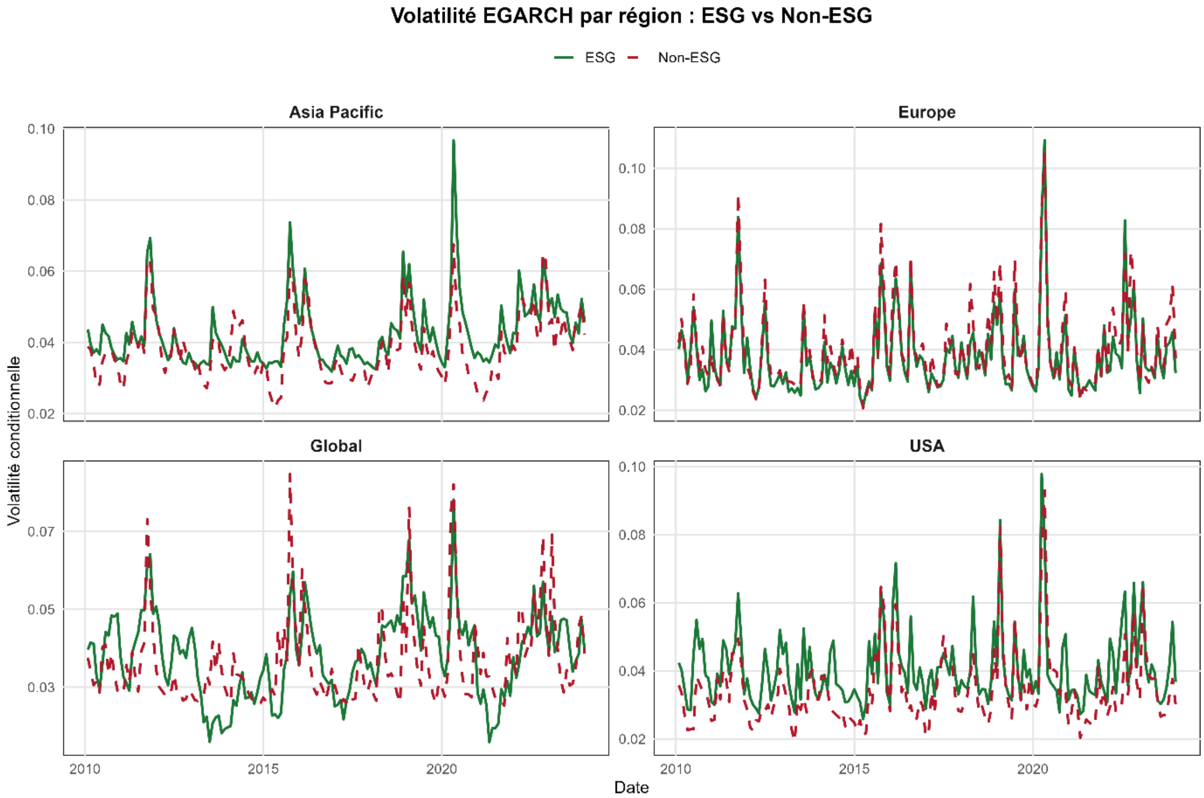


Figure 9. Estimated conditional volatility (EGARCH) by region: ESG vs Non-ESG funds (2010–2023)
Source: Author's computation (through Rstudio with the Refinitiv Eikon Database)

The EGARCH(1,1) model allows us to estimate the asymmetry coefficient (θ), which reflects the so-called leverage effect which describes how volatility responds differently to negative versus positive shocks (see Figure 10). Contrary to what is often reported in the literature, the current analysis shows that most funds, ESG and non-ESG alike, exhibit positive θ values, suggesting an absence of strong leverage effects. Only one ESG fund Orbis ESG Global shows a negative coefficient (θ = -0.0866), indicating moderate downside sensitivity.

Interestingly, non-ESG funds tend to display higher and more consistently positive asymmetry coefficients, with MFS Global reaching 0.4166. This may imply that traditional portfolios exhibit a more symmetric or even upward-biased volatility response, while ESG funds display more mixed behaviour. These results stand in contrast to studies such as Doğan, Ben Jabeur, Tiwari, and Abakah (2025), and Akhtaruzzaman, Boubaker, and Sensoy (2021), who identify pronounced negative asymmetry in ESG assets, particularly during crisis periods. One explanation for this divergence may lie in the sample itself: the 2010–2023 period may not fully capture extreme stress environments, and the regional or sectoral composition of the funds could also play a role. As noted by Broadstock, Chan, Cheng, and Wang (2021), leverage effects in ESG assets are often context-dependent, emerging most clearly during abrupt policy shifts.

Overall, the findings suggest that volatility asymmetry is not a structural feature of ESG funds, but rather a fund- or region-specific phenomenon. The growing diversification and mainstreaming of ESG strategies may be contributing to this reduced sensitivity to negative shocks. While the EGARCH model confirms isolated instances of downside reactivity, it does not support the hypothesis of a generalized leverage effect in ESG investing.

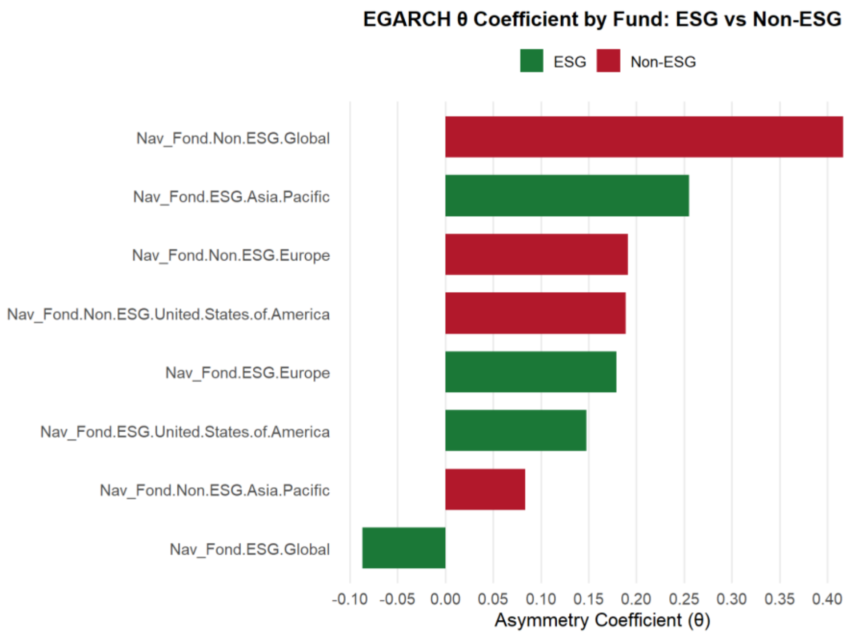


Figure 10. Asymmetry in Volatility Responses — EGARCH θ Coefficients by Fund Type (ESG vs Non-ESG)
Source: Author's computation (through Rstudio with the Refinitiv Eikon Database)

Figure 11 displays the evolution of average conditional volatility for ESG and non-ESG funds surrounding the COP21 climate conference in December 2015, based on the EGARCH(1,1) model. Both fund types experience a pronounced volatility spike in anticipation of the event, reflecting heightened uncertainty around global climate negotiations. However, ESG funds exhibit a more persistent volatility response in the months following COP21, maintaining elevated levels longer than their non-ESG counterparts. This extended sensitivity may indicate greater exposure to policy-driven risk factors, consistent with Engle, Giglio, Kelly, Lee, and Stroebel (2020), and Broadstock, Chan, Cheng, and Wang (2021), who argue that sustainable assets are structurally more reactive to environmental regulation.

Yet, while the direction of these responses aligns with theoretical expectations, the magnitude of divergence between ESG and non-ESG funds remains modest, limiting the statistical significance and practical implications of the observed patterns. In other words, the persistence of ESG volatility may be visible but not decisive.

This nuance echoes broader findings in the literature. While Iannone, Duttilo, and Gattone (2025), report lower volatility for ESG indices in Europe, and highlight the resilience of ESG assets during market shocks, the present results suggest a more context-dependent picture. ESG funds may offer improved risk management in some settings, but their sensitivity to climate policy shifts can also increase volatility in the short term. These mixed signals call for caution in assuming that ESG necessarily provides lower risk exposure particularly around major regulatory or geopolitical climate events.

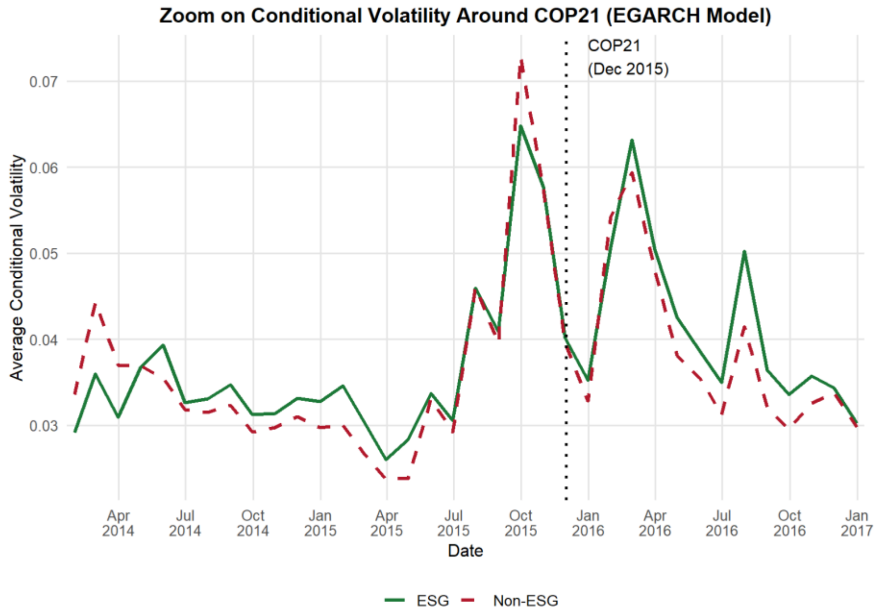


Figure 11. Conditional Volatility of ESG vs Non-ESG Funds Around COP21 (EGARCH Model, 2014–2017)
Source: Author's computation (RStudio)

6.2 Multi Linear regression (MLR)

The two regressions conducted on fund returns and volatility allow for an analysis of the multidimensional impact of climate policies and the ESG approach on risk-return characteristics in the asset management industry.

6.2.1. Global choice as REF REGION

Before starting the analysis, it is important to acknowledge some limitations. To facilitate the interpretation of regional effects, the "Global" category has been set as the reference level for the categorical variable *Investment_Region*. This choice is based on the idea that globally classified funds represent a neutral and aggregated benchmark, providing a natural baseline for comparing funds with specific regional exposures. As such, the estimated coefficients for other regions (Europe, Asia, North America) should be interpreted as differential effects relative to a globally diversified investment portfolio. This framework helps to better assess regional specificities in response to climate policies or in the performance and risk profile of ESG funds.

Still from a regional perspective, it should be noted that climate policies such as the Green Deal or the EU taxonomy are modelled as global events affecting all funds, regardless of their investment region. This approach allows for capturing potential signalling or global spillover effects but does not make it possible to isolate direct effects in the regions specifically targeted by the policies.

