Proceedings of the 4th International Conference on Business and Policy Studies
DOI: 10.54254/2754-1169/156/2025.20653

Feasibility of Quantitative Theory in ESG Investment Field

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Abstract: Environment (E), society (S), and governance (G) are the key drivers for corporate sustainability in the modern world. To better implement ESG investment standards and control risks, quantitative methods should be introduced to practice the ESG investment philosophy. This article studies that sustainable development is a development concept put forward by human beings today after reflection and looking forward to the future. ESG has become a factor to be evaluated together with economic and financial indicators in corporate management and financial investment. By tracing the development history of ESG and analyzing the different focuses of the globally recognized ESG evaluation systems nowadays, the non-financial information of enterprises regarding ESG is used, and the quantitative methods in the field of financial investment are applied to develop relevant data platforms. Research shows that by quantifying the data in the three dimensions related to ESG, the data will be clearer and more accurate, enabling investors to maximize their returns under the condition that ESG risks are controllable.

Keywords: ESG, quantitative, investment

1. Introduction

Environment (E), society (S), and governance (G) are the key drivers for corporate sustainability in the modern world. To promote the implementation of sustainable development principles, the United Nations Global Compact introduced the ESG concept in 2004, which has been widely recognized by regulatory bodies and the business community worldwide. ESG, as three aspects of corporate sustainable development, has also become a consideration for investors' returns and risks. As non-financial information for listed companies, ESG is an important supplement to fundamental research and investment, but in recent years, listed companies have frequently collapsed, often not because of poor financial performance, but because of major risks in non-financial indicators. To better implement ESG investment standards and control risks, quantitative methods should be introduced to practice the ESG investment philosophy.

Dr. Andrij Fetsun1 and Dr. Dirk Söhnholz optimize investment portfolios using the ESG multi-factor model—adopting the ESG data from Sustainalytics and forming the ESG scores and scores of various aspects of companies by aggregating multiple sub-factors, thus laying a foundation for investment analysis.

Environmental Resources Management (ERM), the world's largest pure-play sustainability consultancy, has announced that the company is establishing a partnership with Salesforce, the global leader in CRM, to help organizations accelerate their decarbonization journeys and deliver on their

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sustainability goals[1]. ERM research indicates that with the rapid expansion of ESG fund scale nowadays and the stricter corporate ESG disclosure requirements, insufficient data transparency and lack of consistency in methods of ESG have dampened the confidence of investors and enterprises. Against this backdrop, ERM conducts research to deeply analyze the current situation and pain points of ESG ratings.

The relevant report studied the application of quantitative methods in sustainability. Currently, it is possible to moderately adjust the components of an investment portfolio according to ESG ratings and precisely quantify the ratio of ESG and non-ESG factors to achieve the synergy between wealth appreciation and sustainable goals. This is the development trend of ESG investment. Introducing quantitative methods into ESG investment has powerful advantages. Starting from the history of ESG development, by using well-known investment banks in the world today, applying quantitative theory, and building a data platform through years of effort, ESG ratings can be tracked, and the objectivity and accuracy of ESG assessment can be continuously improved.

ESG is an important means to promote the sustainable development of enterprises in today's world. To better implement the ESG investment standards and control risks, quantitative methods are introduced to practice the ESG investment concept.

2. Development History of ESG

ESG is an important concept of corporate management and financial investment that has emerged in recent years. The core view of ESG is that corporate activities and financial behaviors should not only pursue economic indicators, but also consider environmental protection, social responsibility and governance effectiveness, to achieve sustainable development of human society. The core of the ESG concept is the multi-dimensional and balanced development of enterprises. ESG-related concepts, such as corporate social responsibility and socially responsible investing, emerged in the 70s of the 20th centuries [2].

The concept of ESG can be traced back to socially responsible investing in the 1970s. In 1965, Sweden launched the world's first socially responsible investment-based fund, AkiteAnsvar Aktiefond, marking the beginning of an investment philosophy based on a negative screening strategy. Later, in 1971, the United States launched its first socially responsible investment fund, the Pikes World Fund; In 1977, Leon Sullivan developed the Sullivan Principles to guide corporate behavior. These initial attempts laid the theoretical and practical foundation for the development of ESG [2].

