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Challenges and opportunities in the development of ESG structured products: An analysis of the financial industry.

What are the main challenges and opportunities faced by financial players in developing ESG structured products to stimulate market growth?

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Table of content

1) **Abstract** ……1.

2) **Introduction**……..……..2.

2.1) Subject Presentation ……... 2.

2.2) ESG structured Products definition ……....4.

2.3) Objectives of the research question……**7.**

3) **Review of literature** ……..8.

3.1) Challenges and opportunities ……8.

3.3.1) Case Study of Successful ESG Structured Products" ……... 8.

3.1.2) "Incorporating ESG in Structured Finance" ……..11.

3.2) The issues in their conception ……..... 12.

4) **Methodology** ……..... 13.

4.1) Methodology and tools choices …….. 13.

4.1.1) Qualitative Analysis: Interviews with Industry Experts …….. 13.

4.1.2) Quantitative Analysis: Linear Regression of Market Data ……... 13.

4.1.3) Tools and Software …….. 14.

4.1.4) Justification for Methodological Choices ……....14.

4.2) Experts Interview ……..... 14.

4.3) Analytical ……..... 17.

4.3.1) ESG rating ……... 18.

4.3.2) ETF analysis ……20.

4.3.3) Cumulative return ……..... 21.

4.3.4) Annualized volatility analysis …….. 22.

4.3.5) Volatility vs. Return correlation…….. 23.

4.3.6) Sharpe ratio …… 24.

4.3.7) Linear regression ……... 26.

4.3.8) Correlation matrix …….. 27.

4.3.8.1) Positive Correlations ……... 28.

4.3.8.2) Negative Correlations …….. 28.

5)* Data discussion and limitations*……... 29.

5.1) Overview and analysis ……... 29.

5.2) Limitations….…….. 31.

***6)* Challenges and Opportunities ……... 32.**

6.1) Exploration of the main challenges faced by financial players……..… 32.

6.2) Identifying emerging opportunities (S.W.O.T.) ……..…… 34.

***7)* Contribution ……. 36.**

***8)* Conclusion ……...…… 39.**

***9)* Bibliography ……. 40.**

***10)* Appendix ……..……47.**

List of abbreviations

- *ESG - Environmental, Social and Governance*
- *SDG - Sustainable Development Goals*
- *ETF - Exchange-traded fund*
- *SFDR - Sustainable Finance Disclosures Regulation*
- *GSIA - Global Sustainable Investment Alliance*
- *GSIR - Global Sustainable Investment Review*
- *US SEC - Securities and Exchange Commission in the U.S.*

- *MSCI - Morgan Stanley Capital International*
- *S&P - 500 index Standard & Poor's index*
- *SPDR - Standard & Poor's Depositary Receipt*

List of figures

Figure 1 Key components of structured products ……*4.*

Figure 2 Benefits and drawbacks of structured products ……*6.*

Figure 3 *Cumulative return for each ETF (2015-2023)* ……*21.*

Figure 4 *Annualized volatility analysis for each ETFs* ……*22.*

Figure 5 Sharpe ratios and ESG Ratings of ETFs *(2015-2023)* ……*25.*

List of tables

Table 1 significance of metrics……*18.*

Table 2 ETFs criteria ……*19.*

Table 3 ETFs ranking between annualized volatility and cumulative return ……*23.*

Table 4 Sharpe ratios computation ……*24.*

Table 5 Correlation matrix analysis ……*28.*

Table 6 Challenges risk level ……*32.*

Table 7 S.W.O.T. matrix ……34.

Appendix

Appendix1: Merge of ESG and non ESG ETFs Database ……*47.*

Appendix2: Sharpe Ratios computation ……*48.*

Appendix3: Cumulative return and Annualized volatility computation ……*48.*

Appendix4: Sharpe Ratio Formula ……*49.*

Appendix5: Sharpe Ratios and ESG Ratings of ETFs (2015-2023) ……*49.*

Appendix6: RStudio Database merging ……*50.*

Appendix7: summaries of the Values and ESG data ..... *50.*

Appendix8: Linear regression ..... *51.*

Appendix9: Correlation matrix ..... *52.*

Appendix10: Survey Data ..... *52.*

1) Abstract

This thesis examines the challenges and opportunities associated with the development of ESG structured products within the financial industry. It identifies technical challenges such as the integration of ESG criteria, regulatory obstacles linked to evolving standards, and operational difficulties linked to the balance between standardization and customization. Through case studies, expert interviews and data analysis, the study offers strategic recommendations such as investing in cutting-edge technologies, improving regulatory compliance, and promoting investor education. The results highlight new opportunities, including the growing demand for sustainable investments and technological advances. This work contributes to the literature and practice of sustainable finance by providing actionable strategies to promote the growth and adoption of ESG structured products, supporting the transition to a more sustainable economy.

2) Introduction

2.1) Subject Presentation

In today's dynamic sustainable finance landscape, stakeholders are actively involved in creating and advocating for ESG-focused products like structured products, to meet the increasing investor demand (Global Sustainable Investment Alliance, 2023).This scenario presents difficulties and potential advantages for individuals responsible for developing and promoting ESG financial products

Investors are showing growing interest in supporting businesses and projects that align with their beliefs, particularly those focused on ESG criteria and SDG goals. Regulators are increasingly concerned that ESG structured products should not be viewed as investment products. The European Securities and Markets Authority (ESMA) point the complexity of designing ESG structured products could hide - risks, by creating confusion for investors. In 2021, the SEC warns about the dangers of greenwashing and encouraged investment advisors and funds to openly reveal how they incorporate ESG factors into their strategies.

It is evident that investors are intrigued by sustainable structured products for various reasons. ESG investments are driven significantly by the public's interest. In 2020, the total value of sustainable investment assets managed globally set a new high at $38.2 trillion, covering fixed income and equity instruments as well (Global Sustainable Investment Alliance, 2023). This substantial increase indicates an increasing interest from investors in sustainable investment opportunities.

The financial industry is currently encountering fresh obstacles in meeting the changing needs of investors through the provision of customized ESG structured products (Boffo & Patalano, 2020). It is important for investments to match the cost to highlight clients' expectations of structured products to incorporate performance, transparency, and flexibility. The integration of ESG factors is becoming more important, the investors expect issuers to take more responsibility when utilizing ESG products like structured products. In recent times, instruments like Exchange-Traded Funds (ETFs) and collateralized loan obligations (CLOs) have begun including sustainability criteria and metrics, providing investors with greater insight into the environmental and social impacts of their investments (Morningstar, 2021; Dorfleitner et al., 2022).

In summary, ESG structured products provide a great opportunity for the financial industry to show its commitment to sustainability while meeting investor demand for ethical and high-return investments (Junge & Hackethal, 2021). The aim of this thesis is to investigate the obstacles and possibilities in creating ESG structured products in the finance sector. Basically, the aim is to answer two key questions: What are the main challenges faced by financial institutions in developing and endorsing ESG structured products? Are there any other opportunities available to help grow this market?

The objective of the EU taxonomy and SFDR regulations is to help financial institutions to develop their sustainable investment strategies (European Commission, 2020). Technological advances like big data analytics and artificial intelligence assist financial institutions in assessing ESG risks and opportunities, resulting in improved integration of SDGs into their strategies (Broadridge, 2021).

GSIR reports that sustainable investment assets have exceeded $35 trillion, demonstrating strong demand for ESG products (GSIA, 2020). The financial sector is striving to align itself with sustainability goals, despite changing regulations, investor choices and technological advances. ESG structured products seek to generate profits while also contributing positively to the environment and society, offering an appealing option for sustainable investment. As reported by Boffo and Patalano (2020), these items can serve as a vital link between investors' desire for sustainability and the funding requirements of sustainable endeavors.

However, these products continue to face multiple obstacles in relation to their operations. Auer and Schuhmacher (2016) point out that assessing the effectiveness and economic viability of ESG investments is still difficult because of the absence of uniform measures and evaluations. Structured products encounter difficulties in complying with regulatory disclosure rules, guaranteeing transparency, and handling reputational risks linked to greenwashing (Broadridge, 2021). In fact, standardizing data is a key challenge highlighted in this research. Financial institutions find it challenging to consistently evaluate the environmental and social impacts of their investments due to the varying forms and analysis methods of ESG data.
Another problem emerges, there are worries about greenwashing in the finance market, where investments are promoted as eco-friendly without substantial proof, raising doubts about credibility. Boffo and Patalano (2020) stated that the absence of consistent metrics and

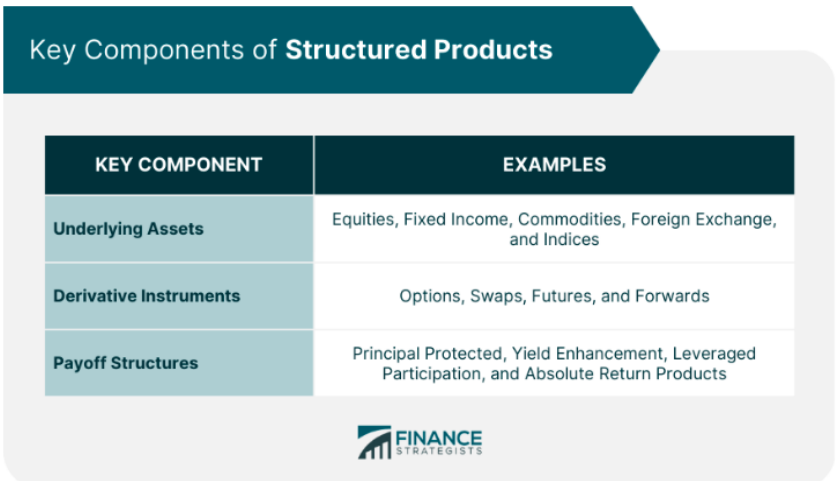
standards in evaluating ESG investments leads to the widespread practice of greenwashing, which undermines investor confidence and reliability. Likewise, ESMA has stressed the importance of transparent and precise information to avoid false statements about the environmental and social effects of ESG products (ESMA, 2020).
Moreover, creating financial instruments that effectively combine financial objectives with sustainability considerations necessitates advanced modeling techniques and a deep understanding of both financial markets and sustainability principles (Dorfleitner et al., 2015). The increasing opportunities can accelerate the growth of the ESG structured finance market, in addition to these challenges. Also, it is essential to educate investors to generate interest in ESG investments and encourage market expansion. Financial institutions can benefit from the increasing investor demand for sustainability by developing new ESG products that match financial and social impact objectives.

This research aims to encourage the growth of a robust and clear market for ESG structured products by identifying the main obstacles and advantages for investors in the financial sector. Financial institutions can have a significant impact on advancing sustainable finance goals and enhancing environmental and social outcomes by tackling challenges and leveraging new opportunities.

2.2) ESG structured Products definition

For a better understanding of the analysis, let's first define what we call ESG structured products.

Figure 1: Key components of structured products



Source: Finance Strategists. Products that are organized in a specific manner.

ESG structured products are sophisticated financial tools that incorporate ESG factors while still use conventional assets such as stocks, bonds, or derivatives.
These instruments offer investors the opportunity to pursue both financial returns and positive societal impact by integrating ESG criteria into traditional investment structures (Giese et al., 2019).
These items frequently include assets such as stocks from companies with strong ESG practices, green bonds supporting environmentally friendly projects, or derivatives linked to sustainability indicators. According to Preclaw and Bakshi (2015), green bonds have gained traction to finance environmentally friendly projects, given their clear connection to specific environmental outcomes.

The process of creating begins with choosing underlying assets, such as stocks, bonds, commodities, forex, or indices. Subsequently, derivative instruments are used in order to form the products, enabling the development of diverse payoff arrangements customized to suit different market conditions and investment goals.

The profits from these items could be tied to the ESG performance of the assets they are based on, which may include rewards for meeting certain sustainability goals, in turn matching investor profits with ethical outcomes. Kölbel, Heeb, Paetzold, and Busch (2020) note that ESG structured products can be designed with performance incentives that reward companies for meeting specific sustainability targets, thereby aligning investors' financial goals with positive environmental and social outcomes.
Nevertheless, they also present challenges and dangers, such as credit risk from the issuer and market risk from the underlying assets. Kuo and Chang (2020) highlight that the performance of structured products can be greatly impacted by the issuer's credit risk, especially in unstable markets. Furthermore, the worth of these items is strongly linked to how well the foundational resources perform, thus putting investors at risk of market fluctuations (Fabozzi et al., 2019).
Also, structured products may possess limitations on liquidity, which can impede their tradability in secondary markets. He and Xiong (2013) indicate that this frequently results in restricted liquidity, which decreases their ability to be traded and raises the possibility of illiquidity premiums. Additionally, investors could struggle to properly assess the value of these assets because of their complex designs (Henderson & Pearson, 2011).

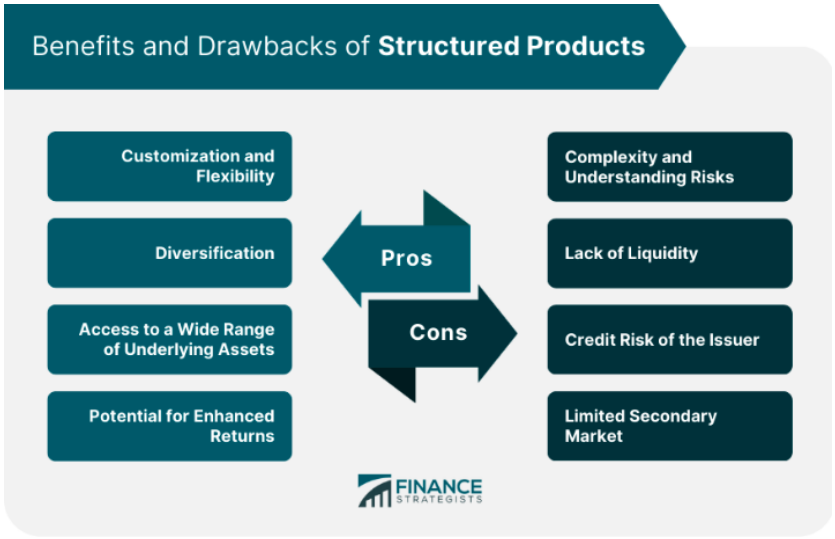
Key market and regulatory trends are driving the rise of ESG-structured products in the current market:

- An increasing desire for sustainable investments: The Global Sustainable Investment Alliance highlights a notable growth in sustainable assets being managed, showing a rising interest from investors in these products.