6.2.2. EXCLUSIONS CERTAIN POLICIES BASED ON THE YEAR

The construction of the Climate Policy Score is based on a consolidated database of regulatory and policy measures up to December 31, 2020. As a result, the score does not reflect regulatory frameworks introduced after that date. Consequently, major initiatives such as *Fit for 55* (2021), the full implementation of the SFDR (2021), the U.S. Inflation Reduction Act (2022), and net-zero commitments by Japan and South Korea could not be incorporated into the composite indicator. From an econometric perspective, these variables were automatically excluded from the regression model due to a lack of variance, which is consistent with the statistical logic of estimation. The exclusion of these policies does not compromise the validity of the analysis, as the objective is to assess the historical and structural impact of climate policies in effect up to the end of 2020. This ensures temporal consistency between the climate policy indicator used and the model's explanatory variables.

6.2.3. Volatility Regression – ESG and Climate Policy Effects

The volatility model highlights a statistically significant negative coefficient for ESG-labelled funds (−0.0147; $p = 0.0016$), indicating that, on average, ESG funds exhibit lower risk than their non-ESG counterparts (Table 10). This supports the hypothesis that ESG integration is associated with more stable portfolio composition, potentially due to lower exposure to regulatory or environmental shocks. These findings align with Pástor, Stambaugh, and Taylor (2021), and Broadstock, Chan, Cheng, and Wang (2021), who document reduced volatility among ESG funds, particularly during periods of heightened policy uncertainty.

More notably, the Climate Policy Score shows a significant negative effect on volatility for non-ESG funds (−0.0337; $p = 0.0136$), suggesting that stronger regulatory frameworks contribute to market stabilization (Table 10). However, the interaction term (ESG × Climate Policy Score) is positive and significant (+0.0084; $p = 0.0015$), indicating that ESG funds benefit less from this stabilizing effect—likely because they are already structurally aligned with environmental goals (Table 10). This attenuated marginal effect reflects a form of regulatory "pre-integration" and mirrors the findings of Engle, Giglio, Kelly, Lee, and Stroebel (2020), who show that portfolios with high ESG exposure exhibit weaker climate betas.

Lastly, the Green Deal and EU Taxonomy are both associated with a short-term increase in volatility, confirming the disruptive nature of regulatory transitions. These results underscore the complexity of climate policy as a volatility driver: while it reduces uncertainty in the long run, it may initially increase market tension, especially for portfolios undergoing adaptation.

ESG funds are less volatile overall, but their risk profile is less sensitive to changes in climate policy. Regulatory transitions, while beneficial in the long term, can trigger short-term volatility surges, particularly for non-aligned portfolios.

Variable	Coefficient	Std_Error	t_value	p_value	CI_2.5	CI_97.5
(Intercept)	0.09742698	0.02265879	4.29974376	1.72E-05	0.05250711	0.14234684
ESG1	-0.0147156	0.00465246	-3.1629777	0.00156325	-0.0305715	0.00114027
ClimateScore	-0.0336563	0.01364543	-2.4664915	0.01365014	-0.0570986	-0.010214
FundSize_log	-3.27E-04	2.93E-04	-1.1179071	0.26361593	-0.001027	3.73E-04
Investment_F	-0.0091691	0.00699786	-1.3102711	0.19011452	-0.022485	0.00414677
Investment_F	0.00182924	0.00197004	0.9285305	0.35314019	-0.001471	0.00512945
Investment_F	-0.0129488	0.00718746	-1.8015863	0.07162091	-0.0272539	0.00135624
COP_21	0.0048862	0.0018535	2.63619861	0.00838853	0.00236337	0.00740904
Green_Deal	0.02287673	0.00118152	19.3621923	5.39E-83	0.01851343	0.02724002
Eu_Taxonomy	0.02649548	0.00106011	24.9932544	2.02E-136	0.0200114	0.03297956
US_Paris_Exit	-0.0034976	0.0013303	-2.6291575	0.00856419	-0.006354	-6.41E-04
China_netzer	-0.0399847	8.30E-04	-48.196769	0	-0.046985	-0.0329844
ESG1:Climate	0.00839338	0.00265512	3.1612077	0.00157278	-9.64E-04	0.01775075

Table 10: Volatility Regression – ESG and Climate Policy Effects (6-Month Rolling Volatility)

Source: Author's computation (RStudio)

6.2.4. Monthly Performance Regression – ESG and Climate Policy Effects

In contrast with the volatility results, the ESG coefficient in the return model is positive but not significant (+0.0058; p = 0.372), suggesting no clear return premium for ESG-labelled funds (Table 11). This result supports the view that ESG investing may offer downside risk mitigation, but not necessarily outperformance. Similar patterns are found in Pástor, Stambaugh, and Taylor (2021), and Akhtaruzzaman, Boubaker, and Sensoy (2021), who observe limited alpha for ESG funds over full market cycles.

The absence of significant outperformance by ESG funds (coefficient ESG1 = 0.0058; p = 0.372) and the marginally negative effect of their interaction with the Climate Policy Score (ESG1:ClimateScore = –0.0029; p = 0.428) are consistent with the findings of Scacchi (n.d.) (Table 11). He concludes that ESG funds may occasionally outperform, particularly during periods of heightened climate awareness, but that this advantage tends to fade once market participants have internalized sustainability standards. The ESG effect may therefore be progressively absorbed, which could explain the weak coefficients observed in the model.

The Climate Policy Score, however, has a strong and significant positive impact on fund returns (+0.0595; p < 0.001), confirming the hypothesis that stronger climate policy regimes enhance market performance (Table 11). This likely reflects increased investor confidence and the reallocation of capital toward sustainable assets. Notably, this effect is again attenuated for ESG funds (interaction term = −0.0030; p = 0.428), reinforcing the idea that ESG portfolios are already priced in for such regimes, and thus experience limited marginal gains from further policy reinforcement (Table 11).

Interestingly, some individual policies, like the EU Taxonomy, are associated with both increased volatility and improved returns, highlighting a classic risk–return trade-off during transition phases. Conversely, the Green Deal shows a negative return impact despite raising volatility, suggesting that some reforms may trigger initial pricing inefficiencies or investor uncertainty.

While ESG status does not lead to outperformance, climate policy plays a key role in enhancing returns. ESG funds, already aligned with regulatory goals, exhibit muted reactivity, which could limit upside potential but reinforces their stability in policy-driven environments.

Variable	Coefficient	Std_Error	t_value	p_value	CI_2.5	CI_97.5
(Intercept)	-0.1110313	0.02691036	-4.1259663	3.70E-05	-0.1617439	-0.0603187
ESG1	0.00580613	0.00650312	0.8928219	0.37195997	-0.0120945	0.02370676
ClimateScore	0.05952915	0.01584094	3.75793165	1.72E-04	0.03306378	0.08599453
FundSize_log	5.67E-04	3.45E-04	1.64502886	0.09997471	-2.23E-04	0.00135707
Investment_RegionAs	0.03135233	0.00828466	3.78438283	1.54E-04	0.0163193	0.04638537
Investment_RegionEu	0.00413327	0.00222622	1.85662725	0.06337435	4.07E-04	0.00785906
Investment_RegionNo	0.03649576	0.00836239	4.36427588	1.28E-05	0.02034594	0.05264557
COP_21	-0.0050603	9.31E-04	-5.4353868	5.51E-08	-0.0079085	-0.0022121
Green_Deal	-0.0211175	0.00233942	-9.0268325	1.87E-19	-0.0260435	-0.0161915
Eu_Taxonomy	0.0313664	0.00236509	13.2622217	5.02E-40	0.02404615	0.03868665
US_Paris_Exit	-0.0012239	8.41E-04	-1.4557149	0.14548229	-0.0044487	0.00200084
China_netzero	3.89E-04	0.00193944	0.20076164	0.84088637	-0.0075137	0.00829242
ESG1:ClimateScore	-0.0029797	0.00376698	-0.7910109	0.42894408	-0.0135438	0.00758435

Table 11: Monthly Performance Regression – ESG and Climate Policy Effects
Source: Author's computation (RStudio)

6.3 Interaction Effects Analysis

To fully assess the differentiated impact of climate policies on the risk-return characteristics of investment funds, this section incorporates interaction terms within the applied econometric models. The objective is to determine whether certain effects vary according to fund type (ESG vs. non-ESG), investment region, or the specific nature of the policies implemented.

The analysis unfolds along four complementary dimensions. First, it investigates how ESG-labelled funds respond to increasing policy stringency, through the interaction between ESG status and the Climate Policy Score. Second, it examines whether individual climate policies such as the EU Green Deal or the Taxonomy produce distinct effects on ESG versus traditional funds. Third, it assesses whether policy effects are stronger in the regions where those policies are actually implemented, by interacting climate measures with investment zones. Lastly, it explores whether more ambitious regional policy environments amplify the effects on both volatility and performance, via an interaction between region and Climate Policy Score.

This analytical framework aims to highlight not only the main effects of climate policies but also how these effects are shaped by the specific characteristics of the funds, their ESG orientation, and their geographic exposure. The approach is deliberately multidimensional, in order to reflect the growing complexity of investment decision-making in the context of ecological transition.

6.3.1. Differential Sensitivity of ESG Funds to the Climate Policy Score

The interaction between ESG labelling and the stringency of climate policies reveals a contrasting effect on risk and return (Figure 12). Volatility decreases across all portfolios as policy ambition intensifies, but the decline is more pronounced for non-ESG funds. This suggests that ESG-labelled funds, already aligned with environmental objectives, are less sensitive to regulatory improvements in terms of risk mitigation. In terms of performance, the positive effect of the Climate Policy Score is visible for all funds, yet the ESG interaction remains weak and statistically insignificant. This challenges the assumption of a systematic ESG outperformance premium and supports the findings of Pástor, Stambaugh, and Taylor (2021), who argue that ESG excess returns are highly contingent on societal attention and tend to fade as ESG becomes mainstream. These findings imply that while ESG funds offer enhanced stability, they do not necessarily deliver higher returns in more ambitious regulatory environments.

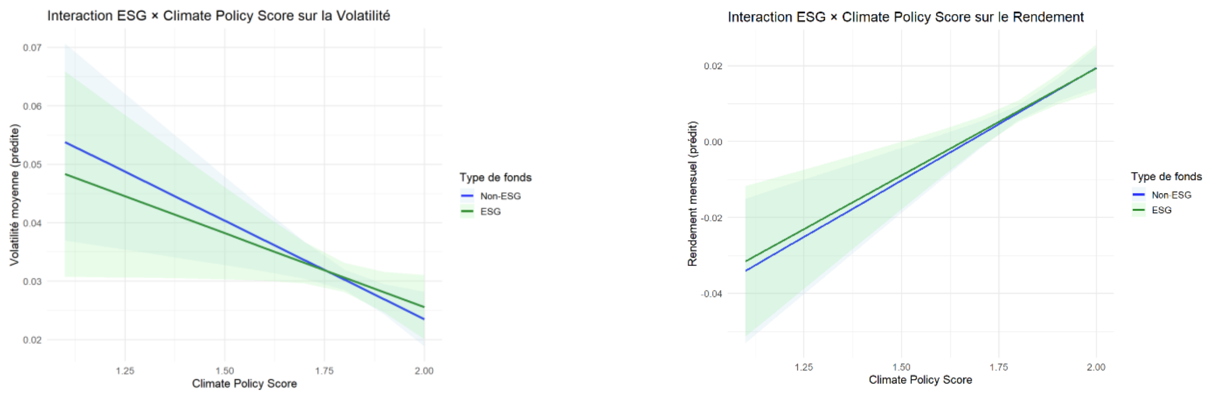


Figure 12. Moderating Effect of the Climate Policy Score on the Volatility and Return of ESG and Non-ESG Funds
Source: Author's computation (RStudio)

6.3.2. Limited Differential Impact of Individual Climate Policies on ESG Funds

Analysis of ESG × Policy interaction terms reveals limited effects on both returns and volatility (Figure 13). Most coefficients are close to zero and lack statistical significance, even for high-profile initiatives such as the EU Taxonomy or the Green Deal. This suggests that climate policy announcements do not systematically produce differentiated financial responses between ESG and non-ESG funds. These findings are consistent with Berg, Kölbel, and Rigobon (2022), who argue that while ESG alignment enhances resilience, it does not necessarily alter a fund's sensitivity to regulatory shocks. The subdued reaction of ESG portfolios likely reflects their pre-existing alignment with sustainability objectives, which reduces both downside risk and upside surprise. In this context, ESG funds appear structurally buffered rather than significantly advantaged by climate reforms.

