

Fund Return Forecasting based on ESG Factors

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Abstract – ESG (Environmental, Social and Governance) is a prominent investment approach that aims to generate excess returns by incorporating information on the E, S, and G dimensions of a company into an equity portfolio. As compared to traditional financial performance-focused investment concepts, ESG investing places greater emphasis on the social responsibility undertaken by companies, and has gained significant attention from governments and investors. As a result, many domestic and international rating agencies have introduced ESG indicators and applied them in practice, leading to a gradual expansion of the domestic and international ESG investment management market, which has gradually become the new mainstream of international investment. Research on ESG investment has become a top priority, however, relevant domestic research is still in its infancy. Therefore, it is essential to study investment strategies based on ESG factors. In this paper, we propose a neural network prediction model based on ESG investment. The model uses ESG rating data of mutual funds and ETFs from 2010 to 2020, to investigate the impact of adding ESG-related factors on the returns of these two types of funds, and to compare the impact on them. The results of the study indicate that fund returns can be more accurately predicted by adding ESG data and that ESG data is more applicable to mutual fund return forecasting. This suggests that ESG factors, as an alternative data source that has not been over-explored, can compensate for the shortcomings of traditional investment strategies through the introduction of alternative information and thus achieve higher returns. In summary, this study contributes to the literature on ESG investment strategies by proposing a novel neural network prediction model and demonstrating the potential benefits of incorporating ESG data into investment decisions. The findings have important implications for investors, fund managers, and policymakers, and suggest the need for further research on the effectiveness of ESG investment strategies.

Keywords – Fund Return Forecasting, Investment Strategy Design, ESG Factors, Neural Networks.

I. INTRODUCTION

Socially Responsible Investment (SRI) emerged in the 1920s, when some investors began to demand a higher level of ethical behaviour from their investments, refusing to invest in industries such as tobacco, gambling, and arms. SRI formally originated in the 1960s and 1970s, with investors who held this philosophy being concerned with. In 1994, British academic John Elkington proposed the TBL (Triple B) concept based on socially responsible investment. Elkington pointed out that companies should be committed to paying as much attention to social and environmental issues as they do to profits. The triple bottom line refers to profits, people, and the planet. It emphasizes that the value of a company can no longer be measured simply through financial indicators but from the perspective of society, the economy, and the natural environment.

In 2006, the UN Supported Principles for Responsible Investment (UN Supported Principles) set out six key principles and 34 recommended practices. In 2015, the UN set out 17 Sustainable Development Goals (SDGs) aiming to achieve goals related to poverty, inequality, climate, environmental degradation, prosperity, and peace and justice by 2030.

ESG (Environmental, Social, and Governance) investment has gained significant attention, and the scale of global ESG assets under management is rapidly increasing. According to the Global Sustainable Investment

Alliance (GSIA), the size of global ESG assets under management was US\$13 trillion at the beginning of 2012, increasing to US\$37.8 trillion by the end of 2020. ESG assets now account for one-third of the total global assets under management, with a compound annual growth rate of 14.27%, exceeding the average growth rate of the global asset management industry.

In recent years, ESG investment has also received relatively wide attention in the mainland Chinese market. Various financial institutions have started to introduce ESG, and government departments have gradually incorporated ESG factors into financial regulation. Climate change has become the focus of responsible investment, research on ESG investment standards and methodologies has accelerated, and mandatory ESG information disclosure has become a trend. In September 2020, China proposed for the first time to achieve the carbon peak by 2030 and the 2060 goal of carbon neutrality. In order to further promote sustainable development and the “double carbon” target, various departments have actively launched relevant policies, standards, and tools for green finance.

However, the development of domestic ESG investment is still in its infancy, and many domestic enterprises' ESG information disclosure is not yet active. The ESG evaluation system is not yet perfect, and there are not yet enough investors involved in ESG investment. ESG-themed funds in the market are not yet taken seriously. Therefore, this paper aims to forecast fund returns based on ESG data to further provide guidance to investors. This paper provides research support on both the theoretical level and practical level.

At the theoretical level, there is little research on ESG investment in domestic academia, but many financial institutions have started to incorporate ESG factors into their investment decision-making systems. ESG investment strategies are mainly divided into seven categories: normative screening, quality screening, negative exclusion, ESG integration, sustainable thematic investment, impact investment, and shareholder engagement strategies. In this paper, a neural network prediction model based on ESG factors is constructed using the quality screening strategy to explore the accuracy of ESG data for fund prediction and provide more basis for investors.