- Measures like the EU's SFDR aim to promote transparency and confidence in ESG investments, urging their integration into conventional investment approaches.

- Financial institutions are constantly creating new ESG products to satisfy the increasing demand for sustainable investment solutions from investors, as stated by BNP Paribas CIB.

Figure 2: Benefits and drawbacks of structured products



Source: Finance Strategists. Products with a specific design or format.

ESG structured products provide advantages such as competitive returns, portfolio diversification, and alignment with values. According to Giese, Lee, Melas, Nagy, and Nishikawa (2019), these products allow investors to achieve attractive returns while managing risks through exposure to various asset classes. Moreover, they help investors align their investments with their personal values and the broader objectives of sustainable development (Kölbel et al., 2020).

To summarize, ESG structured products are a major advancement in the financial sector, linking investor profits with worldwide sustainability goals. As they become more popular, these products not only help investors achieve their financial objectives but also help tackle some of the most urgent global issues. Research by Kölbel, Heeb, Paetzold, and Busch (2020) indicates that ESG structured products can channel substantial private capital towards addressing critical environmental and social challenges, such as climate change and inequality. Continued progress in regulatory structures and market advancements enhance their potential, solidifying their importance in a contemporary, environmentally friendly investment portfolio.

2.3) Objectives of the research question

This research question seeks to find out more about the difficulties and prospects that financial institutions face as they navigate the complex field. The question is designed to show both the barriers and the key drivers shaping the market dynamics of these financial instruments.

The first goal is to highlight the major challenges faced by financial institutions when developing and deploying these products. This involves a detailed examination of obstacles across three key areas: regulatory barriers and market considerations. Moreover, the research will explore the market opportunities with the ESG structured product sector. By identifying emerging trends, the study seeks to show potential growth trends. Additionally, the research will examine how regulatory institution influence the development and reception of ESG structured products. It will specifically talk about the influence of global and regional regulations, such as the EU's SFDR and the US SEC's ESG disclosure guidelines, on market dynamics and investor behavior. An analysis with various aspects including returns, market penetration, and risk profiles on the potential of ESG products will evaluate the financial performance of existing ESG structured products in comparison to traditional financial products. The quantitative data analysis, the research, and the qualitative approach through interviews with industry professionals aims to obtain valuable information that will enrich the overall conclusions.

This means the study will contributes to the forward of sustainable finance practices and propose recommendations targeted at various stakeholders, such as financial institutions, policymakers, and other relevant entities.

3) Review of literature

The review of literature explores the existing work and practical case studies about ESG structured products. This review serves as the foundation to build our understanding of the complexities and nuances of ESG integration into structured finance. By examining both theoretical frameworks and real-world applications, it aims to point out the challenges and opportunities inherent in these financial instruments, as well as the issues of their conception.

3.1) Challenges and opportunities

Thanks to a summary of the current literature and market analyses, we aim to identify the obstacles that obstruct the adoption of ESG principles in structured finance and the factors that help their integration into the general financial market.

3.3.1) "Case Study of Successful ESG Structured Products"[1]

After analyzing in detail "Case study of successful ESG structured products" it illustrates how theoretical concepts are applied in real-world scenarios.

Founded in Stockholm in 2004, Garantum, a Swedish company, has become the leading distributor of retail structured products across the Nordic region. They cater to diverse investor needs by offering a broad selection of structured products. Notably, Garantum has championed green investing with dedicated products well before the rise of ESG popularity. In the future, the company focuses on using technology and new ideas to help investors succeed in the changing market environment.

In fact, choosing Garantum's ESG structured products as the focal point of our thesis. This case study serves as a keystone for our research as it provides a concrete example of how innovative financial products aligned with ESG principles are implemented and received in the market. By examining Garantum's product offerings in detail, we can collect valuable information on the practicalities of developing and promoting structured ESG products within the constantly evolving field of sustainable finance

[1] *Fernandes, T., & Gireesh, S. (February 2023). Case Study of Successful ESG Structured Products.*

They are recognized for their customized investment solutions and have addressed the increasing interest in sustainable investments by creating structured products that incorporate ESG criteria. This case study provides valuable information by demonstrating the obstacles that financial institutions encounter when trying to match investment products with sustainable goals while still maintaining financial profits. For instance, the complexity of ESG integration into structured products often requires rigorous data analysis, compliance with evolving regulations, and alignment with investor preferences (Preclaw & Bakshi, 2015) It also emphasizes the possibilities arising from a more thoughtful investment strategy. The success of Garantum show the potential of combining ESG principles with structured finance to create products that align with both investor values and sustainability goals (Dorfleitner et al., 2022).

The Spi-case study highlights a significant challenge in the realm of ESG structured products, about balancing financial returns with sustainability criteria. Achieving both goals simultaneously proves to be a major obstacle. In fact, investors struggle with the complexities of ESG metrics, finding it difficult to seize the real environmental and social impact these metrics signify, and how these impacts translate into real financial returns on their investments.
This absence of clear information leads to increased skepticism among investors, especially concerning the problem of "greenwashing" in the market. Greenwashing is when an investment product is falsely portrayed as being more eco-friendly or ethical than it is. Investors are wary of overstated green assertions, concerned that investment products might not match environmental or ethical standards as claimed. This doubt creates a major obstacle for establishing trust and gaining wider market approval of ESG structured products. Malgwi and Dahiru (2014) note that standardized reporting frameworks and third-party verification can help improve the credibility of ESG products. Additionally, the Sustainable Finance Disclosure Regulation (SFDR) requires financial market participants to provide detailed disclosures on sustainability risks and impacts, aiming to enhance transparency and build investor trust (Krueger et al., 2020).

Besides those challenges the study reveals some interesting opportunities that can enhance answers for the research question.

The global push by regulatory bodies towards sustainable finance has a real impact behind

the market for ESG structured products because it creates a more structured way for introducing and gaining acceptance of these products. Regulatory bodies are now demanding greater transparency and accountability from financial institutions, encouraging the development of authentic ESG products that meet stricter criteria. Regulatory authorities are currently requiring increased transparency and accountability from financial institutions, promoting the creation of genuine ESG products that adhere to more stringent standards. This push for regulation is creating trust and confidence in the market, which is a positive outcome (Krueger et al., 2020). According to data from Morningstar, sustainable funds in Europe experienced a record inflow of €120 billion in the first quarter of 2021, indicating growing investor trust. (Morningstar, 2021).

Moreover, investors are currently looking for chances to make a positive impact on social and environmental issues while still meeting their financial goals, leading to a growing interest in products that provide benefits beyond monetary returns. This change in investor favor suggests a great opportunity in the market for ESG structured products. ESG structured products can excel in today's market due to the increasing need for impactful investments. Additionally, a survey from EY in 2021 found that 90% of institutional investors worldwide see ESG products as crucial for their investment strategies, highlighting the market's preparedness for ESG structured products. This trend is supported by a notable rise in the availability of ESG data, as MSCI stated a 34% increase in the amount of companies revealing ESG information from 2017 to 2020 (MSCI, 2020).

The analysis of Garantum's approach shows the challenges and the opportunities within the ESG structured product. It indicates that addressing the challenges of integrating ESG factors and combating greenwashing is essential. By effectively dealing with these issues, ESG structured products can gain credibility and appeal, potentially resulting in greater market adoption and trust.
Moreover, the opportunities identified from this case study suggest a new way for growth in sustainable finance. By innovating in product design and leveraging regulatory frameworks, financial institutions can create compelling ESG investment propositions that align with global sustainability goals. Matching the preferences of investors and leading the way to a sustainable economy. This case study brings to our thesis by providing concrete examples of the interplay between market challenges and opportunities in the ESG structured product

domain. It offers a perspective that helps answer our central research question regarding the development and marketing of ESG structured products.

3.1.2) "Incorporating ESG in Structured Finance"[2]

The second case study to analyze is "Incorporating ESG in Structured Finance," It provides a deep dive into how ESG considerations are being integrated into structured finance. This case study is crucial for our thesis because it showed us the challenges and innovations at the intersection of ESG factors and financial structuring. The paper discusses how the integration of ESG factors has expanded but also highlights the lack of clear definitions and regulations, which directly ties into the focus of our thesis on identifying the main challenges and opportunities in this evolving field.

The paper highlights significant obstacles, particularly the absence of standardized regulations in ESG-structured finance. This lack of clear guidelines results in how ESG criteria are applied and measured across various financial products. For instance, it points out that while ESG investing in assets under management in the U.S. was initially reported at $17.1 trillion in 2020, this figure was later adjusted down to $8.4 trillion due to changes in asset manager reporting standards (US SIF Foundation, 2022). This adjustment underscores the challenges in data quality and reliability, critical issues impacting the trust and scalability of ESG financial products. When looking at the opportunities, there's a noticeable rise in innovative ESG-linked transactions, which shows the potential for structured finance to promote sustainable development. For instance, there's been a quadruple increase in the proportion of transactions with ESG-linked criteria in collateralized loan obligations (CLOs) from 2018 to 2022 (Dealscribe, 2022). This growth signals a substantial move towards adopting ESG criteria in intricate financial products, indicating a maturing market that seeks standardized and reliable ESG financial instruments.

It demonstrates the challenges and potential benefits of ESG structured finance. Standardization and regulation in CLOs, provide a detailed insight into the market. In relation to our survey on the development and marketing of ESG products, research shows that almost half of investors surveyed in a recent EY survey cited issues with inconsistent ESG data, while 43% highlighted concerns with regulatory uncertainty (EY, 2021).

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[2] *Morphett, A., Lau, J., Gabig, N., Bensusan, I., Scura, E., Nahas, A. E., Grainger, A., & McDonough, R. (Spring 2023). Incorporating ESG in Structured Finance.*

3.2) The issues in their conception

According to Garcia-Zarate and Kwon (2021), their intricate structures and niche status often lead to difficulties in understanding, evaluating, and comparing them to other investment products. However, to fulfill our research objectives and provide relevant data and analysis, let's set a strategic approach.

Rather than trying to assess ESG and non-ESG structured products, let's focus analysis on their underlying components. By examining the underlying assets that comprise these structured products, it aims to gain deeper information into their evolution, investor behavior, and market dynamics. In fact, Dorfleitner, Utz, and Zhang (2022) emphasize that analyzing the underlying assets reveals important insights into the ESG ratings, risk profiles, and thematic investment trends in structured products. This focus allows us to understand the nuances of how ESG-structured products are developed and marketed (Giese et al., 2019).

This approach allows us to obtain more precise data regarding their ESG ratings, returns, and other relevant metrics, providing a solid foundation for our analysis.
Additionally, analyzing the underlying assets offers insights into investor behavior, such as preferences for specific ESG criteria and their impact on market dynamics (Giese et al., 2019). By narrowing the focus, this study can provide a comprehensive view of ESG structured products, including the evolution of their underlying components, investor demand, and market opportunities (Morningstar, 2021).

Garcia-Zarate and Kwon (2021) point out that sustainable exchange-traded funds (ETFs), which had over $250 billion in global assets in 2021, provide valuable information on investor behavior and market trends. Concentrating on ETFs, which replicate certain indices, asset classes, or strategies (Hill, 2020), allows us to assess our research inquiries efficiently. Dorfleitner, Utz, and Zhang (2022) highlight that the market dynamics for sustainable ETFs show similarities to ESG structured products, offering insight into their diversification and thematic strategies. This method improves our comprehension of the growth, obstacles, and possibilities of ESG-structured products.

This strategy provides numerous benefits. To begin with, (ETFs) are commonly traded and widely comprehended financial tools, offering abundant information for examination. They

display traits resembling structured products, including diversification and exposure to different asset classes. This enables us to make valuable comparisons and reach conclusions about the overall structured products market through our examination of ETFs.

ETFs are perfect for empirical research as they provide both visibility and accessibility. Historical information and performance statistics support in-depth analysis with quantitative and qualitative perspectives on market trends and investor actions. ESG ETFs have experienced notable expansion, as assets under management surged from $25 billion in 2018 to approximately $285 billion by the close of 2020, demonstrating a move towards sustainable investing by both institutional and retail investors (MSCI, 2021). Analyzing the underlying assets of ETFs helps tackle the difficulties of evaluating structured products directly.

4) Methodology

The methodologies and tools selected for our research, which are crucial in understanding the development and potential of ESG structured products within the financial industry. A dual approach is used to encompass both qualitative and quantitative analyses, this way of working designed to provide a comprehensive overview of the current landscape and to identify key trends and factors affecting the adoption and performance of these products.

4.1) Methodology and Tools Choices

4.1.1) Qualitative Analysis: Interviews with Industry Experts

Our methodology starts with holding structured interviews with financial industry experts who have direct experience with structured products. This qualitative method is chosen to collect detailed perspectives and individual stories, offering a thorough comprehension of the market's challenges and opportunities. Interviews are selected due to their ability to gather expert perspectives and personal experiences that are not found in published information or numerical data. This approach allows us to delve into intricate subjects like the effects of regulations, acceptance by the market, and the real-world obstacles of incorporating ESG factors into structured financial products.