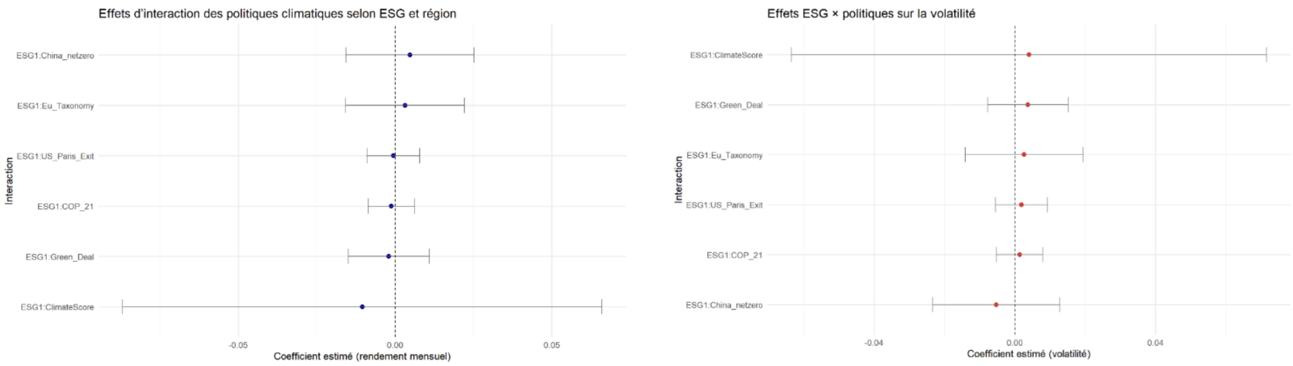


Figure 13. Interaction Effects Between ESG and Climate Policy Indicators by Region on Monthly Returns and Volatility
Source: Author's computation (RStudio)

6.3.3. Amplified Policy Effects in Regions of Implementation

Introducing interaction terms between climate policies and investment regions highlights notable regional heterogeneity in return impacts. For instance, the EU Green Deal is associated with a slight positive return effect for funds primarily invested in Europe, whereas the U.S. exit from the Paris Agreement corresponds to a modest negative effect on North American funds (Figure 14). These patterns are in line with Lanfear, Lioui, and Siebert (2019), who identify a "transition risk premium" whereby financial markets locally adjust asset prices in anticipation of—or in response to—regulatory shifts. The evidence supports the view that climate policies exert stronger financial effects when implemented in the same geographic region as the fund's exposure, reinforcing the importance of local regulatory context in fund performance dynamics.

Figure 14. Differential Effects of Climate Policies by Investment Region on Monthly Returns and Volatility
Source: Author's computation (RStudio)

6.3.4. Regional Policy Stringency and Its Uneven Impact on Fund Performance and Volatility

Marginal effect analyses of the Climate Policy Score by region reveal contrasting return dynamics (Figure 15). North American and Asian funds tend to benefit from increasingly ambitious climate policies, displaying steadily rising return patterns. In contrast, European funds exhibit a counterintuitive negative relationship, potentially reflecting short-term transition costs and stricter compliance requirements in heavily regulated environments. Global funds, meanwhile, show a more muted positive effect likely the result of geographic diversification, which tends to smooth both policy-related gains and risks. These findings echo Battiston, Dafermos, and Monasterolo (2021), who emphasize that diversification buffers the financial exposure to climate policy shocks. Overall, the influence of climate policy on performance appears strongly shaped by regional regulatory maturity and market conditions.

The marginal effect of the Climate Policy Score on predicted volatility varies significantly by region, with Europe showing a strong positive association, while North America exhibits a clear negative relationship, suggesting regional disparities in how climate policy expectations affect market risk (Figure 16).

Taken together, the interaction models reveal that while climate policies are generally associated with lower volatility and higher returns, these effects are not evenly distributed. ESG-labelled funds benefit from enhanced stability but show limited additional gains in performance. The regional context plays a critical role: where and how policies are implemented shapes their financial impact. These results underscore the importance of adopting a multidimensional perspective integrating ESG alignment, regulatory exposure, and geographic allocation when assessing the impact of climate policy on fund performance.

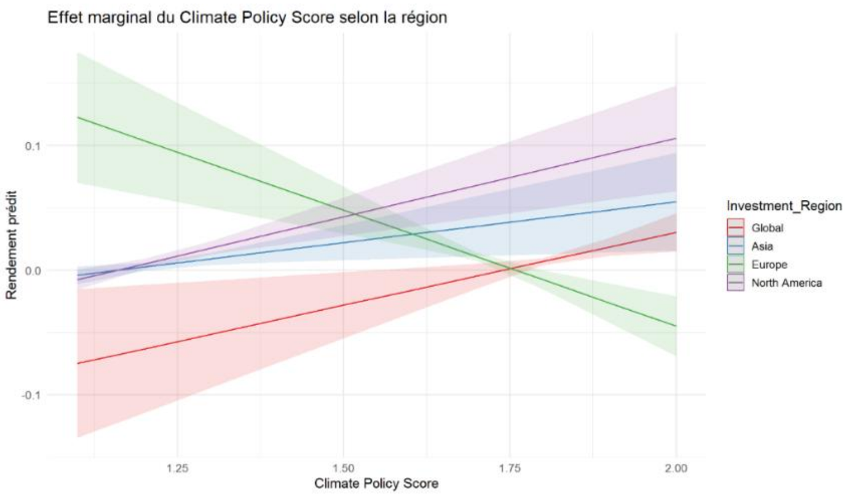


Figure 15. Marginal Effect of the Climate Policy Score on Predicted Returns by Investment Region
Source: Author's computation (RStudio)

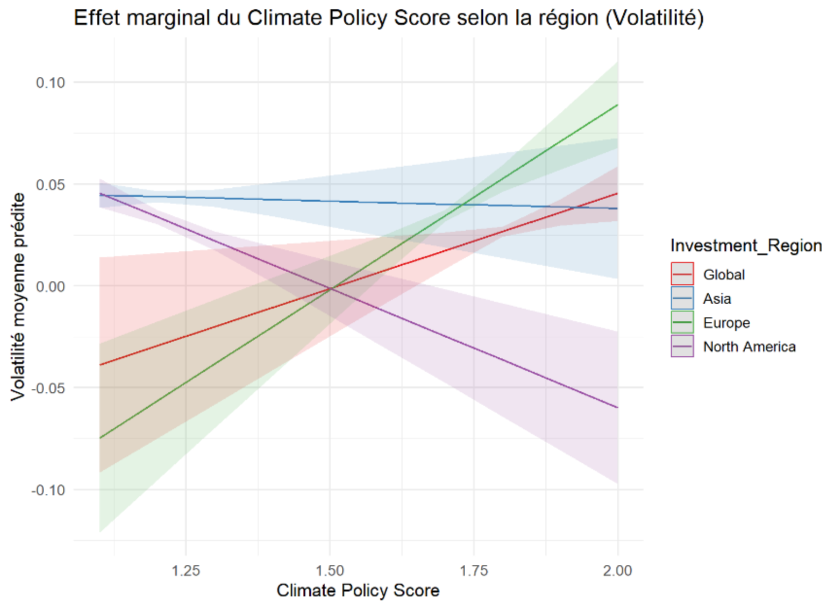


Figure 16. Marginal Effect of the Climate Policy Score on Predicted Volatility by Investment Region
Source: Author's computation (RStudio)

6.3.4. Regional Policy Stringency and Its Uneven Impact on Fund Performance and Volatility

Marginal effect analyses of the Climate Policy Score by region reveal contrasting return dynamics. North American and Asian funds tend to benefit from increasingly ambitious climate policies, displaying steadily rising return patterns. In contrast, European funds exhibit a counterintuitive negative relationship, potentially reflecting short-term transition costs and stricter compliance requirements in heavily regulated environments. Global funds, meanwhile, show a more muted positive effect likely the result of geographic diversification, which tends to smooth both policy-related gains and risks. These findings echo Battiston, Dafermos, and Monasterolo (2021), who emphasize that diversification buffers the financial exposure to climate policy shocks. Overall, the influence of climate policy on performance appears strongly shaped by regional regulatory maturity and market conditions.

Taken together, the interaction models reveal that while climate policies are generally associated with lower volatility and higher returns, these effects are not evenly distributed. ESG-labelled funds benefit from enhanced stability but show limited additional gains in performance. The regional context plays a critical role: where and how policies are implemented shapes their financial impact. These results underscore the importance of adopting a multidimensional perspective integrating ESG alignment, regulatory exposure, and geographic allocation when assessing the impact of climate policy on fund performance.

6.4. Key Empirical results

The empirical results derived from the EGARCH volatility models and multiple linear regressions offer a nuanced understanding of how climate policies influence the risk-return characteristics of investment funds, considering both ESG integration and geographical exposure.

The EGARCH(1,1) estimations indicate that ESG funds are not consistently less volatile than their non-ESG counterparts. On average, ESG-labelled funds exhibit slightly higher volatility (0.0397) than non-ESG funds (0.0371), a difference that is especially pronounced in North America and the Asia-Pacific region. This result likely stems from their sectoral allocation to climate-sensitive industries such as clean technologies and sustainable infrastructure, which are more reactive to policy changes. In contrast, in Europe where environmental regulation is more mature ESG funds display lower average volatility, with a -5.5% gap compared to traditional funds, supporting the hypothesis that stronger alignment with regulation can mitigate risk. These results partially confirm Hypothesis 1 (H1): ESG strategies contribute to improved stability, but this effect is primarily observed in regions with advanced regulatory frameworks.

The temporal dimension of volatility also reveals increased sensitivity of ESG portfolios to major climate-related announcements, with notable spikes around COP21 in 2015. This is especially visible in U.S. and globally diversified funds, highlighting a higher degree of regulatory exposure. EGARCH asymmetry coefficients (θ) are mostly positive for both ESG and non-ESG funds, indicating limited leverage effects. However, non-ESG funds tend to show higher and more consistent θ values up to +0.4166 for MFS Global suggesting more symmetric volatility profiles. One ESG fund, Orbis ESG Global, stands out with a negative θ coefficient (-0.0866), indicating some degree of downside sensitivity. Nevertheless, these asymmetries appear to be fund-specific rather than a structural feature of ESG investing.