During the embryonic period of ESG from 1990 to 2004, global environmental problems became increasingly prominent, arousing the attention of countries to sustainable development, and the coordinated development of society, economy, population, resources and environment became the core issue of the international community at that time. In 2004, the United Nations Global Compact and 20 financial institutions jointly released a famous report entitled Who Cares Wins, which summarized and integrated these ten values and principles into three dimensions of environmental, social and governance, and formally put forward the concept of ESG. The ESC concept is a highly inclusive synthesis of corporate sustainability-related concepts. Many other concepts such as corporate social responsibility, corporate environmental responsibility, socially responsible investment, green finance, impact investing, corporate citizenship, etc.., can be included in the scope of ESG [2].

ESG has ushered in rapid development. In 2006, the United Nations established the United Nations-supported Principles for Responsible Investment (UN PRI) to promote investment institutions to integrate ESG into investment decision-making, to drive the practice and popularization of ESG concepts through investment. In 2009, the Global Impact Investing Network was launched. In 2011, the Sustainability Accounting Standards Board (SASB) was established. In 2015, the United Nations established 17 Sustainable Development Goals (SDGs); The Paris Agreement was reached.

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In 2016, the Workforce Information Disclosure Initiative (WDI) was established. In 2018, the European Union proposed an action plan for sustainable finance. In 2019, the American Business Roundtable organization redefined the mission of business. In 2020, relevant institutions and organizations began to establish a unified ESC disclosure standard. [2] In 2021, the International Financial Reporting Standards Fund (IFRS) Trustees announced the establishment of the International Sustainability Standards Board (ISSB) at COP26 in Glasgow on 3 November 2021[3].

2. ESG Rate System

ESG indicators are parameters that measure the performance of a company in three aspects: environmental mirror, society, and governance. Academic institutions, consulting companies, fund companies, rating institutions and international organizations have proposed dozens of ESC evaluation systems. These evaluation systems focus on building standardized indicators that can reflect the company's ESC performance, providing an orderly and feasible organizational framework for ESG evaluation. Different evaluation systems differ in many ways. According to the report "Rate the Raters 2023 – ESG Ratings at a crossroads", the top-quality rating agencies are selected and introduced [4].

2.1. MSCI ESG

MSCI is a provider of investment decision support tools with a strong presence in global capital markets. Morgan Stanley Capital International's (MSCI) ESG research takes a comprehensive approach to evaluating a company's ESG performance, with a focus on key ESG risk exposures and management capabilities. MSCI screens out the most important ESG issues in each sub-sector of the Global Industry Classification Standard. Data is sourced from corporate disclosures, government databases, media sources, and non-governmental organizations, and the accuracy of assessments is improved through proprietary data and direct corporate involvement. Each key ESG issue is weighted according to its importance to a particular industry and companies are scored, resulting in an overall ESG rating ranging from AAA (Leader) to CCC (Laggard). MSCI also considers controversial events that may affect a company's ESG rating and makes score deductions based on their severity and response. The methodology includes a quality audit to ensure the accuracy and reliability of the data, and its ratings are constantly updated to reflect the latest information. It is to form a dynamically updated ESG rating system [5].

2.2. Sustainalytics

Sustainalytics is a global company focused on research and data analytics. The agency helps investors and businesses identify, understand, and manage sustainability-related risks and opportunities, providing comprehensive support for ESG investing, sustainable finance, and corporate responsibility management. Sustainalytics' ESG risk rating methodology combines the concepts of risk exposure and risk management, identifying 20 material ESG issues for each industry. The rating consists of three core modules: corporate governance, material ESG issues, and special issues (such as black swan events), which are divided into five levels: "low, medium-low, medium, medium, high, and severe". Emphasizing the transparency of its methodology, Sustainalytics covers more than 14,000 companies across 42 industries, with a particular focus on Chinese-listed companies. Sustainalytics ensures that ratings remain relevant and relevant in the changing ESG risk environment by regularly updating its methodology [6].

2.3. FTSE Russell

FTSE RUSSELL's ESG methodology is designed to help investors integrate ESG factors into their investment strategies, providing comprehensive and objective ESG performance data. FTSE Russell

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uses more than 300 indicators to assess more than 8,000 companies in 47 developed and emerging markets. The methodology also identifies industry-specific material ESG issues, ensuring that scores reflect actual risks and opportunities. FTSE Russell emphasizes transparency and makes ESG data accessible through various platform interfaces to facilitate investment decision-making [7].