4.1.2) Quantitative Analysis: Linear Regression of Market Data

The second part of our analysis employs linear regression techniques and a correlation matrix. The objective is to identify factors that predict market success and to detect any emerging trends over time. This statistical approach will validate the qualitative findings gathered from expert interviews. Using Python for data analysis, we will extract ETF data from Yahoo Finance to build our database. This method will help us analyze how various ESG criteria influence the financial performance of structured products, thereby enhancing the depth and credibility of our overall analysis.

4.1.3) Tools and Software

We will use specific tools and software to ensure precision. For qualitative interviews, Microsoft Forms will be used to gather experts' answers, enabling accurate data capture and analysis. For the quantitative analysis, we will use Google Collab as the terminal for gathering ETF data from Yahoo Finance, Using Python as the primary programming language. RStudio will be employed for importing our database and conducting regression and correlation matrix analyses.

4.1.4) Justification for Methodological Choices

The research aims to provide a global perspective by combining qualitative and quantitative methods. Interviews will provide contextual information, while quantitative analysis will provide a larger scope. This combined approach reinforces the study's findings by validating information from two distinct sources and shedding light on various aspects of the research question. This methodical approach ensures that the research addresses the specific complexities of ESG structured products in the financial sector.

4.2) Experts Interviews[3]

Interviews were used to gather qualitative insights on the challenges and opportunities in developing ESG structured products from financial industry experts. These interviews were conducted to collect a variety of viewpoints and thorough insights from experts who are actively engaged with ESG and structured products. The answers offered important qualitative information, revealing the challenges and possible opportunities for growth in this market.

[3] Appendix10: Survey data

The interviewees were rigorously chosen for their vast experience and knowledge in relevant fields. The example consists of individuals with a variety of positions and extensive background in finance, guaranteeing a thorough grasp of ESG structured products. The insights of these experts carry significant weight due to their credibility and depth of knowledge. Alissa Meyer, who has 14 years of experience in the fund industry as a Client Relationship Manager, shared insights derived from her vast experience in managing client relationships and funds. Madhu Ramachandran, an Executive Director with a quarter-century of experience in investment products, such as funds, provided a broad perspective on the strategic challenges and opportunities in the industry. Amine Tounsi, who has 16 years of experience in project management, transaction tools, and ESG, provided valuable insights into the operational challenges related to ESG structured products. Gilles Humbert, who has 16 years of experience in derivatives and structured products as the Head of Structured & Traditional Assets, gave a thorough explanation of incorporating ESG factors into conventional financial instruments. Finally, Clément Croquet, a Structured Product Pricing Analyst with 2 years in financial markets, offered a fundamental viewpoint on ESG structured products.

The experts offered diverse explanations of ESG structured products according to their positions and background. Clément Croquet described ESG structured products as structured products that have ESG as underlying assets, highlighting the incorporation of ESG criteria into conventional structured products. Alissa Meyer defined them as investments or assets that support initiatives centered on environmental, social, and governance criteria, emphasizing the wider influence and goals of ESG designed products. Madhu Ramachandran observed that ESG structured products are not commonly seen in her work, indicating a possible lack of market penetration or awareness in specific sectors. Amine Tounsi emphasized that although these items are essential, they are complicated and challenging to evaluate. Gilles Humbert stressed the importance of incorporating ESG criteria into structured financial products to meet sustainable investment objectives, emphasizing the equal emphasis on financial returns and sustainability.

The specialists pinpointed various crucial elements that distinguish ESG structured products from their conventional equivalents. Clément Croquet highlighted the importance of integrating ESG criteria as the main distinguishing factor, introducing more complexity and accountability. Alissa Meyer emphasized the importance of aligning with sustainable

investment goals, which requires advanced reporting and increased transparency to meet the growing need for accountability and detailed disclosure from investors. Madhu Ramachandran highlighted the significant challenge of achieving a fine balance between standardization and customization to adhere to ESG criteria while maintaining financial performance. Amine Tounsi emphasized the intricate nature and added regulatory obligations that set ESG structured products apart and can often make their development more difficult. Gilles Humbert highlighted the importance of incorporating ESG factors into risk evaluations and product development, demonstrating the more inclusive and extensive approach necessary for ESG products in contrast to conventional ones.

The specialists also pinpointed key elements that were overlooked in the original survey. Madhu Ramachandran believed that the questionnaire thoroughly addressed all crucial elements. Amine Tounsi highlighted the intricate nature of structured products and the changing regulatory environments, essential for grasping market approval and the operational obstacles encountered by financial institutions. Gilles Humbert emphasized how vital it is to consider the changing regulatory landscape and how it influences the creation and reception of ESG structured products, emphasizing the fluidity of the regulatory framework related to ESG investments.

The experts' readiness to offer additional insights or take part in subsequent interviews was also evaluated. Clément Croquet, Alissa Meyer, Amine Tounsi, and Gilles Humbert have shown a strong interest and commitment to furthering their involvement in advancing the understanding and development of ESG structured products.

The interviews showed agreement on the intricacy and importance of ESG structured products. Some important factors include incorporating ESG standards, which require stricter reporting and a greater level of transparency. The challenges that have been identified include finding a balance between standardization and customization, adapting to the changing regulatory environment, and satisfying new compliance demands. On the other hand, the potential for financial institutions to innovate in sustainable investments is complemented by the increasing investor demand in this area. These detailed observations offer a thorough grasp of the real-life obstacles and possibilities in creating and promoting ESG structured products. They will be included in the strategic recommendations at the end of this thesis, adding value to the conversation on sustainable finance and structured products.

4.3) Analytical

In the Analysis section, we will evaluate eight ETFs, with four focusing on (ESG) criteria and four without any focus on them. It will serve as a crucial component in analyzing and comparing the approaches of sustainable investments versus traditional investments. This option allows for a thorough assessment of how well ESG investments are performing in the present financial environment.

The study selected ESG ETFs such as the iShares Global Clean Energy ETF (**ICLN**), which focuses on companies worldwide involved in generating renewable energy. It provides valuable information on the renewable industry's performance, essential for comprehending ESG investments. The Vanguard ESG International Stock ETF (**VSGX**) prioritizes non-U.S. markets and adheres to ESG criteria, demonstrating a higher level of global ESG integration than U.S. markets. The **EFIV** ETF follows the S&P 500 index but incorporates ESG criteria, exhibit how ESG factors can affect the financial performance of top U.S. companies. The focus on green bonds in the VanEck Vectors Green Bond ETF (**GRNB**) provides a unique perspective on ESG impacts within the fixed income industry.

In comparison, the SPDR S&P 500 ETF Trust (**SPY**) is an example of non-ESG ETFs that follows the S&P 500 index without ESG filters, acting as a standard to measure how well the ESG versions perform. The **VTI** provides a broad representation of the whole U.S. stock market for comparing with ESG-focused funds. The **ACWI** ETF from iShares MSCI offers a different option compared to VSGX by including a wide variety of stocks from developed and emerging markets worldwide. In conclusion, the Invesco QQQ Trust (**QQQ**) centers on stocks with a strong emphasis on technology, enabling sector-specific evaluations similar to tech-focused investments commonly found in various ESG strategies.

Having a range of 8 different ETFs, covering different geographical regions and asset classes helps to highlight general market trends, investor attitudes and contrasting ESG performance to traditional investment strategies.

For the construction of the database, we have gathered crucial values to analyze ETFs comprehensively. These include the following metrics gathered in the below table. Each of these metrics offers valuable insights into ETF behavior and performance, forming the foundation for comparing ESG and non-ESG investments.

Table 1: Significance of metrics

Metric	Description
Open, Close, High, and Low	Daily market activity and trends
Adjusted Close	Price stability, ETF liquidity and volatility
Return	ETF profitability and performance over time
Beta	Sensitivity to broader market movements and risk profile
Volatility	Price variability and stability
Total Risk-Adjusted Return	Performance after adjusting for risk
P/E Ratio	ETF valuation relative to earnings
Dividends	Income-generating potential
Volume	ETF liquidity and ease of buying and selling units

Reviewing these indicators seeks to examine not just the financial results but also the market trends of ESG investments in comparison to conventional options, considering factors such as risk, profitability, consistency, and market reception. To guarantee the credibility of our analysis, we have chosen a particular timeframe ranging from March 2015 to December 29, 2023. This time frame encompasses different market situations and economic fluctuations, offering a complete grasp of how ETFs behave and perform, especially when considering ESG integration.

4.3.1) ESG Rating

These values offer background and details on the characteristics and excellence of the investment products under examination.

The SFDR Classification, a part of the Sustainable Finance Disclosure Regulation, offers a method to categorize investment products based on their sustainability attributes and governance strategies. Items are classified into Article 8, Article 9, or Other in this categorization. Article 8 items support eco-friendly or social features and comply with strong governance standards, whereas Article 9 items focus on sustainable investment goals and

adhere to strict governance practices. Items that do not meet the standards for Articles 8 or 9 are classified under the others designation.

Additionally, MSCI ESG Fund Ratings provide a numerical evaluation of funds' environmental, social, and governance practices. The ratings vary from AAA to CCC, with AAA and AA symbolizing the top quality and B and CCC representing the lowest quality. The typical ratings are classified as A, BBB, and BB. Additionally, the MSCI ESG Quality Score assesses a fund's ESG quality comprehensively, ranking it on a scale of 0 to 10. The score is determined by combining the ESG scores of the fund's holdings with ESG rating trends of the assets. It also considers the fund's involvement with assets that have previous performance. MSCI assesses the underlying assets by considering their level of exposure to 35 sectors specific ESG risks and how well they can handle these risks in comparison to their competitors.

Together, these classifications and ratings offer valuable insights into the sustainability and governance practices of investment products, enriching our analysis and providing a broader context for understanding the ESG landscape and the performance of ESG investments.

Table 2: ETFs criteria.

ETF Name	***Ticker***	***MSCI ESG Rating***
Ishares Global Clean Energy ETF	***ICLN***	***7.02 /10***
Vanguard ESG International Stock ETF	***VSGX***	***7.1/10***
SPDR S&P 500 ESG ETF	***EFIV***	***6.88/10***
VanEck Green Bond ETF	***GRNB***	***6.54/10***
Vanguard Total Stock Market ETF	***VTI***	***6.44/10***
SPDR S&P 500 ETF Trust	***SPY***	***6.58/10***
iShares MSCI ACWI ETF	***ACWI***	***6.76/10***
Invesco QQQ Trust Series I	***QQQ***	***6.6/10***

This Table indicates their adherence to (ESG) criteria. Among the ETFs listed, the Vanguard ESG International Stock ETF (VSGX) stands out with the highest rating of 7.1/10, indicating robust ESG performance in its portfolio. Conversely, the VanEck Green Bond ETF (GRNB) has a relatively lower rating of 6.54/10, suggesting comparatively weaker ESG criteria. This information helps investors gauge the ESG performance of different ETFs and align their investment decisions with their sustainability goals.

4.3.2) ETF Analysis

This comparison shows us how well these ETFs perform, how risky they are, and how the market reacts to them in different economic situations.

Firstly, when we compare ESG-focused ETFs with regular ones, we can see if there's any difference in how well they perform. This helps us figure out if sustainable investments can do just as well or even better than regular ones. This is important because it's a big part of why people are starting to invest more responsibly. By looking at things like how much return you make back and how much risk you take, we can collect real data to see if ESG factors make a difference in how well you do financially.

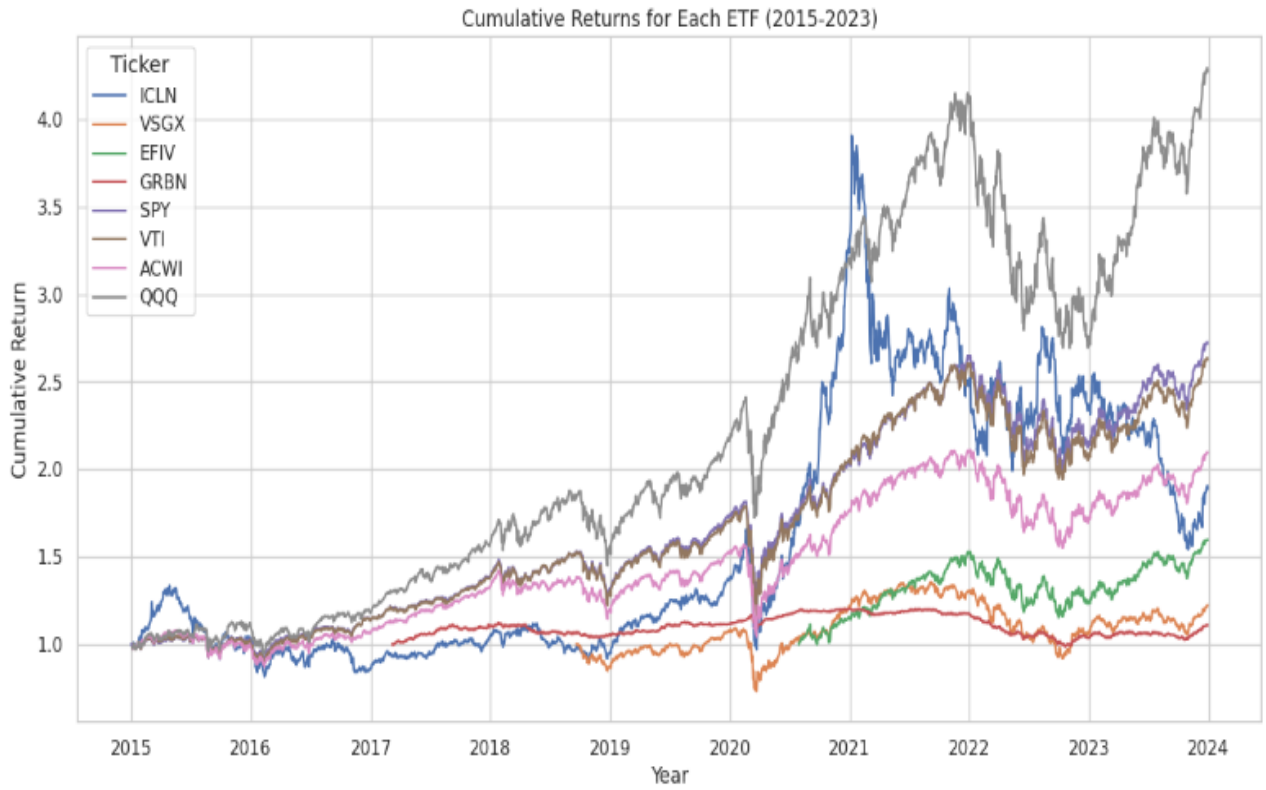
This comparison also reveals people's opinions and market dynamics. ESG ETFs are typically intended for individuals who prioritize factors beyond financial gain, such as contributing to environmental and social causes. By comparing them to traditional ETFs that mainly prioritize financial returns, we can determine if there is a growing trend of individuals investing in a manner that benefits the environment. This assists us in determining if this trend will endure.