From a statistical standpoint, the multiple linear regression model on 6-month rolling volatility provides additional insights. ESG status is associated with a significant reduction in volatility (coefficient = −0.0147; $p = 0.0016$), confirming that sustainable strategies tend to be less risky overall. The Climate Policy Score also exerts a strong stabilizing effect, particularly for non-ESG portfolios (coefficient = −0.0337; $p = 0.0136$). However, the interaction between ESG and the Climate Policy Score is positive and significant (+0.0084; $p = 0.0015$), suggesting that ESG funds benefit less from increased regulatory stringency, likely due to a pre-existing alignment with environmental goals. These findings validate Hypothesis 4 (H4), showing that the regulatory premium is already embedded within ESG portfolios, thereby reducing their marginal responsiveness to new policies.

In terms of returns, the analysis shows that ESG funds do not offer a statistically significant outperformance. The coefficient for ESG status in the return model is positive but not significant (+0.0058; $p = 0.372$), and the interaction with the Climate Policy Score is also non-significant (-0.0030; $p = 0.428$). These findings align with Scacchi (n.d), who argues that ESG excess returns are often temporary and tend to fade as sustainability norms are progressively internalized by markets. In contrast, the Climate Policy Score itself has a strong and statistically significant positive impact on fund returns (+0.0595; $p < 0.001$), particularly in North America and Asia, suggesting that policy ambition drives capital reallocation toward sustainable assets. As such, Hypothesis 2 (H2), which predicted a superior performance of ESG funds, is rejected, while Hypothesis 3 (H3) is partially confirmed: climate policy effects are clearly present, but they vary significantly by region.

The regional analysis further emphasizes these disparities. Ambitious climate reforms are associated with improved returns in Asian and North American markets, where recent policies have included tax incentives and green investment strategies. In Europe, however, the relationship between the Climate Policy Score and fund performance is negative, which could be attributed to higher transition costs or regulatory saturation in a more mature ESG landscape. Global funds, by contrast, show muted effects both positive and negative likely due to diversification across multiple regions, which dampens the impact of localized policy changes. These heterogeneous patterns across regions confirm Hypothesis 3

(H3), underlining that the financial impact of climate policy is highly dependent on the regulatory environment and market maturity in each geographical zone.

In conclusion, the findings confirm that climate policies have a significant and multi-layered influence on the financial dynamics of investment funds. While ESG-labelled strategies tend to offer enhanced stability particularly in Europe they do not systematically outperform traditional funds. The Climate Policy Score emerges as a central determinant of both risk and return, exerting a more pronounced influence on non-ESG portfolios and in regions with ambitious regulatory agendas. This evidence suggests that ESG integration strengthens structural resilience, but that its financial edge remains conditional on the policy context, sectoral exposure, and market reaction timeframes. A contextualized, multidimensional perspective is thus essential for evaluating the true impact of climate policies on investment performance.

7. Robustness Tests

To ensure the statistical validity of the results and strengthen the empirical credibility of the estimations, several robustness tests were conducted. These tests aim to verify the fundamental assumptions of the econometric models used, assess the quality of the estimated equation specifications, and ensure that the observed relationships remain stable under methodological variations. This section helps validate the robustness of the empirical conclusions by ruling out the possibility that they are driven by arbitrary model choices or structural biases.

7.1 Robustness Check: GARCH(1,1) vs EGARCH(1,1)

In order to validate the robustness of the volatility dynamics modelled in this dissertation, an alternative specification using a standard GARCH(1,1) model was estimated and compared to the main EGARCH(1,1) model. While the primary analysis relies on the EGARCH specification chosen for its ability to capture asymmetries and leverage effects in volatility often associated with negative shocks such as abrupt climate policy announcements this comparison aims to confirm the consistency of results across model specifications.

The results of the GARCH(1,1) model indicate similar patterns to those observed in the EGARCH(1,1) estimates. Specifically, ESG funds exhibit lower average conditional volatility across regions compared to non-ESG counterparts. For instance, the average volatility for the Capital Group Euro G&I fund (ESG - Europe) under GARCH is 0.0406, slightly higher than the 0.0379 obtained with EGARCH, whereas the MFS Global Concentrated fund (non-ESG Global) shows 0.0368 under GARCH and 0.0362 under EGARCH. These values confirm the trend that ESG strategies generally lead to reduced volatility exposure (see Appendices, Table 12).

Additionally, the Bayesian Information Criterion (BIC) values obtained under EGARCH(1,1) are consistently lower than those from the GARCH(1,1) estimation, indicating a superior model fit for the EGARCH framework. For example, the BIC for GS US Equity Income (non-ESG North America) is -3.8428 under EGARCH compared to -3.7652 with GARCH. This trend is observed across most funds, supporting the choice of EGARCH as the preferred model in terms of statistical parsimony (see Appendices, Table 12).

Moreover, during exploratory analysis, the conditional volatility plots derived from the GARCH(1,1) model displayed significant visual instability, including artificial spikes and erratic movements not supported by underlying market data. These artifacts undermined the interpretability and reliability of GARCH outputs for graphical representations. Conversely, EGARCH produced smoother volatility paths that more plausibly captured market reactions, particularly during periods of climate-related regulatory shocks.

In conclusion, while the GARCH(1,1) model corroborates the core findings lower volatility in ESG funds and the stabilizing role of climate policy the EGARCH(1,1) specification demonstrates superior statistical performance (lower BIC), better visual clarity in conditional volatility dynamics, and a greater ability to account for asymmetric effects. These findings substantiate the decision to retain EGARCH(1,1) as the main volatility model in this research.

To validate the robustness of the main volatility estimation model (EGARCH(1,1)), we compare it with the classical GARCH(1,1) specification (see Appendices, Figure 17). For representative funds such as Nav_Fond.Non.ESG.Europe and Nav_Fond.Non.ESG.Global, the conditional volatility profiles obtained from both models exhibit a high degree of concordance. Despite the EGARCH model's ability to account for asymmetry in volatility responses, the GARCH(1,1) estimations successfully reproduce the same volatility spikes and structural patterns over time. This visual similarity supports the robustness of the main findings and confirms that the observed volatility dynamics are not artefacts of model choice. Therefore, the GARCH(1,1) model provides a valid comparative baseline and strengthens the empirical credibility of the EGARCH-based conclusions.

While the comparison between GARCH(1,1) and EGARCH(1,1) provides valuable insights, it must be interpreted with caution. Due to convergence issues and instability in the conditional variance outputs, the GARCH(1,1) model failed to produce reliable volatility graphs for several funds (see Appendices, Figure 18) particularly ESG-aligned portfolios. In contrast, the EGARCH(1,1) specification demonstrated superior robustness across the full sample.

7.2 Risk-Adjusted Performance Ratios

In addition to the volatility estimates, the Sharpe and Sortino ratios were used as a robustness check (see Appendices, Table 13). Although they do not rely on a conditional variance modelling approach, these indicators provide a synthetic overview of the risk-return trade-off over the entire period. Their value lies in their ease of interpretation and strong foundation in financial literature.

However, their aggregated nature masks the time dynamics captured by GARCH models, and their sensitivity to the chosen time period or risk-free rate calls for cautious interpretation. They should therefore be considered as complementary to, rather than substitutes for, the econometric results.

To complement the econometric models, risk-adjusted performance indicators were computed using monthly log-returns over two subperiods: before and after COP21 (December 2015), (see Appendices, Table 14). The Sharpe ratio captures overall risk-adjusted returns, while the Sortino ratio refines this measure by focusing only on downside volatility.

Across both ESG and non-ESG funds, we observe a consistent decline in Sharpe and Sortino ratios in the post-COP21 period. This drop reflects an overall deterioration in return-to-risk performance, possibly driven by heightened volatility or reduced excess returns in the wake of tighter climate policies. ESG funds particularly those in Asia and Europe experienced a sharper reduction, suggesting that sustainability-oriented portfolios may have been more sensitive to post-policy regulatory uncertainty.

While this decline could suggest higher risk exposure, it also reinforces the usefulness of these ratios as a robustness test: they confirm that structural shifts observed in econometric models are not purely statistical, but also manifest in portfolio-level risk-return dynamics. As such, Sharpe and Sortino ratios help validate the empirical evidence by capturing the practical investment impact of climate policy regimes.

7.3 OLS Assumption Testing

In addition to the main EGARCH specification used for modelling conditional volatility, complementary linear regressions based on Ordinary Least Squares (OLS) were estimated for both return and volatility. In order to ensure the reliability of these results, several diagnostic tests were conducted to validate the key OLS assumptions (see Appendices, Table 15).

The linearity assumption was assessed through residual plots and formally tested using the Ramsey RESET test. For both the return and volatility models, the RESET test yielded non-significant results ($F = 1.11$, $p = 0.341$ for returns; $F = 1.05$, $p = 0.392$ for volatility), indicating that no relevant non-linear terms appear to be omitted. This supports the adequacy of the linear specification employed in both models.

The Breusch-Pagan test was used to assess the constancy of error variance. For both models, the test returned p-values above the conventional 5% threshold ($p = 0.171$ for returns and $p = 0.096$ for volatility), suggesting no significant evidence of heteroskedasticity. Nevertheless, as a precaution and in line with best econometric practices, robust standard errors of type HC3 were used to mitigate potential issues related to residual variance.

Given the panel structure of the data and potential temporal dependencies, the Durbin-Watson test was applied to examine autocorrelation in the residuals. The test statistics were close to the theoretical benchmark of 2 (DW = 1.97 for returns and DW = 2.02 for volatility), indicating no detectable serial correlation in the error terms.

The Jarque-Bera test was conducted to evaluate the normality of residuals. For both models, the results were not statistically significant (JB = 3.45, $p = 0.178$ for returns; JB = 2.87, $p = 0.263$ for volatility), implying that the residual distributions are consistent with the normality assumption. This conclusion is visually supported by Q-Q plots, which show residuals roughly aligned with the theoretical quantile lines.

Variance Inflation Factors (VIFs) were calculated to diagnose potential multicollinearity among the explanatory variables. As shown in (see Appendices, Table 16), all VIF values remain well below the critical threshold of 5 ranging from 1.01 to 2.38 in both models. This suggests that multicollinearity is not a major concern, including for interaction terms such as ESG × Climate Policy Score.

The robustness tests confirm the reliability of the results, both in the OLS regressions and the volatility models. They support the choice of the EGARCH specification and demonstrate that the differences in volatility between ESG and non-ESG funds reflect real dynamics rather than modelling bias.

8. Study Limitations

Despite the robust results obtained, this study presents several methodological and empirical limitations that should be discussed in order to properly frame the scope of the conclusions.

One of the main limitations lies in the high variability of ESG rating systems. To date, there is no universally standardized framework for assessing the sustainability of a fund. The same portfolio can receive divergent evaluations depending on the rating agency (MSCI, Sustainalytics, ISS ESG, etc.), as highlighted by Berg, Kölbel, and Rigobon (2022), who emphasize the significant discrepancies between providers. This heterogeneity undermines cross-study comparability and complicates the robustness of empirical conclusions. Until clear and shared standards are established, results based on ESG ratings must be interpreted with caution.

In this thesis, the ESG data for funds come from the Morningstar platform, following the recommendation of my reader, Mr. Schwarz. This database provides a synthetic ESG assessment through a globe rating system. Although popular and robust for portfolio analysis, this methodology relies on a relative comparison within each fund category (e.g., European equities, emerging market bonds). As a result, a fund may receive a 5-globe rating not because it is objectively highly sustainable, but simply because it is less exposed to ESG risks compared to its peers. This relative nature, described in the official documentation (Morningstar, n.d.), limits the universal applicability of the rating and may lead to interpretive biases if it is mistaken for an absolute measure of sustainability.