At the practical level, with the increasing development of computer technology and the processing of big data, quantitative investment has begun to enter people's minds, and various quantitative platforms have emerged. In addition to institutional investors, many individual investors have also started to use various quantitative platforms to conduct their own quantitative research and investment.

II. RELATED WORK

Back in 2013, Xia conducted an extensive analysis of the current state of socially responsible investment funds in China and performed a longitudinal study on Xingquan Socially Responsible Investment Fund, the country's first fund of its kind. The primary objective of the study was to evaluate the fund's performance. The findings of the study revealed that the Xingquan Socially Responsible Investment Fund generated significantly higher returns and risk-adjusted returns than the CSI 300 Index, demonstrating its potential to outperform traditional investment strategies [1].

In 2018, Sun's analysis reveals that the impact of ESG responsible investment in China's capital market is still limited. Specifically, ESG information disclosure cannot meet the needs of information users, and ESG rating research is in a nascent stage. To further advance the adoption of ESG responsible investment in China's capital market, concerted efforts are required from both listed companies and investors. Moreover, relevant

regulatory bodies should also tighten their oversight of ESG information disclosure and support the development of ESG credit rating agencies [2].

In 2019, Zhang found that ESG responsible investment still has insufficient influence in China's capital market, ESG information disclosure cannot meet the needs of information users, and ESG rating research is at a preliminary stage. In order to further promote the application of ESG responsible investment in China's capital market, listed companies and investors should actively participate in the practice of ESG responsible investment, relevant regulators should strengthen the regulation and supervision of ESG information disclosure, and support the development of ESG credit rating agencies [3]. The occurrence of negative ESG events has heightened the public's desire for ESG information. This, coupled with the continued promotion of ESG investment concepts by international institutions such as UNPRI and MSCI, as well as the increased promotion efforts by domestic institutions such as Caixin Green Institute and Shangdao Rongreen, has led Ma to believe that more financial institutions will adopt ESG investment strategies in the future. As a result, the advantages of ESG investment products will gradually emerge [4].

In 2020, Yan analyzed the specific connotation and basic principles of ESG investment concept, summarized the current mainstream domestic and international ESG theoretical system and practical application methods, and made an outlook on the application prospect of ESG investment in Chinese capital market [5]. Li studied and analyzed the screening strategy and shareholding of socially responsible investment funds in China, and analyzed the situation of industry allocation. Li's study analyzed the screening strategies and holdings of socially responsible investment funds in China, as well as their sectoral allocations, to further improve the performance attribution analysis of SRI funds. The results show that the overall performance of SRI funds in China is slightly higher than that of the selected benchmark indexes, but there are differences within individual stocks [6]. Then, the ESG performance of the most representative listed companies in A-shares is evaluated by applying hierarchical analysis and fuzzy integrated evaluation method, from which the sample stocks are selected and given reasonable weights to construct the ESG 30 index and propose an index investment strategy. Finally, the ESG index constructed was compared with other relevant ESG indices, and the performance of the ESG index fund constructed by the designed strategy was analyzed with similar funds to verify the conclusions [7].

In 2021, Zhang used an empirical method to conduct a multiple linear regression under the assumption that the application of ESG investment strategy in public funds is feasible, and selected ESG rating, firm size, and firm valuation factors, and concluded that ESG investment strategy in practice in public funds has a relatively significant linear enhancement in indicators such as maximum retracement and daily amplitude [8].

In 2022, Zhang empirically analyzed the factors influencing the willingness to execute ESG investment funds in China based on of Chinese ESG investment funds data from 2015-2020, from two dimensions of fund product characteristics and fund manager characteristics. The results of the study indicate that ESG fund risk rating and fund manager education are the main influencing factors of ESG investment fund execution intention [9]. Qu used all listed companies in the A-share market that received a rating from the China Securities Index in 2019 as a sample, measured the stock price decline by the cumulative abnormal return calculated using the event study method, and measured the daily stock. The results proved that high ESG portfolios generally outperformed low ESG portfolios, and the higher the ESG rating, the higher the average annual share price incr-

-ease [10].