Furthermore, comparing both ETF types under similar circumstances allows us to determine if ESG investments demonstrate greater stability during economic downturns. This is crucial as it enables us to determine whether ESG investments are simply a trend during prosperous times or a wise decision for the future. This is very important for people looking to invest in a way that is good for both the environment and their finances.

Comparing ESG and traditional ETFs is beneficial for both researchers and individuals looking to make socially responsible investments. This perspective enhances our thesis by being grounded in real-world scenarios and results.

4.3.3) Cumulative Returns Analysis

Figure 3: Cumulative return for each ETF (2015-2023)[4]



This graph[4] illustrates growth trajectories for each fund, which is essential for evaluating how investments have compounded over time.

VTI stands out with a remarkable upward trend showing growth from an indexed value near 100 in 2015 to around 263 in 2023. This ETF consistently outperformed others, indicating strong management or favorable market conditions affecting its sector.

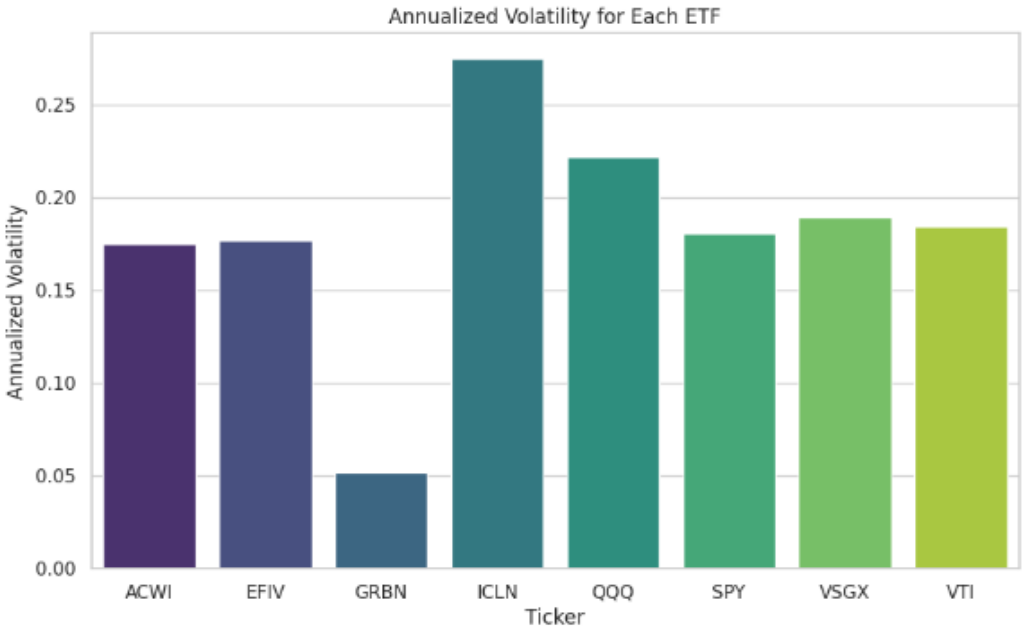
For a moderate Growth, the ICLN's ETF shows a less dramatic rise in value, indicating a more conservative or stable investment approach. This ETF started at an indexed value near 100 in 2015 and reached around 189 by 2023, suggesting a more gradual but consistent return on investment.

And the one with the most volatility impact is QQQ which demonstrates periods of sharp increase followed by declines, reflective of a higher-risk investment. This model underlines its higher-risk nature, likely due to its exposure to sectors prone to significant market fluctuations. This ETF started near 100 in 2015 and impressively climbed to a cumulative return of 427 by 2023, demonstrating high growth potential amid its volatility at 0.2.

[4] See appendix 1 and 3

4.3.4) Annualized Volatility Analysis

Figure 4: Annualized volatility analysis for each ETF[5]



The bar graph[5] illustrates annualized volatility and provides information on the risk associated with each ETF. Volatility is a fundamental factor in assessing the risk-return profile of investments.
ICLN has the most volatility, which shows the highest annualized volatility among the group, indicated by a bar reaching approximately 0.27. This high level of volatility suggests that ICLN's returns are subject to significant fluctuations, which might appeal to risk-tolerant investors looking for potentially high returns.

We can also see that GRBN shows the lowest volatility, with values around 0.05. It's likely preferred by risk-averse investors who prioritize stability and are less concerned with capturing high returns at the cost of higher risk.

The ETF with a moderate volatility is ACWI, EFIV, SPY, VSGX, and VTI, around 0.17 and 0.19 with moderate fluctuations and represent a balanced risk profile for investors looking for a mix of stability and potential growth.

[5] See appendix 3

4.3.5) Volatility vs. Return Correlation

Table 3: ETFs ranking between annualized volatility and cumulative return.

Rank	*Ticker*	*Cumulative Return*	*Annualized Volatility*
1	QQQ	4.27	0.22
2	SPY	2.72	0.18
3	VTI	2.63	0.18
4	ACWI	2.09	0.18
5	ICLN	1.89	0.27
6	EFIV	1.59	0.18
7	VSGX	1.22	0.19
8	GRBN	1.11	0.05

On one hand, QQQ leads the ranking with the highest growth, achieving an indexed value of 4.27 by 2023, which underscores its potential for high returns. This performance profile is particularly attractive to investors with a higher risk appetite, although it accompanies a moderate level of volatility at 0.22. Despite these risks, QQQ maintains a respectable MSCI ESG Rating of 6.6/10, indicating a balanced approach to incorporating responsible investment principles.

On the other hand, GRBN is noted for its remarkable stability, showing the lowest annualized volatility at just 0.05. This stability makes it an ideal choice for conservative investors who prioritize capital preservation. Additionally, GRBN's MSCI ESG Rating of 6.54/10 supports its role as a secure and responsibly managed investment.

For the other, they are classed as middle-ranked ETFs like ACWI, EFIV, SPY, VSGX, and VTI, that provide investors with normal returns and low to moderate volatility, suitable for those looking for a diversified investment strategy. Among these, VSGX is particularly notable, holding the highest MSCI ESG Rating of 7.1/10, which makes it an attractive option for investors prioritizing sustainability alongside financial gains. EFIV also integrates solid financial performance with a strong commitment to responsible practices, reflected in its ESG rating of 6.88/10. ACWI offers broad exposure to global markets and adheres to ESG principles with a rating of 6.76/10, while SPY and VTI offer platforms that not only provide

robust market returns but also uphold ethical investment practices with ratings of 6.58/10 and 6.44/10, respectively.

The significance of assessing ETFs goes beyond financial metrics to include their ESG commitments. This two-pronged strategy enables investors to make knowledgeable choices that address their financial goals and ethical values, meeting the increasing need for sustainable investment options.

4.3.6) Sharpe Ratio

In our situation, it is essential to consider the Sharpe ratio when evaluating ETF performance. Indeed, the metric assists in assessing how effectively an investment's profit stacks up against the level of risk it involves. In a sense, it shows how much you earn on your investment, considering both the return and the risk involved.

Initially, it is valuable for determining if an investment is worth the level of risk involved. This is crucial when evaluating various ETFs with different levels of risk and return. Additionally, it enables easier comparison among ETFs. Higher Sharpe ratios indicate that investments are generally considered better because they offer greater returns compared to the associated risk. Then, it is important for making intelligent investment choices. Understanding the Sharpe ratios of various ETFs aids in selecting investments that match an investor's risk tolerance and objectives.

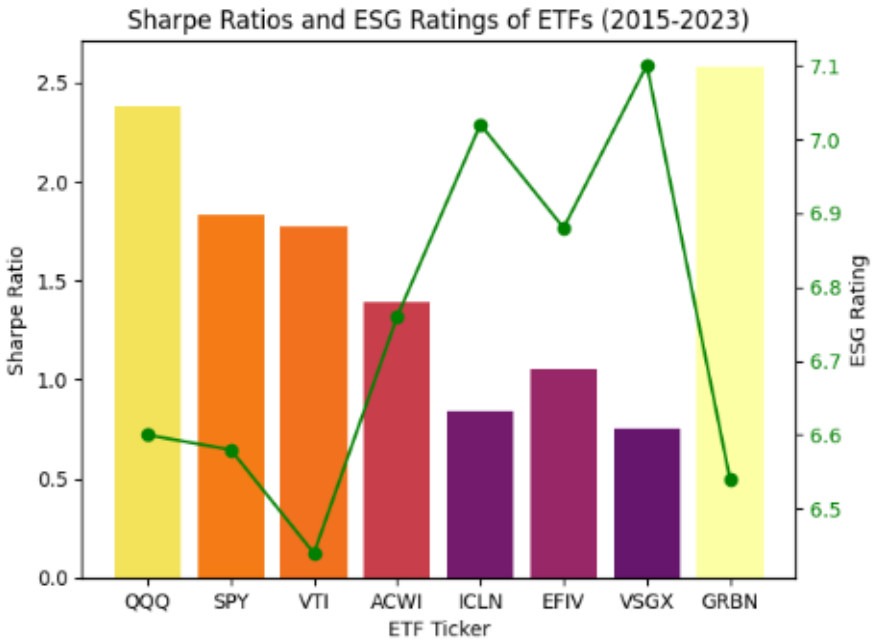
Therefore, it provides a more comprehensive perspective on ETF performance. It goes further than merely examining returns and considers the ETF's risk management, assisting you in making better-informed choices.

Table 4: Sharpe ratios computation[6]

Ticker	Cumulative Return	Years	Annualized Return Calculation	Annualized Return	Volatility	Sharpe Ratio Calculation	Sharpe Ratio
QQQ	4.27	8	4.27/8	0.534	0.22	(0.534-0.01)/0.22	2.38
SPY	2.72	8	2.72/8	0.34	0.18	(0.34-0.01)/0.18	1.83
VTI	2.63	8	2.63/8	0.329	0.18	(0.329-0.01)/0.18	1.77
ACWI	2.09	8	2.09/8	0.261	0.18	(0.261-0.01)/0.18	1.39
ICLN	1.89	8	1.89/8	0.236	0.27	(0.236-0.01)/0.27	0.84
EFIV	1.59	8	1.59/8	0.199	0.18	(0.199-0.01)/0.18	1.05
VSGX	1.22	8	1.22/8	0.153	0.19	(0.153-0.01)/0.19	0.75
GRBN	1.11	8	1.11/8	0.139	0.05	(0.139-0.01)/0.05	2.58

[6] See appendix2

Figure 5: Sharpe ratios and ESG Ratings of ETFs (2015-2023)[7]



Let's examine the Sharpe ratios and ESG ratings[7] of various ETFs. The colors of the bars in the graph represent the Sharpe ratios, with purple indicating lower values and yellow indicating higher values. This color scheme helps us quickly assess which ETFs offer better returns relative to the risk involved.

So, ETFs like GRBN and QQQ exhibit the highest Sharpe Ratios, around 2.58 and 2.38, respectively. They have provided excellent returns considering the level of risk they carry.

Nevertheless, ETFs such as SPY, VTI, and ACWI exhibit respectable Sharpe ratios, ranging from 1.39 to 1.83, indicating good returns relative to the risk involved.
However, ICLN and VSGX ETFs exhibit lower Sharpe ratios of approximately 0.84 and 0.75, displayed in purple. This suggests that their outcomes have not met expectations considering the amount of risk involved.

Moving on to the ESG ratings, represented by the green line on the graph, they reflect how well each ETF integrates environmental, social, and governance factors into its investment strategy. Overall, the ETFs demonstrate relatively high ESG ratings with minimal variation.

This analysis shows how different ETFs balance financial performance and ESG commitments. It provides information for investors and stakeholders looking ETFs that offer

[7] See Appendix 5

strong financial returns while upholding high ESG standards. Additionally, the differences between financial performance and ESG ratings, particularly evident in ETFs like ICLN and VSGX, prompt important discussions about the challenges of integrating sustainability into investment strategies without compromising profitability. This detailed interpretation offers a deeper understanding of investments, essential for your thesis on ESG structured products in the financial industry.

4.3.7) Linear regression:

The regression model aims to understand the relationship between ESG ratings and various financial and risk-related factors. The independent variables included in the model are, Stock return Volatility.x, Beta, Dividends, Sharpe Ratio, Cumulative, and Annualized Return.