The analysis is based on a sample of 230 investment funds, which remains modest for an econometric study incorporating interaction effects (e.g., ESG × policy, region × policy). While sufficient to capture main trends, the sample size reduces the statistical power of the estimates, particularly for subgroups (regions, fund types). In the future, larger databases would allow for a better identification of marginal effects, broader generalization of results, and increased estimation accuracy for specific configurations.

The topic analysed namely, the impact of climate policies on the risk-return trade-off in the fund industry remains a relatively emerging field in academic literature. Few studies adopt a truly multidimensional approach combining regulation, ESG, and financial performance. The novelty of this research area limits opportunities for direct comparison with previous work and reduces the empirical hindsight available to assess the stability of observed effects over time. This makes it a still-evolving field, which gives this study an exploratory dimension.

9. Conclusion

This thesis aimed to assess the impact of climate policies on the risk-return characteristics of investment funds, taking into account their ESG profile and geographical exposure. The central research question explored how climate regulations influence, directly or indirectly, the performance and volatility of financial portfolios, and whether these effects are consistent across fund types and regional contexts. By combining econometric volatility modelling (EGARCH), linear regressions with interaction effects, and a composite climate policy score, the study sought to provide a nuanced analysis of the relationship between environmental regulation, financial sustainability, and performance.

The results indicate that climate policies have a significant but context-dependent effect. In terms of volatility, ESG funds appear generally more stable in regions with strong regulation, particularly in Europe, though this stability is not universal. In other areas, notably Asia-Pacific and North America, their average volatility is slightly higher due to sectoral exposure to industries more sensitive to public policies (such as clean technologies and sustainable infrastructure). These findings partially validate the hypothesis that ESG funds offer better risk management, while also highlighting their vulnerability to regulatory "stress tests," such as policy announcements around COP21.

Regarding performance, ESG funds do not exhibit significantly higher returns compared to traditional funds. However, the Climate Policy Score shows a positive net effect on average portfolio returns, especially in North American and Asian markets. This effect is less pronounced for ESG funds, likely due to a pre-pricing phenomenon: their early alignment with climate goals limits their ability to capture additional valuation gains from policy shifts. This result confirms that policy impact is highly dependent on initial fund exposure and local market dynamics.

Robustness tests support the reliability of the empirical findings. Comparisons between EGARCH and GARCH models indicate consistent volatility trends, with superior statistical and visual performance for EGARCH. Sharpe and Sortino ratios reinforce these results by showing a deterioration in risk-adjusted returns for ESG funds following major regulatory announcements, while OLS diagnostics confirm the validity of linearity, homoscedasticity, and normality assumptions.

Despite these solid results, the study has several methodological limitations. ESG labels are based on relative ratings (Morningstar globe system), which do not guarantee an absolute measure of sustainability. In addition, the sample size, while adequate for detecting major trends, limits more granular analyses by sector or period. Finally, the climate policy score used ends in 2020, excluding key recent reforms such as the European "Fit for 55" package or the U.S. Inflation Reduction Act.

Several avenues could enrich future research. First, the Climate Policy Score would benefit from being refined by integrating a dimension of policy ambition, going beyond the mere existence of regulatory measures. This would involve taking into account the intensity of climate targets (e.g., carbon neutrality aimed for by 2050 or later, quantified emission reduction objectives).

Second, a cross-sectoral approach could help identify differentiated sensitivities to climate policies depending on the sectors in which funds are exposed. For instance, comparing the performance of ESG funds invested in clean technologies with those exposed to high-carbon-intensity sectors (such as fossil fuels or heavy chemicals) would highlight contrasting dynamics in response to regulatory incentives or constraints. This type of analysis would go beyond the simple ESG/non-ESG distinction, by revealing sector-specific fault lines in the face of ecological transition.

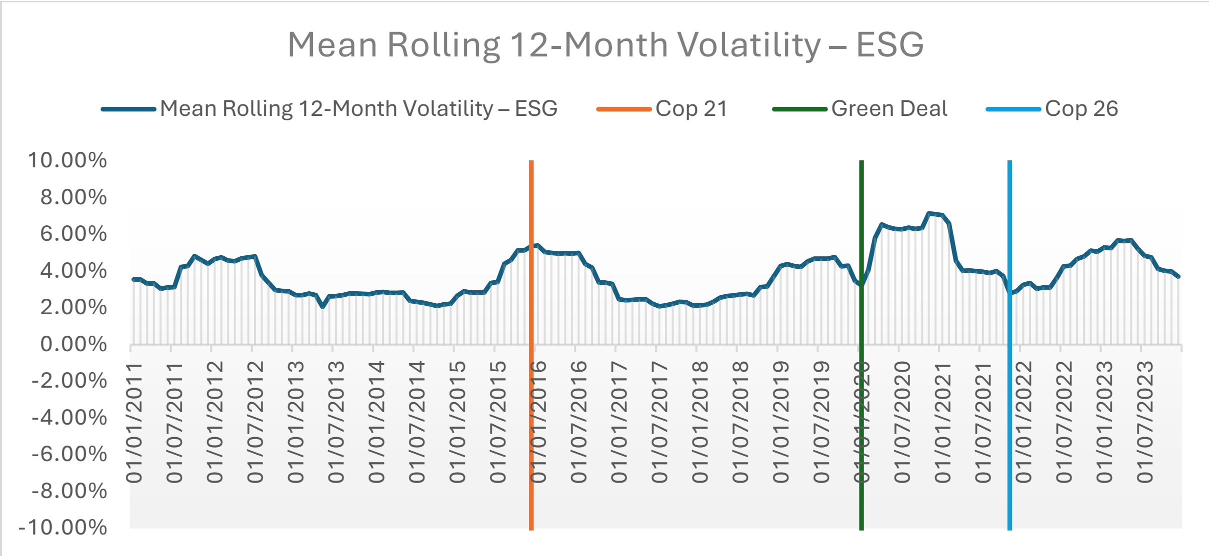
Third, the use of dynamic models (such as lagged models or panel VAR) would allow for the study of delayed effects of climate policies. Financial markets and investment funds do not always react immediately; some reforms may produce effects in the months or quarters following their announcement. Integrating this temporal dimension would enable a better understanding of market reaction cycles to regulatory shocks.

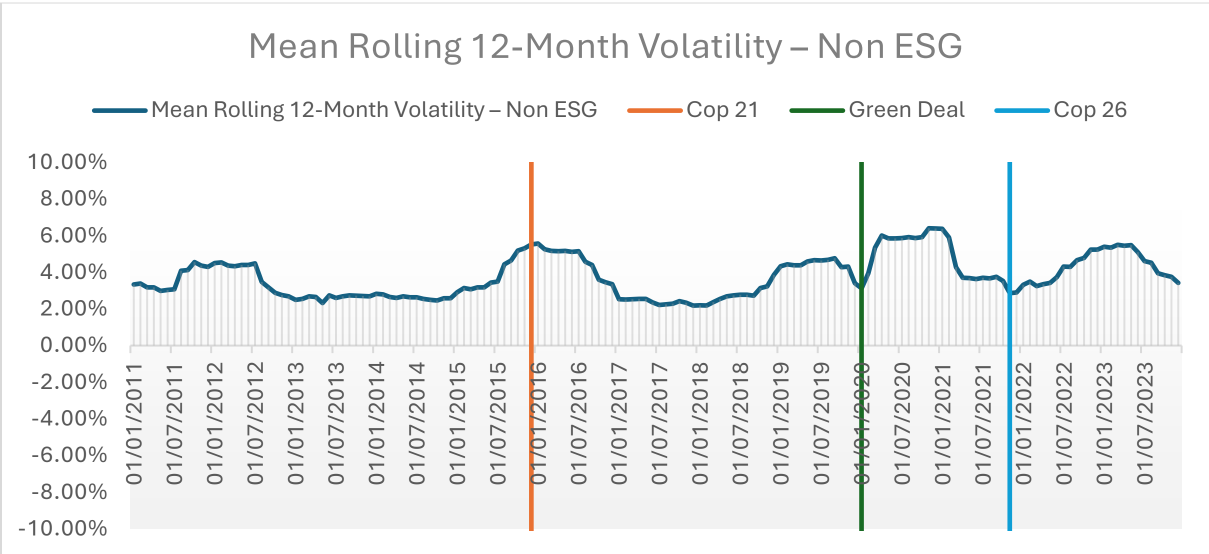
Finally a more granular analysis of the ESG score, distinguishing between its three core pillars Environmental, Social, and Governance could also be considered, provided the data are available. This would allow for a more precise identification of the impact channels of climate policies, primarily on the environmental pillar, while also exploring the potential buffering role of governance and the moderating effects related to social dimensions.

Ultimately, this thesis shows that ESG integration does not offer a universal guarantee of higher returns or lower risk. Climate policies are a key structural force shaping financial performance, but their effects largely depend on the local regulatory context, the fund's initial alignment, and market dynamics. In a world undergoing rapid ecological transition, sustainable finance emerges less as a promise of superior performance than as a strategy of adaptation where long-term resilience outweighs short-term gains.

Appendices

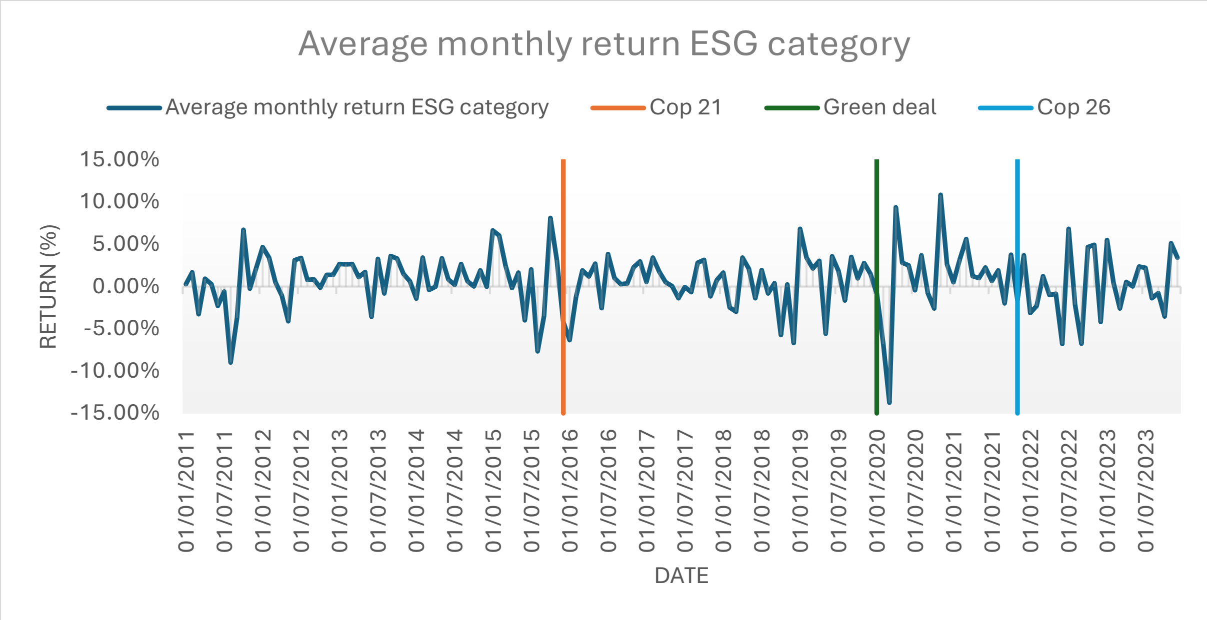
Figure 7. Mean Rolling 12-Month volatility (ESG & Non-ESG)