2.4. ISS ESG

ISS ESG considers the impact on all relevant stakeholders, including employees, suppliers, customers, communities, etc. ISS ESG focuses on material ESG issues related to long-term value creation, adopting a dual materiality perspective, considering both the financial impact of ESG risks on companies and the broader impact of corporate activities on society and the environment. The company's sustainability performance is rated from D- to A+, and companies that exceed certain industry thresholds are awarded "Prime Status". The rating process includes industry classification, rating structure and weight adjustment, identification of key issues, evaluation rule judgment and quality review [6].

2.5. Moody's

Moody's ESG solutions incorporate ESG factors into its credit analysis and are designed to assess ESG factors that have a significant impact on an issuer's credit profile. For example, the Issuer Profile Score (IPS) is used to assess the exposure to ESG risks, the Credit Impact Score (CIS) is used to reflect the impact of these risks on credit ratings, and the Carbon Transition Index (CTI) is provided to analyze the carbon transition risks of non-financial companies. Moody's regularly updates its ESG methodology, optimizes its data structure, and fully interacts with customers and market participants to uncover the true demands of the market [6].

2.6. Vigeo Eiris

Vigeo Eiris is part of Moody's ESG solutions, where ESG factors are categorized into six key areas, including environment, human rights, human resources, community engagement, business conduct and corporate governance. The criteria in each area are scored based on the company's policies, actions, and results, resulting in an overall ESG rating of 0 to 100. In addition, Vigeo Eiris evaluates controversies related to ESG issues, analyzing events that may affect a company's reputation and overall performance, with significant controversies leading to lower scores in relevant areas. Vigeo Eiris also collaborates with stakeholders such as sustainable finance professionals, academics, and regulators to continuously improve its assessment process [6].

2.7. Bloomberg

Bloomberg's ESG data services provide a comprehensive and transparent approach. First, the ESG scoring system assigns an environmental and social (ES) score to a company, which ranges from 0 to 10. These scores are based on the Bloomberg Intelligence (BI) Prioritization Rankings, which are weighted for industry-relevant issues. Second, Bloomberg provides a board composition score, which assesses factors such as board diversity, tenure, and independence. The scoring system focuses on metrics related to financial materiality, business relevance, and industry specificity [6].

2.8. LSEG ESG

LSEG ESG (formerly known as Refinitiv) scores cover nearly 70% of the world's markets, using more than 400 indicators. Environmental and social scores are weighed according to their sector relevance, while governance scores are weighed consistently across all sectors, resulting in an overall

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score ranging from 0 (worst) to 100 (best). Refinitiv uses a proprietary materiality matrix to assess the materiality of different ESG metrics across industries, dynamically adjusting as a company's ESG disclosures evolve. This approach assigns zero points to companies that do not report relevant metrics to encourage better disclosure practices [8].

2.9. CDP

The Carbon Disclosure Project (CDP) has a special focus on climate change, water security and forests-related issues. CDP standardizes the data collected through detailed questionnaires to ensure comparability between companies and industries. CDP classifies company scores into four levels: Disclosure Level (D-/D), Awareness Level (C-/C), Management Level (B-/B), and Leadership Level (A-/A). The methodology adjusts the weighting of different environmental factors based on the relevance of different industries, ensuring that the scores reflect the specific environmental challenges and opportunities faced by companies in different industries. CDP's questionnaires and scoring methodologies are aligned with global frameworks, including the Task Force on Climate-related Financial Disclosures (TCFD), the International Financial Reporting Standards (IFRS) for climate-related disclosures, and the European Sustainability Reporting Standards (ESRS) [4].

3. Quantitative Investing

According to the Certificate in Quantitative Finance (CQF) website, quantitative investing is an investment field that uses mathematical methods, probabilistic and statistical analysis, and data analysis, including machine learning techniques, to develop trading strategies, build portfolios, and manage risk. For investment portfolios, ESG is actually a consideration of returns and risks and a combination of long-term investment and fundamental investment. ESG investment puts the non-financial information of listed companies in the primary research object, which is an important supplement and improvement of fundamental research and investment, and ESG investment has complete review standards in the field of non-financial information research. ESG investment is to collect non-financial information puzzles through a comprehensive analysis of the bits and pieces of listed companies in the process of continuous operation, to make a relatively objective and accurate assessment of the ESG risks of listed companies. ESG investing and mainstream investment methods can complement each other by merging non-financial and financial information into a more complete information puzzle. Specifically, it is embodied in:

Data availability: ESG-related data includes three dimensions: environmental, social and governance, involving hundreds of thousands of different data indicators. Data types are further divided into numerical data, text data, images, and images. The data comes from professional databases, websites, corporate sustainability reports, and information disclosed by government regulatory authorities. Data is the foundation of all ESG analysis and ESG investing.