The Linear regression equation[8]:

$$ESG_Rating = \beta 0 + \beta 1 Return + \beta 2 Volatility.x + \beta 3 Beta + \beta 4\ Sharpe\ Ratio + \beta 5 Cumulative\ Return + \beta 6 Annualized\ Return$$

The intercept has an estimate of 9.92529 with a standard error of 0.02445, a t-value of 380.183, and a p-value of <2e-16. This indicates strong statistical significance, suggesting that there are substantial factors affecting ESG ratings not captured by the included independent variables.

- The coefficient for Return is -0.00577, with a standard error of 0.01352, a t-value of -0.427, and a p-value of 0.67. It means that returns do not have a significant impact on ESG ratings, as the p-value is greater than 0.05.
- The coefficient for Volatility is -0.03209, with a standard error of 0.00127, a t-value of -25.236, and a p-value of <2e-16. This indicates statistical significance with a negative coefficient, suggesting that higher volatility is associated with lower ESG ratings.
- The coefficient for Beta is -2.19828, with a standard error of 0.01745, a t-value of -110.135, and a p-value of <2e-16. This significant negative coefficient implies that higher beta (higher risk) is associated with lower ESG ratings.
- Sharpe Ratio is 21.3128, with a standard error of 0.00187, a t-value of 11383.846, and a p-value of <2e-16. This indicates statistical significance with a positive coefficient, suggesting that higher Sharpe ratios are associated with higher ESG ratings.

[9] See Appendix 9

- Cumulative Return is -35.67507, with a standard error of 0.43269, a t-value of -82.449, and a p-value of <2e-16. This significant negative coefficient suggests that higher cumulative returns are associated with lower ESG ratings.

- for Annualized Return is 20.53756, with a standard error of 0.24593, a t-value of 83.335, and a p-value of <2e-16. This indicates statistical significance with a positive coefficient, suggesting that higher annualized returns are associated with higher ESG ratings.

- The residual standard error is 0.08174. The multiple R-squared value is 0.8608, and the adjusted R-squared value is 0.8607, with an F-statistic of 1.568e+04 on 6 and 15217 DF and a p-value of <2.2e-16. The high R-squared value indicates that the model explains about 86% of the variance in ESG ratings, suggesting that the included variables capture most of the factors influencing ESG ratings.

The significant coefficients for volatility, beta, Sharpe ratio, cumulative return, and annualized return highlight the importance of these financial and risk metrics in determining ESG ratings. The non-significant coefficient for returns suggests that short-term financial performance may not be a major driver of ESG ratings.

In summary, it shows the importance of risk management, stable financial performance, and efficient return in achieving High ESG scores. The below information guide investors, companies, and policymakers in making more decisions that promote sustainable and responsible investing.

4.3.8) Correlation Matrix

The correlation matrix[9] will provide a clear and straightforward analysis of the relationships between multiple variables. It is a valuable tool for identifying significant associations and potential trade-offs, helping to inform both investors and financial institutions about the dynamics of ESG investing.

In this context, the matrix helps to understand how ESG ratings and financial metrics are interrelated. Here is a detailed analysis of the correlation matrix:

[9] See Appendix 9

Table 5: Correlation matrix analysis

Metric	*Return*	*Volatility*	*Beta*	*Sharpe Ratio*	*Cumulative Return*	*Annualized Return*	*ESG Rating*
Return	1.00	0.15	0.20	0.61	0.68	0.68	-0.05
Volatility	0.15	1.00	0.89	-0.35	-0.30	-0.30	0.62
Beta	0.20	0.89	1.00	-0.30	-0.28	-0.28	-0.88
Sharpe Ratio	0.61	-0.35	-0.30	1.00	0.57	0.57	0.40
Cumulative Return	0.68	-0.30	-0.28	0.57	1.00	1.00	-0.89
Annualized Return	0.68	-0.30	-0.28	0.57	1.00	1.00	-0.89
ESG Rating	-0.05	-0.30	-0.88	0.40	-0.89	-0.89	1.00

4.3.8.1) Positive Correlations

Return and Sharpe Ratio (0.61): This indicates a moderate positive correlation between return and Sharpe ratio. A higher Sharpe ratio, which signifies better risk-adjusted returns, is associated with higher returns.

Cumulative Return and Annualized Return (0.9999): These two metrics are nearly perfectly correlated, indicating that they provide very similar information about investment performance over time. This strong correlation is expected, as annualized return is derived from cumulative return.

4.3.8.2) Negative Correlations

ESG Rating and Volatility (-0.62): This strong negative correlation suggests that higher ESG ratings are associated with lower volatility. Investments with high ESG ratings tend to be more stable.

ESG Rating and Beta (-0.88): The strong negative correlation between ESG rating and beta indicates that higher ESG ratings are linked to lower systematic risk. ETFs with better ESG scores are less affected by market fluctuations.

ESG Rating and Cumulative Return (-0.89): This significant negative correlation indicates that higher ESG ratings are associated with lower cumulative returns. This relationship suggests a potential trade-off between high ESG scores and long-term performance.

We can see a higher ESG ratings are linked to lower volatility and beta in ETFs, indicating that they have less market risk. Stable companies, well-managed and focused on ESG factors, are less vulnerable to market changes. Investors valuing ESG could see reduced risk and financial stability in their portfolios.

The inverse relationship between ESG ratings and cumulative/annualized returns indicates a possible trade-off, where investments with superior ESG scores could result in diminished long-term returns. Rising costs from sustainable practices and a focus on long-term security over short-term profits could lead investors and companies to weigh the benefits of sustainability against potential financial losses.

The strong relationship between Sharpe ratio and return highlights the significance of considering risk-adjusted performance when assessing investment achievements. Investors might discover that combining the Sharpe ratio with ESG ratings offers a more well-rounded strategy for making sustainable and profitable investments. This connection shows that although raw returns matter, it is also important to consider the effectiveness and reliability of how those returns are generated, especially in ESG investing where ensuring long-term stability and managing risks are top priorities.

The challenge of balancing sustainability and financial performance in ESG investing. Investors and institutions need to consider ethical concerns and financial trade-offs when integrating ESG criteria. Improving the quality and transparency of ESG data can support informed decision-making for a sustainable financial system.

5) Data Discussion and limitations

5.1 Overview of Analysis and Writing

First, the main technical obstacles encountered are at regulatory and operational levels. but also on the investor side, such as understanding ESG criteria, product liquidity and financial performance concerns.

Two case studies provided practical examples and theoretical frameworks. The first, "Garantum's ESG Structured Products," shows a Swedish company's efforts, highlighting challenges like complex ESG measurements, regulatory compliance, and greenwashing risks, while identifying opportunities such as growing investor interest and favorable regulations. The second, "Incorporating ESG in Structured Finance," explored the integration of ESG factors, noting obstacles like inconsistent regulations and data quality issues, and potential for innovative deals.

To bring more consistency, the expert Interviews offered a qualitative overview of the challenges and opportunities associated with ESG structured products. The main themes addressed were the complexity of integrating ESG criteria, the evolving regulatory framework, data standardization issues and investor education. Experts stressed the need for advanced reporting, transparency and a balance between standardization and customization. The specialists all agreed on the difficulty and importance of ESG structured products, emphasizing the opportunity for creativity in sustainable investments due to growing investor interest.

The analytical part involved an evaluation of eight ETFs, analyzing both funds that focus on ESG criteria and those that do not. Factors such as profits, volatility, Sharpe ratios, and ESG scores were assessed to understand their performance and risk attributes. The findings indicate that ESG ETFs VSGX, EFIV, and ICLN have varying performance and risk levels, with ICLN showing greater volatility. Usually, companies that have high ESG ratings experience lower returns and higher volatility, indicating a trade-off between sustainability and financial prosperity. Investors are increasingly focusing on environmental, social, and governance aspects alongside financial returns, resulting in a growth in sustainable investments.

The regression model and correlation matrix analysis confirmed that higher ESG ratings are correlated with lower volatility and beta in ETFs, showing that companies with strong ESG practices are more stable and less risky. Additionally, a negative correlation between ESG ratings and returns was observed, suggesting a trade-off between sustainability and profitability. The positive correlation between return and Sharpe ratio pushs the importance of risk-adjusted performance in investment evaluation.

Financial institutions face challenges in developing and marketing ESG structured products due to technical integration, regulatory compliance, and operational obstacles. Incorporating ESG factors into financial instruments necessitates sophisticated data analysis, disclosure, and clarity. To comply with regulations and prevent greenwashing, it requires a lot of resources to navigate the ever-changing regulatory environment. Operational difficulties involve the need to balance standardization and customization, guarantee product liquidity, and respond to investor worries about financial results.

In the investor's point of view, they face multiple obstacles in choosing ESG structured products, such as a limited comprehension of the criteria, worries about product liquidity, , and uncertainty about financial benefits compared to traditional investments. Regulations like SFDR shape the market by promoting transparency and accountability, but inconsistencies remain.

Despite the obstacles, financial industry participants are noticing various new opportunities. There is a chance to bring innovation by managing the balance between sustainability and financial performance. Using big data analytics and AI has the potential to enhance ESG data accuracy and openness, assisting in more comprehensive assessment of ESG risks and opportunities. The growing demand for sustainable investments offers a significant market potential for ESG structured products.

5.2 Limitations

While this study offers a thorough analysis, it is important to recognize various constraints. Initially, the incorporation of ESG factors into structured products is a quickly growing area, with ongoing shifts in regulatory requirements. The changing nature of something could impact how relevant certain discoveries are in the future. Furthermore, the valuable insights obtained from expert interviews through qualitative data collection could potentially be affected by the personal viewpoints of the individuals being interviewed. Thirdly, the thorough quantitative analysis depends on existing data that may not encompass all market dynamics. Also, the case studies concentrate on occurrences of ESG incorporation, which may not be applicable to every situation or area. Future studies should consider these restrictions and strive to overcome them by integrating.

additional data sources of various types, wider range of geographic viewpoints, and continuous updates to accommodate changes in regulations.

6) Challenges and Opportunities

6.1) Exploration of the main challenges faced by financial players

The risk table categorizes the main challenges identified based on their impact and likelihood. The challenges are ranked from highest to lowest risk, providing a clear overview of the most significant obstacles faced by financial industry players in designing and structuring ESG products.

The following risk descriptions are selected from various parts mentioned earlier in this paper, including case studies, expert interviews, regression and correlation analyses, and analytical data.

Table 6: Challenges risk level

Risk Level	*Challenges*	*Description*
High	Integration of ESG Criteria	*Complexity in incorporating ESG factors into structured products, requiring advanced data analysis and transparency.*
High	Evolving Regulatory Landscape	*Constant changes in regulations demanding greater transparency and accountability, leading to compliance challenges.*
High	Data Standardization and Quality	*Lack of standardized ESG data and inconsistent quality metrics complicate evaluation and comparison.*
Medium-High	Investor Understanding and Education	*Investors often lack understanding of ESG criteria, leading to skepticism and slower adoption.*
Medium-High	Market Perception of ESG Financial Performance	*Concerns over financial returns compared to traditional investments, impacting investor confidence.*
Medium	Balancing Standardization and Customization	*Difficulty in achieving a balance between standardized processes and customized ESG products.*
Medium	Product Liquidity and Scalability	*Ensuring liquidity and scalability of ESG products to meet market demand and investor expectations.*
Medium	Risk Management and Volatility	*Higher volatility associated with ESG products, requiring robust risk management strategies.*
Low-Medium	Technological Integration	*leveraging technology to improve ESG data quality and transparency, requiring significant investment and expertise.*
Low	Corporate Engagement and Accountability	*Increasing corporate accountability and integrating ESG factors into business strategies.*

Integration of ESG Criteria: Integrating ESG criteria into structured products is challenging due to its complexity. This procedure necessitates data examination, extensive reporting, and transparency. Financial institutions must create advanced models to evaluate ESG effects and harmonize them with financial objectives.

Evolving Regulatory Landscape: The regulatory environment is always changing, with new regulations and criteria being implemented to increase transparency and responsibility. Financial institutions face compliance challenges due to the need to continually adjust to new regulations to prevent penalties and uphold investor confidence.

Data Standardization and Quality: Standardized ESG data shortages and varied metric quality pose significant barriers. Financial institutions find it challenging to assess and measure ESG products efficiently because of these discrepancies.

Investor Understanding and Education: do not have a comprehensive understanding of ESG criteria, investments, and their advantages. The lack of understanding results in doubt and delays in adopting new technologies.

Market Perception of ESG Financial Performance: Investors frequently view ESG products as providing decreased financial returns in comparison to conventional investments. Despite the potential long-term benefits, this perception can discourage investment in ESG products.

Operational Challenges: Balancing Standardization and Customization: Financial institutions need to find a balance between standardized processes and customization of ESG products to meet investor needs and regulations. Balancing compliance and market appeal is essential for success.

Product Liquidity and Scalability: Another obstacle is making sure that ESG products have enough liquidity and can be scaled up to meet market demand and investor expectations.

Risk Management and Volatility: ESG products often show higher volatility, necessitating robust risk management strategies. Financial institutions must develop effective risk mitigation frameworks to manage this volatility while ensuring attractive returns.

Technological Integration: Using technology like big data analytics and AI Tools to improve the quality and transparency of ESG data.

Corporate Engagement and Accountability: Increasing corporate accountability and integrating ESG factors into business strategies are essential for the credibility of ESG products. As companies adopt more sustainable practices, financial institutions have opportunities to collaborate and create products that align with these values.