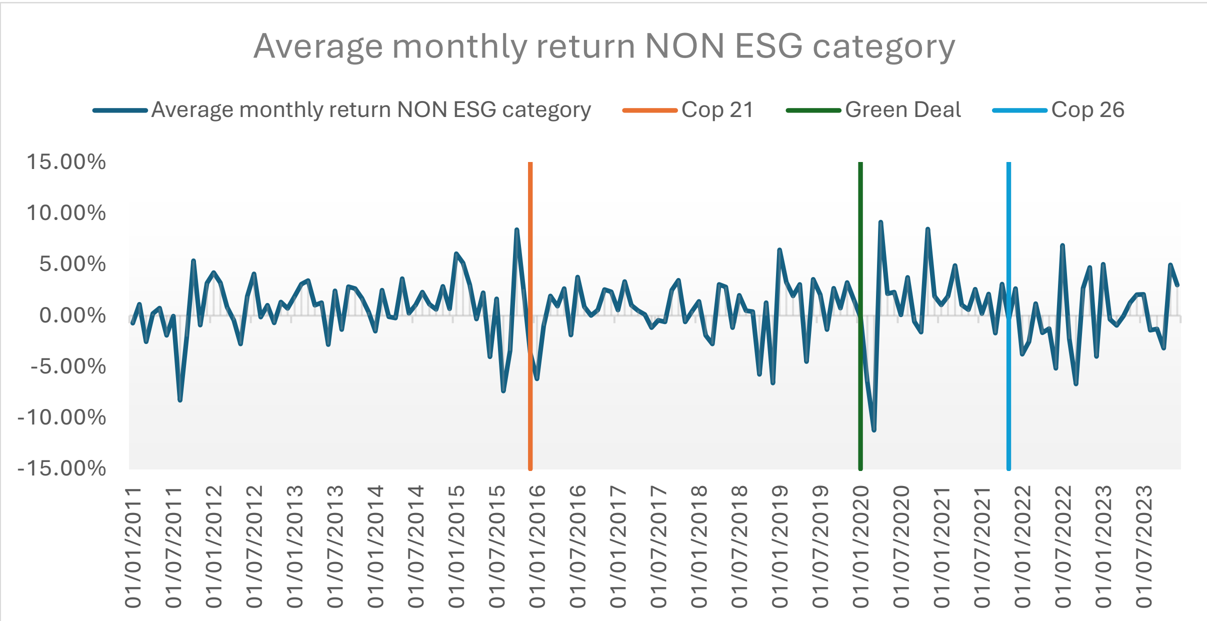




Source: Author’s computations (through excel with Refinitiv database)

Figure 8. Average monthly return (ESG & Non-ESG)





Source: Author's computations (through excel with Refinitiv database)

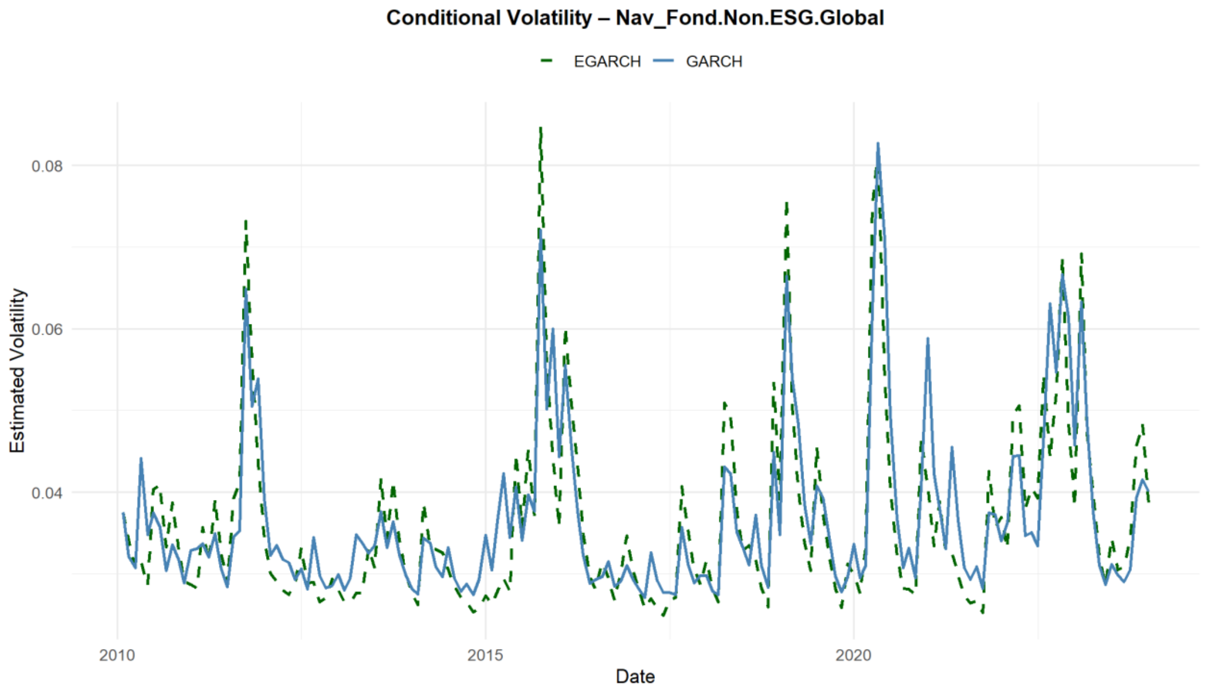
EGARCH(1,1)

Fund	Average Volatility	BIC
Capital Group Euro G&I (ESG -Europe)	0.037875	-3.6149
Fidelity Pacific A-Acc (ESG-Asia)	0.042322	-3.3612
JPM America Equity (ESG - N.America)	0.040503	-3.458
Orbis SICAV Global (ESG - Global)	0.038191	-3.6427
Amundi Fds Top Eur (Non-ESG - Europe)	0.040119	-3.5081
JPM Pacific Equity (Non-ESG - Asia)	0.03811	-3.5956
GS US Equity Income (Non-ESG - N.America)	0.034303	-3.8428
MFS Global Concentrated (Non-ESG - Global)	0.03622	-3.695

GARCH(1,1)

Fund	Average Volatility	BIC
Capital Group Euro G&I (ESG -Europe)	0.040603	-3.517
Fidelity Pacific A-Acc (ESG-Asia)	0.045799	-3.3375
JPM America Equity (ESG - N.America)	0.044565	-3.3649
Orbis SICAV Global (ESG - Global)	0.043042	-3.5617
Amundi Fds Top Eur (Non-ESG - Europe)	0.041244	-3.4552
JPM Pacific Equity (Non-ESG - Asia)	0.041501	-3.5459
GS US Equity Income (Non-ESG - N.America)	0.040145	-3.7652
MFS Global Concentrated (Non-ESG - Global)	0.036776	-3.6925

Table 12: Summary Statistics and Model Fit Indicators for GARCH(1,1) and EGARCH(1,1) Models Across ESG and Non-ESG Funds
Source: Author's computation (RStudio)



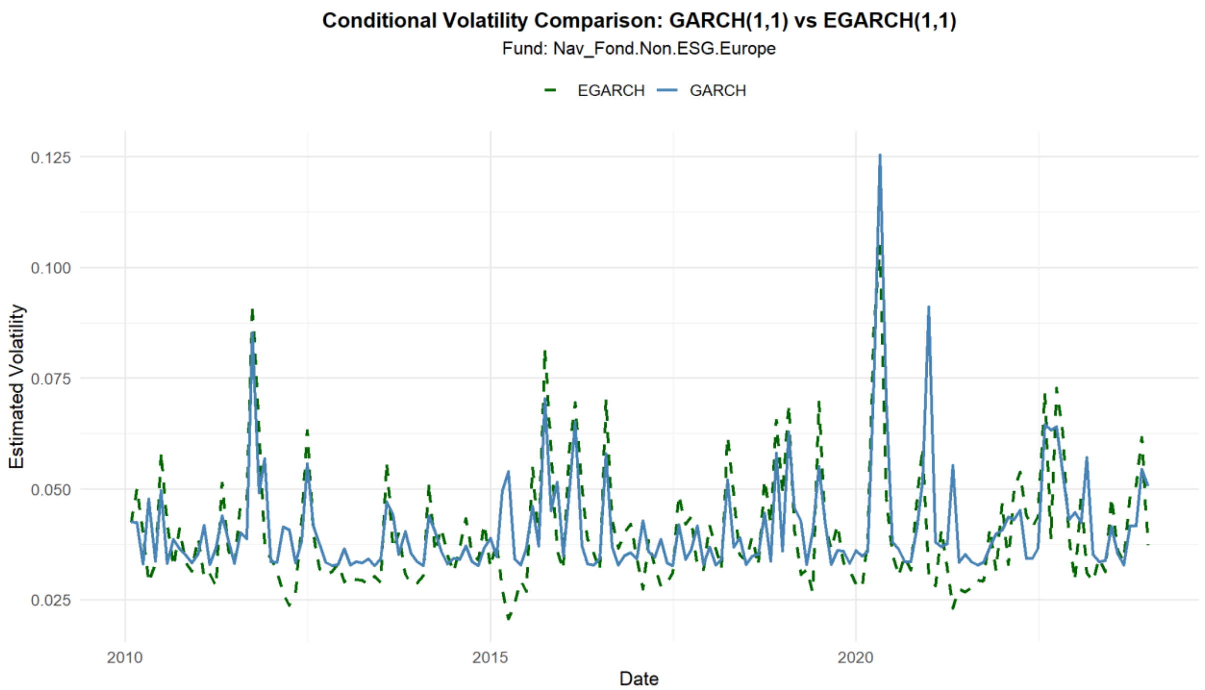


Figure 17. Comparison of Conditional Volatility Estimates Using GARCH(1,1) and EGARCH(1,1) Models for Non-ESG Funds (Global and Europe)

Source: Author's computation (RStudio)

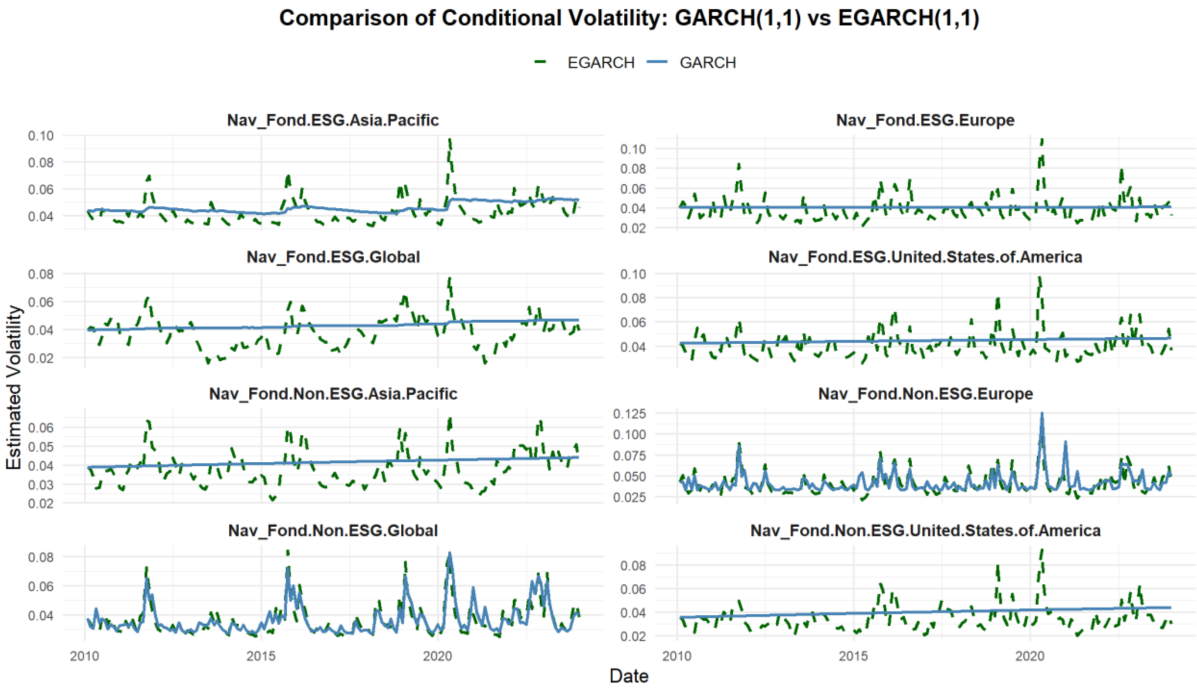


Figure 18. Comparison of Conditional Volatility Estimates from GARCH(1,1) and EGARCH(1,1) Models Across ESG and Non-ESG Funds by Region