Quantitative processing of qualitative data: Many of the data in ESG are not all numerical data, including qualitative descriptions of a large amount of textual information. Since the final data processing must be for numerical data, ESG investment must face the quantitative processing of qualitative data.

3.1. ESG investing

Early research has shown that ESG factors may improve investment returns, but their optimization effect is limited by the dimension and weight allocation of scoring data. Modern quantitative methods provide investors with a more forward-looking optimization tool by integrating a more comprehensive set of ESG factors, data sources and scoring agencies: ESG data from Sustainalytics, a global leader in sustainability analytics covering 2,265 companies and back testing. The agency

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compiles ESG scores based on a variety of sources, including 148 ESG sub-factors (34 governance, 58 social, and 55 environmental scores), each sub-factor is valued by analysts (0% - 100%) and revalidated, and the company's total ESG score is weighted by users to determine the weight of each sub-factor, and the aggregate score data of environmental, social, and governance is available on a monthly basis. The conclusion is that Sustainalytics' 148 ESG factors are potentially important to investors in responsible investment strategies, but not all of them optimize portfolios. Constructing a customized strategy based on multi-factor analysis, back-testing has shown that it can increase returns rather than reduce risks, and future research can expand the time series and analyze industry and regional characteristics [9].

3.2. Quantitative ESG Investing

PanAgorn Asset Management is a quantitative investment management firm with a unique approach designed to capitalize on market cycle inefficiencies to achieve relative and absolute returns through innovative strategies, blending investment ideas, original research and quantitative frameworks, and teamwork to drive growth. In an article produced by the company, the following six ESG investment strategies are described in detail: 1. Solving 2. Utilizing unstructured data3. Dealing with ESG data quality issues: 4. Extracting ESG insights5. Identifying important ESG factors (IMM)6. Replicating commercial ESG ratings. The role of these methods is to use financial domain knowledge, combined with advanced statistical techniques, to analyze the collected and cleaned ESG data, and mine insights into various ESG issues based on the statistical analysis and econometric fitting of ESG ratings based on company indicators, a reasonable model that can better predict business ESG ratings is found through linear combination. This allows asset owners to optimize their portfolios based on their specific preferences and make trade-offs between wealth creation goals and societal preferences.

Using the strategy, the advantages of the quantification method are described: the quantification method can use unstructured data (e.g., NLP analysis of meeting records) to fill data gaps and deal with quality issues (e.g., normalization detection of outliers). In addition, ESG ratings vary greatly due to definitions, data acquisition, and weighting differences, so quantitative investors can identify material ESG factors (IMMs) based on company characteristics to avoid the limitations of industry classification. Quant can fit ESG ratings based on company metrics, and PanAgora's research confirms that its proprietary ESG factors are effective in predicting business ESG ratings. In addition, quantitative methods can be better integrated with MPT, incorporate ESG factors into portfolio construction, use quantitative techniques to balance financial returns and social preferences and explore portfolio optimization solutions

The article concludes that a major aspect of quantitative investing in the first place is to develop models based on historical relationships to assign predictive alpha scores to a range of stocks. In the world of ESG investing, quantitative techniques combine domain knowledge, modern data, and digital tools to help investors succeed in sustainable investing [10].

4. Conclusion

This paper explores the relationship between ESG concepts and listed company investment, which is increasingly concerned in today's economic field, through the concept of more precise corporate management and financial investment in recent years. Based on internationally recognized ESG evaluation systems, such as Sustainalytics, ISS ESG, FTSE Russell, and Vigeo Eiris, this paper analyzes the events that may affect the company's reputation and overall performance, as well as the degree of influence of various stakeholders, based on the company's risk exposure and risk management. The ESG methodology aims to help investors integrate ESG factors into their investment strategies and provide comprehensive and objective ESG performance data. The collected

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data can be standardized through detailed questionnaires to ensure comparability between companies and industries.

ESG investing is a consideration of both returns and risks. Controlling the risk factors derived from ESG investment is called "ESG risk", and controlling ESG risk has become an important part of ESG investment management. Through the research on ESG evaluation system and quantitative investment principles, it is found that quantitative investment is actually based on the consideration of returns and risks, and is a combination of long-term investment and fundamental investment.

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