6.2) Emerging opportunities

Table 7 S.W.O.T. matrix

	POSITIVE	NEGATIVE
INTERNAL	***Strengths*** *Strong regulatory frameworks promoting ESG transparency* *Increasing investor demand for sustainable investments* *Innovative financial products*	***Weaknesses*** *Complexity in integrating ESG criteria* *Data standardization and quality issues* *Investor understanding and education*
EXTERNAL	***Opportunities*** *Growing market for innovative ESG products* *Technological advancements in ESG data analytics* *Increased corporate accountability and engagement* *Regulatory support and incentives*	***Threats*** *Evolving regulatory requirements* *Market skepticism about ESG financial performance* *High volatility and risk*

Strengths:

Strong Regulatory Frameworks Promoting ESG Transparency: SFDR in the EU push investor trust by increasing transparency and accountability in ESG investments (Krueger et al., 2020).

Increasing Investor Demand for Sustainable Investments: There is a growing trend for sustainable investments, with a focus on ESG factors. An example would be the previously unseen increase in investments of €120 billion towards sustainable funds in Europe during the first quarter of 2021 (Morningstar, 2021).

Innovative Financial Products: Garantum and other companies have effectively created ESG structured products, showing that these new financial instruments are both feasible and accepted in the market (Case Study 1).

Weaknesses:

Complexity in Integrating ESG Criteria: Integrating ESG criteria into structured products is complex and requires advanced data analysis and comprehensive reporting (Interviews, Case Studies).

Data Standardization and Quality Issues: The lack of standardized ESG data and inconsistent quality of available metrics are major obstacles that complicate evaluation and comparison (Regression Analysis, Interviews).

Investor Understanding and Education: Many investors lack understanding of ESG investments, leading to skepticism and slower adoption rates (Interviews).

Opportunities:

Growing Market for Innovative ESG Products: There is significant potential for developing new and innovative ESG products that balance sustainability with financial performance (Analytical Data, Case Studies).

Technological Advancements in ESG Data Analytics: Leveraging big data analytics and artificial intelligence can significantly improve data quality and transparency, aiding in better evaluation of risks and opportunities (Interviews, Analytical Data).

Increased Corporate Accountability and Engagement: Financial institutions have opportunities to collaborate and create products that align with these values (Interviews).

Regulatory Support and Incentives: Regulatory incentives, like tax breaks or subsidies for sustainable investments, can encourage the development and adoption of ESG products (External Source).

Threats:

Evolving Regulatory Requirements: Constant changes in regulations demand significant resources for compliance and adapting to new standards, posing challenges for financial institutions (Case Studies, Interviews).

Market Skepticism about ESG Financial Performance: Concerns over the financial returns of ESG products compared to traditional investments can deter investment despite their potential long-term benefits (Analytical Data).

High Volatility and Risk: ESG products often exhibit higher volatility, necessitating robust risk management strategies to manage this risk while ensuring attractive returns (Analytical Data, Regression Analysis).
The S.W.O.T. analysis provides an overview to identify and interpret the emerging opportunities in ESG structured products. By leveraging strengths, addressing weaknesses, capitalizing on opportunities, and mitigating threats, financial institutions can enhance their ESG offerings, meet evolving investor preferences, and contribute to a more sustainable financial system.

7) Contribution

The study recognizes and examines the primary technical, regulatory, and operational obstacles encountered by participants in the financial sector. One of the main difficulties lies in incorporating ESG criteria into structured products. Advanced data analysis, reporting and transparency are needed to invest in technologies such as big data analytics and AI to improve the quality and evaluation of ESG data.

In fact, the, financial institutions need to develop smarts models to assess ESG impacts accurately and align them with financial goals.
Also, regulatory challenges are another significant obstacle. The constant evolving landscape requires financial institutions to always adapt to new standards to maintain compliance and avoid penalties.

Staying informed of regulatory changes and investing in compliance systems is crucial. Institutions can build trust and transparency by aligning with regulations like the SFDR.

Operationally, balancing standardization with customization presents a significant challenge. Financial institutions must develop standardized processes to ensure compliance while also offering customized ESG products that meet specific investor needs. The results indicate that financial institutions ought to put resources into education and growth opportunities to enhance the comprehension of ESG standards within their employees and customers, promoting increased approval and utilization of ESG offerings.

Despite the obstacles, the study highlights various new possibilities for participants in the financial industry. The increasing interest from investors in sustainable investments offers a substantial chance in the market. This thesis shows that investors are placing more importance on ESG factors in addition to financial gains, leading to a positive market landscape for ESG structured products. Financial institutions can benefit from this trend by creating new ESG products that link financial success with sustainability objectives.

Technological advancements offer another critical opportunity. Using big data and AI enhances ESG data accuracy, aiding in better risk assessment. Investing in these technologies gives competitive advantage in the market. The growing regulatory backing for ESG investments also offers a chance. Effective regulations provide an organized setting for the introduction and approval of ESG products. Incentives from regulations, like tax benefits or financial support for eco-friendly investments, can promote the growth and acceptance of ESG offerings. Financial institutions can collaborate with regulators to influence policies that support sustainable finance. Moreover, the increasing corporate responsibility and participation in sustainable initiatives create chances for working together to create sustainable products, improving the credibility and appeal of ESG investments.

Based on the research, the strategic recommendations are proposed for the growth of ESG structured products. Financial institutions should invest in advanced technologies like big data analytics and artificial intelligence to improve ESG data quality, credibility, risk evaluation, and product transparency. Therefore, it is essential to invest in strong compliance systems. Financial institutions need to collaborate with regulators to ensure their products align with changing standards and influence policies that promote sustainable finance.

It is crucial to create standardized procedures for ESG product development that can still be tailored to fulfill individual investor requirements. Training and development initiatives can assist employees and customers in enhancing their comprehension of ESG standards, encouraging increased acknowledgment and utilization of ESG offerings. Key to taking advantage of the increasing interest from investors in sustainable investments is to create new ESG products that combine financial success with sustainability objectives. Financial institutions need to promote these products in a compelling manner to draw in and keep

investors. Working with companies dedicated to sustainable practices can improve the credibility and appeal of ESG products. These collaborations may result in the creation of products that support sustainable business strategies, advantageous for both financial institutions and companies.

This study contributes to academic literature by conducting an examination of the obstacles in creating ESG structured products. It shows the current knowledge base by integrating real-world data, case studies, and expert opinions to offer a detailed insight into the ESG structured product market.

The research provides advices for the financial industry, policymakers, and stakeholders in sustainable finance, analyzing challenges and opportunities in ESG structured products. It offers strategic recommendations to improve growth and adoption of these products, aligning financial goals with environmental and social objectives. The suggestions aim to foster development and acceptance of ESG products, promoting sustainable finance practices for a more sustainable financial system.

8) Conclusion

This study examines the barriers and benefits associated with the use of ESG structured products in the financial industry.
The main obstacles are technical, regulatory, and operational. Integrating ESG standards into structured products requires complex data analysis, comprehensive reporting, and full transparency. Case studies and interviews with experts demonstrate the difficulties faced by financial institutions when attempting to align ESG measures with financial objectives, due to data quality and lack of standardization.

ESG regulations like the EU's SFDR create regulatory obstacles, requiring strict compliance. Adapting to new regulations poses challenges in developing ESG products. Financial industry must balance standardization of ESG products with investor and regulatory demands. Maintaining the liquidity and scalability of ESG products remains a major obstacle. Investors' lack of understanding of ESG criteria and their benefits is an obstacle to their adoption. Investor interest is also discouraged by concerns about the liquidity and financial performance of ESG products compared to traditional investments.

Despite the obstacles, the demand for innovative ESG products merging sustainability and financial benefits creates growth opportunities. The regression analysis points a trade-off between ESG ratings and financial returns, suggesting that investors might need to balance sustainability objectives with profitability goals. Big data analysis and AI can enhance the quality and transparency of ESG data, improving risk assessment. Engaging in sustainable practices and demonstrating corporate responsibility can create further opportunities.

Financial institutions and companies can create ESG products that reflect their values and attract investors by implementing sustainable practices and using government incentives. Improving ESG risk assessment involves improving analysis, using standardized metrics, investor education, and AI. Communication with regulators is crucial.

In conclusion, this study points the challenges and opportunities involved in creating and promoting ESG products, underlining that overcoming these obstacles and capitalizing on new opportunities can help align financial goals with sustainability objectives and support a transition to a more sustainable economy.

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9) Appendix:

Appendix1: Merge of ESG and non ESG ETFs Data Base

```
esg_stats = esg_df.describe()
print("Descriptive Statistics for ESG ETFs:")
print(esg_stats)
non_esg_stats = non_esg_df.describe()
print("Descriptive Statistics for non-ESG ETFs:")
print(non_esg_stats)
```

```
Descriptive Statistics for ESG ETFs:
                                Date         Open         High          Low  \
count                           6171  6171.000000  6171.000000  6171.000000
mean   2020-08-03 09:53:24.472532992    29.164870    29.286464    29.010763
min              2015-01-02 00:00:00     7.770000     7.830000     7.650000
25%              2019-01-04 00:00:00    17.139999    17.275001    16.960000
50%              2020-12-04 00:00:00    26.320000    26.360001    26.250000
75%              2022-06-17 00:00:00    42.060001    42.225000    41.780001
max              2023-12-29 00:00:00    65.879997    65.879997    65.610001
std                              NaN    15.788678    15.837640    15.725687

             Close    Adj Close       Return         Beta   Volatility  \
count  6171.000000  6171.000000  6171.000000  6171.000000  6171.000000
mean     29.153875    27.260847     0.000308     0.751814     0.180956
min       7.760000     6.711365    -0.128111     0.056281     0.052219
25%      17.080000    16.765569    -0.004438     0.056281     0.052219
50%      26.309000    23.349678     0.000189     1.031746     0.189589
75%      41.992001    40.162358     0.005215     1.031746     0.274976
max      65.779999    60.891361     0.114046     1.065038     0.274976
std      15.785782    14.866842     0.012691     0.434074     0.088734

               TRR     PE Ratio    Dividends        Volume
count  6171.000000  6171.000000  6171.000000  6.171000e+03
mean     48.583923    11.574296     0.002292  7.944291e+05
min      10.759940     0.000000     0.000000  0.000000e+00
25%      10.759940     0.000000     0.000000  1.050000e+04
50%      59.465494    14.081645     0.000000  4.460000e+04
75%      88.553923    14.081645     0.000000  2.021000e+05
max      88.553923    24.769957     0.670000  2.513540e+07
std      33.908373     8.055138     0.024131  2.124822e+06
Descriptive Statistics for non-ESG ETFs:
                                Date         Open         High          Low  \
count                           9056  9056.000000  9056.000000  9056.000000
mean   2019-07-01 19:15:03.180211968   191.751379   192.908721   190.481441
min              2015-01-02 00:00:00    49.509998    49.750000    49.040001
25%              2017-04-02 06:00:00   102.209999   102.847498   101.552498
50%              2019-07-02 12:00:00   167.190002   168.595001   166.044998
75%              2021-09-29 06:00:00   267.432510   268.824997   265.022507
max              2023-12-29 00:00:00   479.220001   479.980011   476.260010
std                              NaN   109.984507   110.656751   109.103974

             Close    Adj Close       Return         Beta   Volatility  \
count  9056.000000  9056.000000  9053.000000  9056.000000  9056.000000
mean    191.782705   181.256376     0.000532     1.011723     0.190680
min      49.520000    42.270130    -0.119788     0.929937     0.175089
25%     102.137499    93.371498    -0.004259     0.972637     0.179469
50%     167.205002   159.403572     0.000737     0.995491     0.182821
75%     266.920013   246.224972     0.006343     1.034576     0.194032
max     477.709991   475.213501     0.094898     1.125972     0.222067
std     109.930554   108.514163     0.012066     0.071449     0.018448

               TRR     PE Ratio    Dividends        Volume
count  9056.000000  9056.000000  9056.000000  9.056000e+03
mean    192.780690    25.701432     0.011196  3.475513e+07
min     109.370819    19.370440     0.000000  2.739000e+05
25%     149.226393    22.438429     0.000000  2.701100e+06
50%     167.208754    24.412069     0.000000  1.327425e+07
75%     210.763851    27.675071     0.000000  5.787218e+07
```

Appendix2: Sharpe Ratios computation

```
import pandas as pd


file_path = 'data.xlsx'
data = pd.read_excel(file_path)
risk_free_rate = 0.005
average_returns = data.groupby('Ticker')['Return'].mean()
volatility = data.groupby('Ticker')['Return'].std()
sharpe_ratios = (average_returns - risk_free_rate) / volatility
print("Sharpe Ratios for Each ETF:")
print(sharpe_ratios)
```

```
Sharpe Ratios for Each ETF:
Ticker
ACWI   -0.418367
EFIV   -0.394200
GRBN   -1.500694
ICLN   -0.263860
QQQ    -0.304515
SPY    -0.394228
VSGX   -0.400107
VTI    -0.387259
Name: Return, dtype: float64
```

Source: Ozcan, U. (March 3, 2022). Introduction to Python for Finance. UCLouvain. https://github.com/UbeyOzcan/UCLouvain_Python_Courses

Appendix3: Cumulative return and Annualized volatility computation

```
import matplotlib.pyplot as plt
import seaborn as sns
sns.set(style="whitegrid")
data['Cumulative Return'] = data.groupby('Ticker')['Return'].transform(lambda x: (1 + x).cumprod())

# cumulative return
plt.figure(figsize=(14, 7))
sns.lineplot(data=data, x='Date', y='Cumulative Return', hue='Ticker')
plt.title('Cumulative Returns for Each ETF (2015-2023)')
plt.xlabel('Year')
plt.ylabel('Cumulative Return')
plt.legend(title='Ticker', title_fontsize='13', fontsize='11')
plt.show()

# annualized volatility
annual_volatility = data.groupby('Ticker')['Return'].std() * (252**0.5)
plt.figure(figsize=(10, 6))
sns.barplot(x=annual_volatility.index, y=annual_volatility.values, palette='viridis')
plt.title('Annualized Volatility for Each ETF')
plt.xlabel('Ticker')
plt.ylabel('Annualized Volatility')
plt.show()
```