In the same year, Wang analyzed the relationship between ESG score and style factor based on E, S, G score and ESG overall score data from 2019 to 2021. The results show that the ESG factor has stock selection ability; the multi-head-short hedging strategy combination of E, S, G and ESG factors can obtain excess returns. There is a significant correlation between ESG and style factors, but there are differences in the correlation between ESG factors on different style factors [11]. Meng uses the ESG rating data published by the Shangdao Ronglv Institution as the data source of the ESG factor, and selects the CSI 300 Index constituent stocks and the CSI 500 Index constituent stocks as the stock pools respectively. Using the method of single factor validity test and investment strategy construction, the positive screening strategy and integration strategy based on the ESG factor are constructed, and the advantages and disadvantages of the two stock investment strategies are compared and analysed [12]. Based on China's Shanghai and Shenzhen 300 constituent stock market data from 2014 to 2021 and ESG score data from 2013 to 2020, Liu constructed a traditional multi-factor stock selection model and a support vector machine (SVM) stock selection model to explore the impact of ESG-related factors on the above stock selection model, and compared the impact of the two models [13].

In 2023, Zhang used the CiteSpace visualization technique to conduct a bibliometric analysis of 1,564 papers in the WOS and CNKI databases from 2004 to 2021, to sort out the research hotspots and development process in the field of ESG responsible investment, to show the basic status quo in the field of ESG responsible investment [14]. Based on the data of A-share listed companies in China from July 2017 to June 2022, Zeng added ESG factor to the Fama-French five-factor model and constructed a six-factor model to empirically study the relationship between ESG rating of listed companies and their stock returns. The results show that listed companies with higher ESG ratings have higher stock returns [15].

III. EMPIRICAL ANALYSIS

A. Theoretical Analysis and Research Hypothesis

To make forecasts that are reasonably accurate and reliable, investors must make the best use of available information, particularly with regard to a fund's future earnings. Fund ESG (Environmental, Social, and Governance) performance is closely linked to future value and risk and provides vital information for investors in the surplus projection process. In this paper, we argue that fund ESG performance can serve as a valuable source of information for investors in their surplus projections.

Firstly, funds with good ESG performance tend to have a higher willingness to disclose information, which can improve the transparency of information and have a positive effect on the quality of investors' surplus projections. This increased transparency enables investors to access timely, accurate, and cost-effective information, thereby enhancing the information environment for funds.

Secondly, good ESG performance can directly impact fund performance and increase fund value. As a key information intermediary in capital markets, fund investors are concerned about the profitability and future development of funds. Fund ESG performance can directly convey information about the problems and efforts made by funds in significant areas that impact the potential of fund development. This helps investors obtain information that affects the future surplus of the fund, thus improving the quality of surplus forecasts.

Lastly, funds with good ESG performance are subjected to greater external attention and scrutiny, and any fr-

-audulent activities or unethical practices can result in the loss of the high reputation and good image built up by the fund through improved ESG performance. Based on the quantitative and qualitative dimensions of information, ESG performance can improve the market information environment and reduce the level of information asymmetry between investors and funds, thereby enhancing the quality of investor surplus forecasts.

In summary, good ESG performance of funds can improve the quantity and quality of information disclosure, reduce information asymmetry between investors and funds, reduce uncertainty in the fund's operating environment, enhance the stability and sustainability of earnings, and decrease bias in investors' earnings forecasts. Based on the above analysis, we propose the hypothesis that good ESG performance of funds can improve the quality of investors' surplus forecasts.

B. Data Sources and Selection of Indicators

In the realm of ESG evaluation systems, both domestic and international frameworks exhibit a diverse range of indicators and themes, with inconsistent aspects of focus. This can be observed in the varying degrees of emphasis placed on certain indicators across different evaluation systems. For instance, foreign institutions may prioritize the diversity of a company's employees, whereas this may not be accorded much attention in domestic evaluations. Conversely, domestic evaluations may place a greater emphasis on a company's contribution to major national initiatives, which may be given less attention in foreign evaluations. In addition, scoring methods differ across various evaluation systems, with some opting to weigh scores, while others choose to combine controversial items or take into account industry and specific companies. Furthermore, different evaluation systems utilize varying evaluation criteria.

Thus, when studying ESG issues, it is imperative to clearly define the object and subject of research. In the present study, we aim to examine the relationship between ESG factors and fund return forecasting. As such, Exchange-Traded Funds (ETFs) represent a viable and cost-effective alternative to Mutual Funds and have experienced rapid growth in popularity over the past decade. The dataset contains 57,603 Mutual Funds and 9,495 ETFs with general aspects (as Total Net Assets, management company and size), portfolio indicators (as cash, stocks, bonds, and sectors), returns (as year_to_date, 2020-11) and financial ratios (as price/ earning, Treynor and Sharpe, alpha, and beta). It has been scraped from the publicly available website <https://www.morningstar.co.uk>. Some of the data presented are shown in the table below:

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