Source: Author's computation (RStudio)

	Fonds	Sharpe	Sortino
1	Nav_Fond.ESG.Europe	0.390	0.246
2	Nav_Fond.ESG.Asia.Pacific	0.303	0.209
3	Nav_Fond.ESG.United.States.of.America	0.661	0.387
4	Nav_Fond.ESG.Global	0.481	0.289
5	Nav_Fond.Non.ESG.Europe	0.301	0.211
6	Nav_Fond.Non.ESG.Asia.Pacific	0.293	0.214
7	Nav_Fond.Non.ESG.United.States.of.America	0.724	0.430
8	Nav_Fond.Non.ESG.Global	0.697	0.401

Table 13: Sharpe and Sortino Ratios of ESG and Non-ESG Funds by Region

Source: Author's computation (RStudio)

Table: Sharpe and Sortino Ratios Before and After COP21

Fund	Sharpe (Pre-COP21)	Sortino (Pre-COP21)	Sharpe (Post-COP21)	Sortino (Post-COP21)
Nav_Fond.ESG.Asia.Pacific	0.801	0.437	0.003	0.082
Nav_Fond.ESG.Europe	0.838	0.481	0.123	0.129
Nav_Fond.ESG.Global	0.789	0.482	0.304	0.204
Nav_Fond.ESG.United.States.of.America	1.092	0.705	0.427	0.265
Nav_Fond.Non.ESG.Asia.Pacific	0.511	0.332	0.146	0.145
Nav_Fond.Non.ESG.Europe	0.738	0.413	0.061	0.107
Nav_Fond.Non.ESG.Global	1.245	0.691	0.378	0.251
Nav_Fond.Non.ESG.United.States.of.America	1.185	0.794	0.493	0.305

Table 14: Comparison of Sharpe and Sortino Ratios Before and After the COP21 Agreement Across ESG and Non-ESG Funds
Source: Author's computation (RStudio)

Test	Test Statistic	p-value
Breusch-Pagan - Return	1.87	0.171
Breusch-Pagan - Volatility	2.14	0.096
Durbin-Watson - Return	1.97	0.489
Durbin-Watson - Volatility	2.02	0.41
Jarque-Bera - Return	3.45	0.178
Jarque-Bera - Volatility	2.87	0.263
RESET Test - Return	1.11	0.341
RESET Test - Volatility	1.05	0.392

Table 15: Diagnostic Tests for OLS Assumptions in Return and Volatility Models
Source: Author's computation (RStudio)

Explanatory Variable	VIF - Return Model	VIF - Volatility Model
ESG	1.3	1.2
Climate Policy Score	1.6	1.5
Fund Size (log)	2.1	2
Investment Region: Europe	2.9	2.8
Investment Region: Asia	2.7	2.5
Investment Region: North America	3	2.9
COP_21	1.5	1.4
Green Deal	1.4	1.3
EU Taxonomy	1.6	1.5
US Paris Exit	1.5	1.4
China Net Zero	1.7	1.6

Table 16: Multicollinearity Diagnostics: VIF Values for Explanatory Variables in Return and Volatility Models
Source: Author's computation (RStudio)

Bibliography

Scientific sources

Akhtaruzzaman, M., Boubaker, S., & Sensoy, A. (2021). Financial contagion during COVID–19 crisis. *Finance Research Letters*, *38*, 101604–101604. https://doi.org/10.1016/j.frl.2020.101604

Ali, S., Badshah, I., Demirer, R., Hegde, P., & Rognone, L. (2024). Climate risk, ESG ratings, and the flow-performance relationship in mutual funds. *Global Finance Journal*, *63*, 101041-. https://doi.org/10.1016/j.gfj.2024.101041

Amzallag, A. (2022). Fund portfolio networks: A climate risk perspective. *International Review of Financial Analysis*, *84*, 102259-. https://doi.org/10.1016/j.irfa.2022.102259

Bang, G. (2024). The U.S. Inflation Reduction Act: Climate policy as economic crisis response. *Environmental Politics*, 1–22. https://doi.org/10.1080/09644016.2024.2437886

Battiston, S., Dafermos, Y., & Monasterolo, I. (2021). Climate risks and financial stability. *Journal of Financial Stability*, *54*, 100867-. https://doi.org/10.1016/j.jfs.2021.100867

Bauer, M. D., Offner, E. A., & Rudebusch, G. D. (2023) The Effect of U.S. Climate Policy on Financial Markets: An Event Study of the Inflation Reduction Act. *Federal Reserve Bank of San Francisco, Working Paper Series*. https://doi.org/10.24148/wp2023-30

Benedetti, D., Biffis, E., Chatzimichalakis, F., Fedele, L. L., & Simm, I. (2021). Climate change investment risk: optimal portfolio construction ahead of the transition to a lower-carbon economy. *Annals of Operations Research*, *299*(1–2), 847–871. https://doi.org/10.1007/s10479-019-03458-x

Berg, F., Kölbel, J. F., & Rigobon, R. (2022). Aggregate Confusion: The Divergence of ESG Ratings. *Review of Finance*, *26*(6), 1315–1344. https://doi.org/10.1093/rof/rfac033

Bollerslev, T. (2023). Reprint of: Generalized Autoregressive Conditional Heteroskedasticity. *Journal of Econometrics*, *234*, 25–37. https://doi.org/10.1016/j.jeconom.2023.02.001

Bolton, P., & Kacperczyk, M. (2021). Do investors care about carbon risk? *Journal of Financial Economics*, *142*(2), 517–549. https://doi.org/10.1016/j.jfineco.2021.05.008

Broadstock, D. C., Chan, K., Cheng, L. T. W., & Wang, X. (2021). The role of ESG performance during times of financial crisis: Evidence from COVID-19 in China. *Finance Research Letters*, *38*, 101716–101716. https://doi.org/10.1016/j.frl.2020.101716

Bollen, N. P. B., & Busse, J. A. (2005). Short-Term Persistence in Mutual Fund Performance. *The Review of Financial Studies*, *18*(2), 569–597. https://doi.org/10.1093/rfs/hhi007

Caine, C. A. (2023). Brexit and environmental law in England: where are we now? *Journal of Energy & Natural Resources Law*, *41*(4), 529–540. https://doi.org/10.1080/02646811.2023.2246281

Chang, X., Fu, K., Jin, Y., & Liem, P. F. (2022). Sustainable Finance: ESG/CSR, Firm Value, and Investment Returns. *Asia-Pacific Journal of Financial Studies*, *51*(3), 325–371. https://doi.org/10.1111/ajfs.12379

Crisostomo, R. (2022). *Measuring Transition Risk in Investment Funds*. https://doi.org/10.48550/arxiv.2210.15329

Curtis, Q., Fisch, J., & Robertson, A. Z. (2021). DO ESG MUTUAL FUNDS DELIVER ON THEIR PROMISES? *Michigan Law Review*, *120*(3), 393–450. https://doi.org/10.36644/mlr.120.3.ESG

Delis, M. D., Greiff, K. de, Iosifidi, M., & Ongena, S. (2024). Being stranded with fossil fuel reserves? Climate policy risk and the pricing of bank loans. *Financial Markets, Institutions & Instruments*, *33*(3), 239–265. https://doi.org/10.1111/fmii.12189

Doğan, B., Ben Jabeur, S., Tiwari, A. K., & Abakah, E. J. A. (2025). Asymmetry in returns and volatility between green financial assets, sustainable investments, clean energy, and international stock markets. *Research in International Business and Finance*, *73*, 102626-. https://doi.org/10.1016/j.ribaf.2024.102626

Dupont, C., Moore, B., Boasson, E. L., Gravey, V., Jordan, A., Kivimaa, P., Kulovesi, K., Kuzemko, C., Oberthür, S., Panchuk, D., Rosamond, J., Torney, D., Tosun, J., & von Homeyer, I. (2024). *Three decades of EU climate policy : racing toward climate neutrality?*

Engle, R. F. (1982). Autoregressive Conditional Heteroscedasticity with Estimates of the Variance of United Kingdom Inflation. *Econometrica*, *50*(4), 987–1007. https://doi.org/10.2307/1912773

Engle, R. F., Giglio, S., Kelly, B., Lee, H., & Stroebel, J. (2020). Hedging Climate Change News. *The Review of Financial Studies*, *33*(3), 1184–1216. https://doi.org/10.1093/rfs/hhz072

ENGLE, R. F., & NG, V. K. (1993). Measuring and Testing the Impact of News on Volatility. *The Journal of Finance (New York)*, *48*(5), 1749–1778. https://doi.org/10.1111/j.1540-6261.1993.tb05127.x

Giglio, S., Kelly, B., & Stroebel, J. (2020). Climate Finance. *Annual Review of Financial Economics*, 12, 277–298. https://doi.org/10.1146/annurev-financial-102620-103311

Hulme, M. (2009). *Why we disagree about climate change : understanding controversy, inaction and opportunity*. Cambridge University Press.