Source: Ozcan, U. (March 3, 2022). Introduction to Python for Finance. UCLouvain. https://github.com/UbeyOzcan/UCLouvain_Python_Courses

Appendix4: Sharpe Ratio Formula

$$Sharpe\ Ratio = \frac{R_p - R_f}{\sigma_p}$$

R_p = Return of portfolio

R_f = Risk-Free rate

σ_p = Standard deviation of portfolio's excess return

Appendix5: Sharpe Ratios and ESG Ratings of ETFs (2015-2023)

```
import matplotlib.pyplot as plt
import numpy as np

tickers = ['QQQ', 'SPY', 'VTI', 'ACWI', 'ICLN', 'EFIV', 'VSGX', 'GRBN']
sharpe_ratios = [2.38, 1.83, 1.77, 1.39, 0.84, 1.05, 0.75, 2.58]
esg_ratings = [6.6, 6.58, 6.44, 6.76, 7.02, 6.88, 7.1, 6.54]
sharpe_normalized = np.array(sharpe_ratios) / max(sharpe_ratios)
colors = plt.cm.inferno(sharpe_normalized)
fig, ax1 = plt.subplots()
ax1.bar(tickers, sharpe_ratios, color=colors)
ax1.set_xlabel('ETF Ticker')
ax1.set_ylabel('Sharpe Ratio')
ax1.tick_params(axis='y')

# ESG
ax2 = ax1.twinx()
ax2.plot(tickers, esg_ratings, 'o-', color='green')
ax2.set_ylabel('ESG Rating')
ax2.tick_params(axis='y', labelcolor='green')
plt.title('Sharpe Ratios and ESG Ratings of ETFs (2015-2023)')
plt.show()
```

Source: Ozcan, U. (March 3, 2022). Introduction to Python for Finance. UCLouvain. https://github.com/UbeyOzcan/UCLouvain_Python_Courses

Appendix6: Rstudio Database merging

```
> merged_data <- dplyr::left_join(data, esgrating, by = "Ticker")
> head(merged_data)
# A tibble: 6 x 20
  Ticker Date                Open  High   Low Close `Adj Close`   Return  Beta Volatility.x   TRR `PE Ratio`
  <chr>  <dttm>             <dbl> <dbl> <dbl> <dbl>       <dbl>    <dbl> <dbl>        <dbl> <dbl>      <dbl>
1 ICLN   2015-01-02 00:00:00  9.84  9.84  9.64  9.75        8.26  0        1.03        0.275  88.6       14.1
2 ICLN   2015-01-05 00:00:00  9.80  9.80  9.47  9.54        8.08 -0.0215   1.03        0.275  88.6       14.1
3 ICLN   2015-01-06 00:00:00  9.60  9.64  9.45  9.52        8.06 -0.00210  1.03        0.275  88.6       14.1
4 ICLN   2015-01-07 00:00:00  9.52  9.67  9.52  9.61        8.14  0.00945  1.03        0.275  88.6       14.1
5 ICLN   2015-01-08 00:00:00  9.67  9.85  9.67  9.84        8.33  0.0239   1.03        0.275  88.6       14.1
6 ICLN   2015-01-09 00:00:00  9.78  9.86  9.75  9.81        8.31 -0.00305  1.03        0.275  88.6       14.1
# i 8 more variables: Dividends <dbl>, Volume <dbl>, ESG_Rating <chr>, `Cumulative Return` <chr>, Years <dbl>,
#   `Annualized Return` <chr>, Volatility.y <chr>, `Sharpe Ratio` <chr>
```

Appendix7: **summaries of the Values and ESG data**

```
> model <- lm(Return ~ ESG_Rating + Volatility.x + Beta + Dividends + `Sharpe Ratio` + `Cumulative Return` + `Annualized Return`, data = merged_data)
> summary(model)
```

```
> summary(merged_data)
    Ticker               Date                          Open             High             Low
 Length:15227       Min.   :2015-01-02 00:00:00.00   Min.   :  7.77   Min.   :  7.83   Min.   :  7.65
 Class :character   1st Qu.:2017-11-16 00:00:00.00   1st Qu.: 27.70   1st Qu.: 27.75   1st Qu.: 27.65
 Mode  :character   Median :2020-03-03 00:00:00.00   Median : 80.68   Median : 81.04   Median : 80.18
                    Mean   :2019-12-10 08:17:37.27   Mean   :125.86   Mean   :126.60   Mean   :125.04
                    3rd Qu.:2022-02-08 00:00:00.00   3rd Qu.:199.88   3rd Qu.:201.16   3rd Qu.:198.16
                    Max.   :2023-12-29 00:00:00.00   Max.   :479.22   Max.   :479.98   Max.   :476.26

     Close          Adj Close          Return                Beta          Volatility.x          TRR
 Min.   :  7.76   Min.   :  6.711   Min.   :-0.1281108   Min.   :0.05628   Min.   :0.05222   Min.   : 10.76
 1st Qu.: 27.69   1st Qu.: 25.389   1st Qu.:-0.0043483   1st Qu.:0.92994   1st Qu.:0.17501   1st Qu.: 59.47
 Median : 80.70   Median : 75.918   Median : 0.0005412   Median :1.00411   Median :0.18469   Median :109.37
 Mean   :125.87   Mean   :118.847   Mean   : 0.0004416   Mean   :0.90639   Mean   :0.18674   Mean   :134.34
 3rd Qu.:199.78   3rd Qu.:181.042   3rd Qu.: 0.0059313   3rd Qu.:1.03175   3rd Qu.:0.22207   3rd Qu.:171.91
 Max.   :477.71   Max.   :475.214   Max.   : 0.1140456   Max.   :1.12597   Max.   :0.27498   Max.   :327.33
                                    NA's   :3
    PE Ratio        Dividends            Volume           ESG_Rating        Cumulative Return      Years
 Min.   : 0.00   Min.   :0.000000   Min.   :        0   Length:15227       Length:15227       Min.   :8
 1st Qu.:14.08   1st Qu.:0.000000   1st Qu.:    92800   Class :character   Class :character   1st Qu.:8
 Median :23.46   Median :0.000000   Median :  2611300   Mode  :character   Mode  :character   Median :8
 Mean   :19.98   Mean   :0.007587   Mean   : 20991983                                         Mean   :8
 3rd Qu.:25.36   3rd Qu.:0.000000   3rd Qu.: 27883850                                         3rd Qu.:8
 Max.   :34.61   Max.   :1.906000   Max.   :507244300                                         Max.   :8

 Annualized Return  Volatility.y       Sharpe Ratio
 Length:15227       Length:15227       Length:15227
 Class :character   Class :character   Class :character
 Mode  :character   Mode  :character   Mode  :character
```

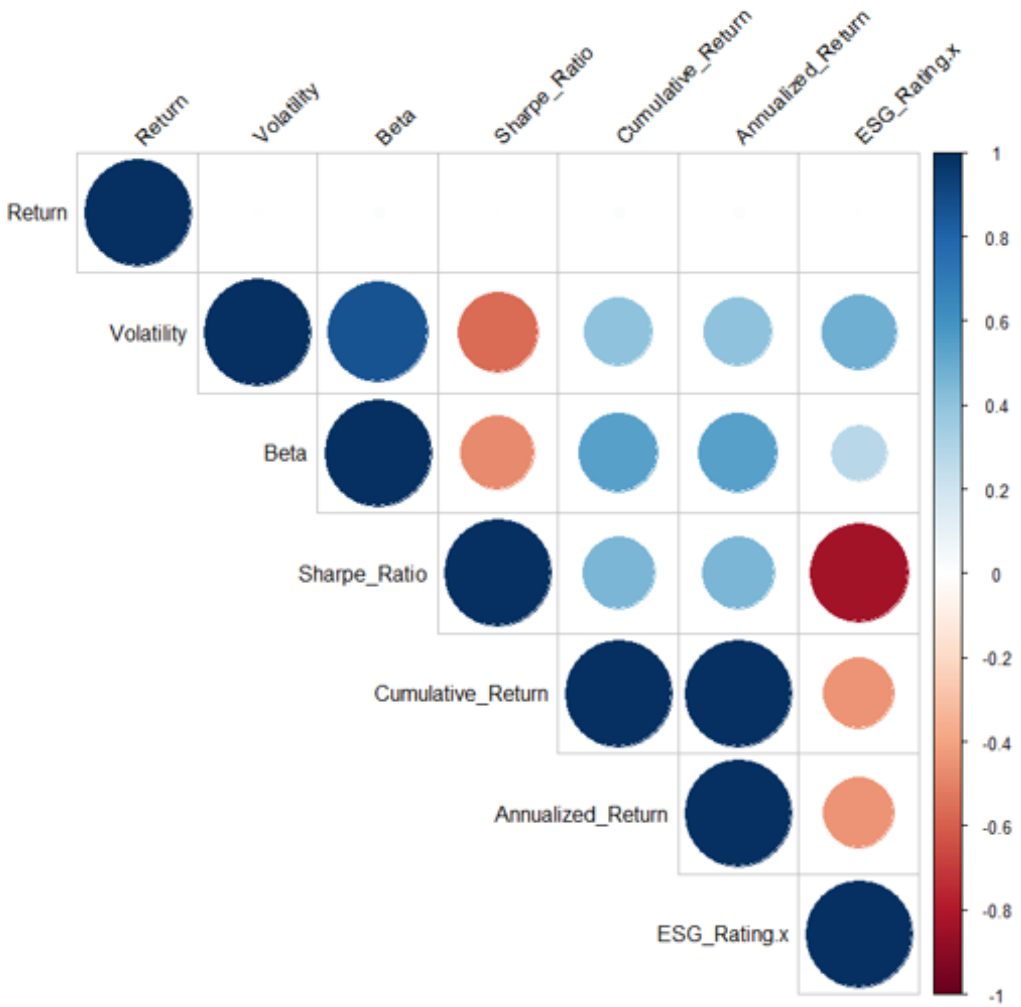
Appendix8: Linear regression

```
> data$ESG_Rating <- as.numeric(data$ESG_Rating.x)
> str(data)
'data.frame':   15227 obs. of  20 variables:
 $ Ticker           : chr  "ACWI" "ACWI" "ACWI" "ACWI" ...
 $ Date             : POSIXct, format: "2015-01-02" "2015-01-05" "2015-01-06" "2015-01-07" ...
 $ Open             : num  58.7 58 57.2 57.1 57.9 ...
 $ High             : num  58.9 58 57.4 57.4 58.4 ...
 $ Low              : num  58.2 57.1 56.4 56.9 57.8 ...
 $ Close            : num  58.4 57.2 56.6 57.4 58.3 ...
 $ Adj Close        : num  48.6 47.6 47.2 47.8 48.5 ...
 $ Return           : num  NA -0.0197 -0.0103 0.0131 0.0157 ...
 $ Beta             : num  0.93 0.93 0.93 0.93 0.93 ...
 $ Volatility       : num  0.175 0.175 0.175 0.175 0.175 ...
 $ TRR              : num  109 109 109 109 109 ...
 $ PE Ratio         : num  19.4 19.4 19.4 19.4 19.4 ...
 $ Dividends        : num  0 0 0 0 0 0 0 0 0 0 ...
 $ Volume           : num  1424100 2173500 5221500 2697900 1926900 ...
 $ ESG_Rating.x     : num  6.76 6.76 6.76 6.76 6.76 6.76 6.76 6.76 6.76 6.76 ...
 $ ESG_Rating.y     : num  6.76 6.76 6.76 6.76 6.76 6.76 6.76 6.76 6.76 6.76 ...
 $ Cumulative_Return: num  2.09 2.09 2.09 2.09 2.09 2.09 2.09 2.09 2.09 2.09 ...
 $ Annualized_Return: num  0.261 0.261 0.261 0.261 0.261 0.261 0.261 0.261 0.261 0.261 ...
 $ Sharpe_Ratio     : num  1.39 1.39 1.39 1.39 1.39 1.39 1.39 1.39 1.39 1.39 ...
 $ ESG_Rating       : num  6.76 6.76 6.76 6.76 6.76 6.76 6.76 6.76 6.76 6.76 ...
>
```

```
Call:
lm(formula = ESG_Rating.x ~ Return + Volatility + Beta + Sharpe_Ratio +
    Cumulative_Return + Annualized_Return, data = data)

Residuals:
      Min        1Q    Median        3Q       Max
-0.153385 -0.003599  0.016462  0.044035  0.134945

Coefficients:
                   Estimate Std. Error  t value Pr(>|t|)
(Intercept)         9.29529    0.02445  380.183   <2e-16 ***
Return             -0.02293    0.05377   -0.427     0.67
Volatility         -1.18841    0.04709  -25.236   <2e-16 ***
Beta               -1.92186    0.01745 -110.135   <2e-16 ***
Sharpe_Ratio       -1.31328    0.01154 -113.838   <2e-16 ***
Cumulative_Return -35.67507    0.43269  -82.449   <2e-16 ***
Annualized_Return 290.53756    3.48637   83.335   <2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.08174 on 15217 degrees of freedom
  (3 observations effacées parce que manquantes)
Multiple R-squared:  0.8608,    Adjusted R-squared:  0.8607
F-statistic: 1.568e+04 on 6 and 15217 DF,  p-value: < 2.2e-16
```

Appendix9: Correlation matrix

```
> relevant_columns <- data[, c("Return", "Volatility", "Beta", "Sharpe_Ratio", "Cumulative_Return", "Annualized_Return", "ESG_Rating.x")]
> cor_matrix <- cor(relevant_columns, use = "complete.obs")
> print(cor_matrix)
                      Return   Volatility        Beta Sharpe_Ratio Cumulative_Return Annualized_Return ESG_Rating.x
Return            1.000000000  0.009740643  0.01157397  0.001396812        0.01349032        0.01348709 -0.002901535
Volatility        0.009740643  1.000000000  0.86217984 -0.568457248        0.40682265        0.40600864  0.482828579
Beta              0.011573967  0.862179835  1.00000000 -0.472471942        0.54837669        0.54802674  0.276137978
Sharpe_Ratio      0.001396812 -0.568457248 -0.47247194  1.000000000        0.45586160        0.45648707 -0.839727990
Cumulative_Return 0.013490325  0.406822651  0.54837669  0.455861601        1.00000000        0.99999789 -0.447122423
Annualized_Return 0.013487095  0.406008640  0.54802674  0.456487072        0.99999789        1.00000000 -0.447560486
ESG_Rating.x      -0.002901535 0.482828579  0.27613798 -0.839727990       -0.44712242       -0.44756049  1.000000000
> corrplot(cor_matrix, method = "circle", type = "upper", tl.col = "black", tl.srt = 45)
>
> view(cor_matrix)
```



Appendix10: Survey

Réponses	Réponses
2	Croquet Clément
14	Alissa Meyer
25	Madhu Ramachandran
16	Amine T
16	Gilles Humbert

4. Area of Expertise

5 Réponses

ID ↑	Nom	Réponses
1	anonymous	Financial Markets
2	anonymous	Fund Industry
3	anonymous	Investment Products incl Funds
4	anonymous	Project Management / Transaction Tools / ESG
5	anonymous	Derivatives & Structured Products

5. How would you define ESG structured products in the context of your work?

5 Réponses

ID ↑	Nom	Réponses
1	anonymous	A structured product with ESG underlying(s).
2	anonymous	products/funds investing in projects that focus on impact on society and environment while still aiming to generate returns
3	anonymous	Not very often
4	anonymous	A needed but complex offering difficult to assess from an ESG Perspective
5	anonymous	integrate environmental, social, and governance factors into their investment strategies, aiming to generate returns while promoting sustainable and responsible practices. In my role, I design tailored investment solutions aligning with clients' ESG preferences using derivatives and structured products.

5. How would you define ESG structured products in the context of your work?

5 Réponses

ID ↑	Nom	Réponses
1	anonymous	A structured product with ESG underlying(s).
2	anonymous	products/funds investing in projects that focus on impact on society and environment while still aiming to generate returns
3	anonymous	Not very often
4	anonymous	A needed but complex offering difficult to assess from an ESG Perspective
5	anonymous	integrate environmental, social, and governance factors into their investment strategies, aiming to generate returns while promoting sustainable and responsible practices. In my role, I design tailored investment solutions aligning with clients' ESG preferences using derivatives and structured products.

7. What are the primary challenges you face in developing structured products?

5 Réponses

ID ↑	Nom	Réponses
1	anonymous	the needs of the clients, defining its risk profile and the complexity of the asset.
2	anonymous	strict regulations and additional layer of framework to comply with
3	anonymous	Incorporate ESG & SI features and content in the design phase and enable bespoke choices to be made by clients in design phase for tailor-made structured products
4	anonymous	Issuer Default Risk / Uncollateralised Product Risk
5	anonymous	The primary challenges in developing structured products include complexity in design and understanding, ensuring regulatory compliance amidst evolving regulations, managing various market risks such as interest rate and credit risk, ensuring suitability for clients, determining fair pricing and valuation, addressing counterparty risk, and staying responsive to market demand and trends.

8. How significant is the issue of data availability and quality in developing sustainable structured products? Can you provide examples?

5 Réponses

ID ↑	Nom	Réponses
1	anonymous	/
2	anonymous	reliable and up-to-date data is key for the ability to assess if a product/target investment qualifies for ESG
3	anonymous	The availability of data and taxonomy around companies and instruments issued has significant improved especially in Europe. However challenges remain with exotic instruments like Hedge Funds, EM Bonds etc.
4	anonymous	The taxonomy is improving but there is no clear guidance from regulator to facilitate Comparability between ESG Rating methods between Marketdata providers
5	anonymous	Reliable and comprehensive ESG data is crucial for assessing sustainability performance and integrating ESG criteria into product design. For example, when structuring green bond-linked derivatives, detailed environmental impact data on underlying projects is essential for assessing green credentials and managing risks

9. What challenges do you encounter in marketing ESG structured products to investors?

5 Réponses

ID ↑	Nom	Réponses
1	anonymous	not my domain
2	anonymous	regulatory framework around ESG disclosures and marketing standards are evolving, leading to uncertainty and potential compliance challenges
3	anonymous	A simple and understandable way to understand and incorporate ESG / SI in Structured Products. An approach similar to funds like Article 6, 8 & 9 funds should be considered and will ease the process for investors.
4	anonymous	It is often a limited offer for professional clients for whom ESG might not a driver for investments
5	anonymous	Challenges in marketing ESG structured products to investors include the need for education and awareness about ESG concepts, addressing perceptions of performance trade-offs, ensuring data transparency and disclosure, aligning products with investors' values, and navigating a competitive landscape.

10. In your view, how does regulatory uncertainty or variance across regions affect the development and marketing of ESG structured products?

5 Réponses

2	anonymous	higher uncertainty and potential compliance challenges
3	anonymous	Given we are in Europe and issuance of Structured Products is govered by European prospectus directive one can consider the regulatory uncertainty is minimum. However there are still challenges in topics like Carbon Emissions etc. where further improvements are needed to standardize and harmonize. However once we look at markets beyond Europe there very diverging regulatory landscape. Convergence here will take very many years and will also be affected by discussions in COP etc.
4	anonymous	ESG Regulation in European Countries is adding a layer of complexity and sometimes unnecessary processing which is not the case is majority of countries.
5	anonymous	Divergent regulatory frameworks and standards create complexity and compliance challenges for product development and distribution. For instance, differing ESG reporting requirements and definitions of sustainability criteria across jurisdictions can complicate the assessment of ESG performance and the design of standardized products. Additionally, regulatory uncertainty regarding future ESG mandates or taxonomies may deter investors and issuers from fully committing to ESG investments. Moreover, compliance costs associated with navigating multiple

11. What opportunities do you see for the growth of ESG structured products in the current financial landscape?

5 Réponses

ID ↑	Nom	Réponses
1	anonymous	huge opportunity with the increased interest from the clients
2	anonymous	increasing investor demand, especially from younger generations that align with their values and beliefs
3	anonymous	Surely key and important for Structured Products to adopt ESG & SI. That is the future
4	anonymous	This is a niche market from my perspective. Unless you show this is performing better than a non ESG structured Product, the buy in will be low
5	anonymous	increasing investor demand, supportive regulatory initiatives, advancements in ESG data analytics, and collaborations driving product innovation and market expansion.

12. Can you share examples of innovative practices or products that have successfully addressed challenges in sustainable structured product development?

5 Réponses

ID ↑	Nom	Réponses
1	anonymous	??
2	anonymous	Impact investing funds focusing on generating positive environmental impact alongside financial returns (e.g. fund focused on UN's SDG 14 (Life below Water); fund aiming to lead UK's energy transition by investing in the emerging green hydrogen economy; fund seeking to transform the paper and textile pulp industries while protecting the world's high carbon, high biodiversity-value forests; fund focusing on creation of a high quality carbon economy by reversing humanity's carbon streams)
3	anonymous	Not involved in structuring and hence leave this for the experts involved in product origination.
4	anonymous	Nothing to my knowledge. Makes more sense in the fund industry.
5	anonymous	For instance, green bonds have been integrated as underlying assets in structured products, providing investors exposure to environmentally friendly projects while benefiting from structured payoff profiles. Similarly, structured products linked to ESG indices have gained traction, offering investors exposure to companies with strong environmental, social, and governance practices. Derivative instruments like ESG futures, options, and swaps enable investors to manage ESG-related risks effectively, offering flexibility and customization. Impact-linked securities tie financial returns to specific sustainability outcomes, aligning investor incentives with measurable impact metrics. Additionally, green structured notes combine structured payoff profiles with green bond proceeds, catering to investor demand for sustainable investment options. These innovative solutions address challenges such as risk management, data transparency, and investor demand, enabling investors to align financial objectives with sustainability goals seamlessly

13. What role do you believe technology and innovation play in overcoming the challenges associated with ESG structured products?

5 Réponses

ID ↑	Nom	Réponses
1	anonymous	??
2	anonymous	provision of advanced tools, analytical capabilities and investment opportunities promoting sustainable and responsible investing
3	anonymous	Technology will be key as clients need to understand more easily the ESG / SI aspects, and moreover they should have possibility to customize their preferred SI features in a bespoke manner when subscribing into Structured Products
4	anonymous	Unless there is a standardized way to rate a structured product as soon as it is issues, there is no reason to give an ESG rating which can vary depending on the issuer and the underlying market data he is using
5	anonymous	Data Analytics and Artificial Intelligence (AI) - Blockchain Technology: - Fintech Solutions -Big Data and Predictive Analytics - Sustainable Finance Innovations

14. How do you foresee the evolution of ESG structured products in the next 5-10 years ?

5 Réponses

ID ↑	Nom	Réponses
1	anonymous	a sustained growth
2	anonymous	ESG considerations will become integrated into mainstream investment practices leading to diversification of ESG products as well as enhanced data and analytics; in addition, regulatory developments should lead to more transparency and consistency as well as accountability
3	anonymous	It is here to stay and will even be the main stay. One can even argue that there is no way one can be a viable provider if ESG is not offered.
4	anonymous	This is not going to be a major ESG Relevant instrument. Unless for simple Structured Products
5	anonymous	In the next 5-10 years, ESG structured products will see significant growth and evolution. This will be driven by expanding integration of ESG into mainstream investment strategies, continued innovation in product design, advancements in technology such as AI and blockchain, standardization of ESG reporting, and increased focus on impact investing. These trends will contribute to greater accessibility, transparency, and adoption of ESG structured products, playing a pivotal role in driving sustainable finance and contributing to a more inclusive and environmentally sustainable global economy.

15. What actions or changes would you recommend to stimulate growth and investor interest in sustainable structured products?

5 Réponses

ID ↑	Nom	Réponses
1	anonymous	to define an ESG profile for investor (similar to the risk profile)
2	anonymous	regulatory support and incentives (tax incentives, subsidies, preferential treatment)
3	anonymous	Build on the high level of awareness on SI / ESG created due to MiFID regulations and make Structured Product offering a key component
4	anonymous	Show the real added value to end investors based on a consensus Rating which is never going to be possible
5	anonymous	Increased standardization in ESG criteria and reporting would positively impact ESG structured products. It would enhance transparency and comparability, reducing information asymmetry between issuers and investors. This would foster trust and confidence, driving greater acceptance of ESG products. Standardization would streamline product development, leading to a wider variety of ESG products catering to diverse investor preferences. Lower compliance costs for issuers would incentivize more ESG product development, increasing market liquidity. Overall, increased standardization could lead to broader market adoption of ESG structured products, driving further innovation and growth in the ESG investment space.

16. In your opinion, what could be the impact of increased standardization (e.g., in ESG criteria, reporting) on the development and acceptance of ESG structured products?

5 Réponses

ID ↑	Nom	Réponses
1	anonymous	it would facilitate the development of ESG structured products
2	anonymous	improved transparency and comparability, reduced information asymmetry, facilitated regulatory compliance
3	anonymous	A fine balance is needed between standardization and customization. Standards are key so that there is transparency for the investors and but customization is also key to position structured products as being different than Investment Funds etc.
4	anonymous	Reporting has never increase acceptance of ESG in general. As this ends up the same way. Big corporations/issuers will have the capacity to market their instruments in an ESG way.
5	anonymous	Increased standardization in ESG criteria and reporting could boost transparency, comparability, and trust in ESG structured products, driving greater acceptance among investors. Streamlined product development, lower compliance costs, and increased market adoption may result, fostering innovation and growth in the ESG investment space.

17. Is there any aspect of ESG structured products not covered in this questionnaire that you think is crucial for understanding their development and market acceptance?

4 Réponses

ID ↑	Nom	Réponses
1	anonymous	/
2	anonymous	Questionaire covers all aspects
3	anonymous	Structured Products are complex instruments with multiple variation often for experienced investors who don't focus on ESG to make trading decisions. There is potentially a tax aspect to non ESG instruments.
4	anonymous	One crucial aspect not covered in this questionnaire is the role of active engagement, stewardship, and industry collaboration in promoting the development and market acceptance of ESG structured products. Active engagement involves investors influencing companies' ESG practices through dialogue and voting, while stewardship focuses on responsible investment management for long-term value creation. Industry collaboration fosters standardization, innovation, and best practices, creating a conducive environment for ESG structured product adoption. Understanding these factors is essential for comprehensively assessing ESG structured product development and market acceptance.

Abstract:

This thesis examines the challenges and opportunities associated with the development of ESG structured products within the financial industry. It identifies technical challenges such as the integration of ESG criteria, regulatory obstacles linked to evolving standards, and operational difficulties linked to the balance between standardization and customization. Through case studies, expert interviews and data analysis, the study offers strategic recommendations such as investing in cutting-edge technologies, improving regulatory compliance, and promoting investor education. The results highlight new opportunities, including the growing demand for sustainable investments and technological advances. This work contributes to the literature and practice of sustainable finance by providing actionable strategies to promote the growth and adoption of ESG structured products, supporting the transition to a more sustainable economy

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