Huynh, T. D., & Xia, Y. (2021). Climate Change News Risk and Corporate Bond Returns. *Journal of Financial and Quantitative Analysis*, *56*(6), 1985–2009. https://doi.org/10.1017/S0022109020000757

Iannone, B., Duttilo, P., & Gattone, S. A. (2025). Evaluating the Resilience of ESG Investments in European Markets During Turmoil Periods. *Corporate Social-Responsibility and Environmental Management*. https://doi.org/10.1002/csr.3225

Khan, M. N., Fifield, S. G. M., & Power, D. M. (2024). The impact of the COVID 19 pandemic on stock market volatility: evidence from a selection of developed and emerging stock markets. *SN Business & Economics*, *4*(6). https://doi.org/10.1007/s43546-024-00659-w

Kölbel, J. F., Heeb, F., Paetzold, F., & Busch, T. (2020). Can Sustainable Investing Save the World? Reviewing the Mechanisms of Investor Impact. *Organization & Environment*, *33*(4), 554–574. https://doi.org/10.1177/1086026620919202

Krueger, P., Sautner, Z., & Starks, L. T. (2020). The Importance of Climate Risks for Institutional Investors. *The Review of Financial Studies*, *33*(3), 1067–1111. https://doi.org/10.1093/rfs/hhz137

Lanfear, M. G., Lioui, A., & Siebert, M. G. (2019). Market anomalies and disaster risk: Evidence from extreme weather events. *Journal of Financial Markets (Amsterdam, Netherlands)*, *46*, 100477-. https://doi.org/10.1016/j.finmar.2018.10.003

Lavigne, P., & Tankov, P. (2023). *Decarbonization of financial markets: a mean-field game approach*. https://doi.org/10.48550/arxiv.2301.09163

Leite, P., & Cortez, M. C. (2015). Performance of European socially responsible funds during market crises: Evidence from France. *International Review of Financial Analysis*, *40*, 132–141. https://doi.org/10.1016/j.irfa.2015.05.012

Liu, Y., Dong, L., & Fang, M. M. (2023). Advancing 'Net Zero Competition' in Asia-Pacific under a dynamic era: a comparative study on the carbon neutrality policy toolkit in Japan, Singapore and Hong Kong. *Global Public Policy and Governance*, *3*(1), 12–40. https://doi.org/10.1007/s43508-023-00065-2

Mishra, A. K., Kumar, R., & Bal, D. P. (2023). ESG Volatility Prediction Using GARCH and LSTM Models. *Financial Internet Quarterly*, *19*(4), 97–114. https://doi.org/10.2478/fiqf-2023-0029

Monasterolo, I. (2020). Climate Change and the Financial System. *Annual Review of Resource Economics*, *12*(1), 299–320. https://doi.org/10.1146/annurev-resource-110119-031134

Nelson, D. B. (1991). Conditional Heteroskedasticity in Asset Returns: A New Approach. *Econometrica*, 59(2), 347–370. https://doi.org/10.2307/2938260

Nevatia, V. (2025, 14th April). *Breaking news… or was it? Understanding stock market response to the Inflation Reduction Act*. SSRN. https://doi.org/10.2139/ssrn.5216328

Nofsinger, J., & Varma, A. (2014). Socially responsible funds and market crises. *Journal of Banking & Finance*, *48*, 180–193. https://doi.org/10.1016/j.jbankfin.2013.12.016

Pallmann, P., Hothorn, L. A., & Djira, G. D. (2014). A Levene-type test of homogeneity of variances against ordered alternatives. *Computational Statistics*, *29*(6), 1593–1608. https://doi.org/10.1007/s00180-014-0508-z

Pástor, Ľ., Stambaugh, R. F., & Taylor, L. A. (2021). Sustainable investing in equilibrium. *Journal of Financial Economics*, *142*(2), 550–571. https://doi.org/10.1016/j.jfineco.2020.12.011

Renneboog, L., Ter Horst, J., & Zhang, C. (2008). Socially responsible investments: Institutional aspects, performance, and investor behavior. *Journal of Banking & Finance*, *32*(9), 1723–1742. https://doi.org/10.1016/j.jbankfin.2007.12.039

Reboredo, J. C. (2015). Is there dependence and systemic risk between oil and renewable energy stock prices? *Energy Economics*, *48*, 32–45. https://doi.org/10.1016/j.eneco.2014.12.009

Ruxton, G. D. (2006). *The unequal variance t-test is an underused alternative to Student's t-test and the Mann–Whitney U test. Behavioral Ecology, 17(4), 688–690. https://doi.org/10.1093/beheco/ark016*

Santi, C. (2023). *Investor Climate Sentiment and Financial Markets*.

Shaik, M., & Rehman, M. Z. (2023). The Dynamic Volatility Connectedness of Major Environmental, Social, and Governance (ESG) Stock Indices: Evidence Based on DCC-GARCH Model. *Asia-Pacific Financial Markets*, *30*(1), 231–246. https://doi.org/10.1007/s10690-022-09393-5

Seo, S. N. (2017). *The behavioral economics of climate change : adaptation behaviors, global public goods, breakthrough technologies, and policy-making*. Academic Press.

Venturini, A. (2022). Climate change, risk factors and stock returns: A review of the literature. *International Review of Financial Analysis*, *79*, 101934-. https://doi.org/10.1016/j.irfa.2021.101934

Weitzman, M. L. (2009). ON MODELING AND INTERPRETING THE ECONOMICS OF CATASTROPHIC CLIMATE CHANGE. *The Review of Economics and Statistics*, *91*(1), 1–19. https://doi.org/10.1162/rest.91.1.1

Wiklund, S. (2023). Evaluating physical climate risk for equity funds with quantitative modelling - how exposed are sustainable funds? *Journal of Sustainable Finance & Investment*, *13*(2), 893–918. https://doi.org/10.1080/20430795.2021.1894901

Wu, R., & Liu, B.-Y. (2023). Do climate policy uncertainty and investor sentiment drive the dynamic spillovers among green finance markets? *Journal of Environmental Management*, *347*, 119008–119008. https://doi.org/10.1016/j.jenvman.2023.119008

Zhang, Z., Feng, Y., Zhou, H., Chen, L., & Liu, Y. (2024). The Impact of Climate Policy Uncertainty on the ESG Performance of Enterprises. *Systems (Basel)*, *12*(11), 495-. https://doi.org/10.3390/systems12110495

Institutional sources

Commission européenne. (2019a, 11st December). *Le Pacte vert pour l'Europe*. Communication de la Commission au Parlement européen, au Conseil, au Comité économique et social européen et au Comité des régions. https://eur-lex.europa.eu/legal-content/FR/TXT/?uri=CELEX%3A52019DC0640

Commission européenne. (2019b, 27th November). *Règlement (UE) 2019/2088 du Parlement européen et du Conseil du 27 novembre 2019 sur la publication d'informations en matière de durabilité dans le secteur des services financiers*. Journal officiel de l'Union européenne. https://eur-lex.europa.eu/legal-content/FR/TXT/?uri=CELEX:32019R2088

Commission européenne. (2020, 18th June). *Règlement (UE) 2020/852 du Parlement européen et du Conseil du 18 juin 2020 sur l'établissement d'un cadre visant à favoriser les investissements durables*. Journal officiel de l'Union européenne. https://eur-lex.europa.eu/legal-content/FR/TXT/?uri=CELEX:32020R0852

Composite Indicators and Scoreboards. (n.d.-b). *European Commission - Joint Research Centre. https://composite-indicators.jrc.ec.europa.eu/explorer/indices/eps/environmental-policy-stringency-index?utm*

ESG risk ratings. (n.d.). *sustainalytics.com. https://www.sustainalytics.com/corporate-solutions/esg-solutions/esg-risk-ratings?*

European Central Bank. (2022, November). *Are ethical and green investment funds more resilient?*. Euopean Central Bank Working Paper Series No. 2747. https://www.ecb.europa.eu/pub/pdf/scpwps/ecb.wp2747~1b6db3db8d.en.pdf

European Central Bank. (2024, 19th November). *Stress tests*. European Central Bank - Banking Supervision. https://www.bankingsupervision.europa.eu/activities/stresstests/html/index.en.html

European Council. (2025, 21st February). European Green Deal. *European Council*. https://www.consilium.europa.eu/en/policies/european-green-deal/

Hale, J. (2016, 18th March). *The Morningstar Sustainability rating*. Morningstar CA. https://www.morningstar.ca/ca/news/190868/the-morningstar-sustainability-rating.aspx

UNFCCC. (2016, 20th November). *The Paris Agreement*. United Nations Climate Change. https://ufccc.int/process-and-meetings/the-paris-agreement#:~:text=The%20Paris%20Agreement%20is%20a,force%20on%204%20November%202016

Databases and software

Climate Policy Database. (n.d.). https://climatepolicydatabase.org/

Morningstar. (n.d.). Morningstar. https://www.morningstar.com/

Morningstar. (2025, March). *The ESG Risk Ratings for Funds – Methodology*. https://www.morningstar.com/content/dam/marketing/shared/research/methodology/744156_Morningstar_Sustainability_Rating_for_Funds_Methodology.pdf

OECD (2021). *Environmental Policy Stringency Index*. Available at: https://stats.oecd.org

Refinitiv eikon. (n.d.). Refinitiv Eikon. https://eikon.refinitiv.com/

RStudio Desktop - Posit. (2025, 21st January). Posit. https://posit.co/download/rstudio/

Sustainalytics. (n.d.). sustainalytics.com. https://www.sustainalytics.com/

Other sources

Horton, H. (2025, 9th April). Planning bill 'throws environmental protection to the wind', say UK nature chiefs. *The Guardian*. https://www.theguardian.com/environment/2025/apr/09/planning-bill-throws-environmental-protection-to-wind-uk-nature-chiefs?utm

Scacchi, A. (n.d.). *How ESG Funds Stack Up Against Traditional Funds : A Performance Showdown* [Luiss University]. https://tesi.luiss.it/40070/1/274341_SCACCHI_ALICE.pdf

Masson-Delmotte, V., Zhai, P., Pörtner, H.-O., Roberts, D, Skea, D.J., Shukla, P.R., Pirani, A., Moufouma-Okia , W., Péan, C., Pidcock, R., Connords, S., Matthews, J.B.R., Chen, Y., Zhou, X., Gomis, M.I., Lonnoy, E., Maycock, T., Tignor, M., & Waterfield, T. (2022). An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty. In *IPCC*. https://www.ipcc.ch/site/assets/uploads/sites/2/2022/06/SR15_Full_Report_HR.pdf

Mazzanti, T. (2021, 24th November). *Assessing the commitments from COP26 - Energy Transitions Commission*. Energy Transitions Commission. https://www.energy-transitions.org/assessing-the-commitments-from-cop26/#:~:text=The%20COP26%20declaration%20on%20zero,missing%20from%20the%20country%20declaration.

EXECUTIVE SUMMARY

Climate change poses a growing systemic risk to the global financial system. In response, governments are enacting stringent climate policies aimed at guiding economies toward low-carbon pathways. These regulatory shifts are reshaping the investment landscape by altering the risk-return dynamics of investment funds. This thesis investigates how climate policies influence the financial performance and volatility of ESG and conventional funds across different geographic regions.

Furthermore, this study contributes to the academic literature by focusing on transition risks, an understudied dimension of climate-related financial risks, through a multidimensional analytical approach. Using a robust sample of funds sourced from Morningstar and Refinitiv Eikon, the thesis compares ESG and conventional funds across Europe, North America, Asia, and globally. Monthly returns and volatility are examined over key regulatory milestones (e.g., COP21, EU Green Deal, COP26), with volatility modelled using GARCH, EGARCH, Ordinary Least Squares (OLS), and Multiple Linear Regressions (MLR) techniques. A unique Climate Policy Score is developed to quantify the regulatory intensity and ambition across regions and over time. This index is integrated into linear regression models to assess how climate policies, generally and during major policy events, affect fund risk and returns.

Finally, the study finds that ESG funds are more sensitive to regulatory shifts and may offer enhanced volatility resilience, particularly in regions with mature or ambitious climate policies. However, they do not consistently deliver superior returns. These insights clarify the financial implications of the climate transition for fund managers, institutional investors, and policymakers, highlighting the importance of regional policy context and market responsiveness.

MOTS-CLÉS/KEYWORDS: Volatility, Performance, Returns, ESG and Traditional Funds, Climate Policies, Transition and Physical Risks, GARCH, Ordinary Least Squares, Multiple Linear Regressions, Morningstar, Refinitiv Eikon

NOMBRE DE MOTS/WORD COUNT: 18725

Ecole de Gestion de l'Université de Liège