THE PERFORMANCE OF ESG THEMATIC FUND IN CHINA AND

ESG RATINGS

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ABSTRACT

We uses ESG thematic funds to conduct a detailed statistical profile of their operating status in the Chinese market, including the size, the proportion of different investment types, and the characteristics of return and risk. The OLS model is used to empirically analyze the applicability of the Fama-French five-factor model in the Chinese mutual fund market. Based on the a ESG rating as a starting point, we study the profit improvement mechanism and risk-return characteristics of the ESG portfolios. The main findings are that the five-factor model better explained the excess returns of ESG thematic funds during the entire sample period of the study and can be used for attribution analysis of the performance. It shows that, despite the poor performance of ESG thematic funds in the market during certain periods, there is no significant difference between the performance of ESG thematic funds and the market during the economic crisis. The ROEs and dividend rates of the ESG high-scoring groups are both higher than those of the ESG low-scoring groups. This shows that companies with higher ESG scores have higher and more sustainable profitability and greater willingness to pay dividends. Furthermore, the ESG high-scoring group has better returns and lower risks.

Keywords: ESG rating, ESG thematic fund, five-factor model, performance, risk return

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1. INTRODUCTION

1.1 Research Background

Environmental, Social and Governance, referred to as ESG, is an investment philosophy that fully considers environmental, social and corporate governance factors into the process of decision-making and investment management. The related concepts include ethical investment, responsible investment, and socially responsible investment, impact investment, sustainable investment, etc. Compared with traditional financial information, ESG reflects more dimensional information. By observing ESG performance, it can not only assess the impact of environmental and social factors on investment targets, but also contribute to promoting sustainable economic development and fulfilling social responsibilities. It also reflects the robustness of corporate governance of the company. ESG includes environmental standards, social standards, and governance standards. Environmental factors include climate change, resource consumption, emission management, environmental management, green business, etc.; social factors include supply chain management and supervision, consumer protection, community relations, product safety, production safety and public safety, etc.; governance factors include bribery and corruption, executive compensation, board diversity and structure, information disclosure, etc.

In recent years, international organizations and more and more governments and investment institutions around the world have continuously deepened the concept of ESG and actively explored and practiced ESG responsible investment. Many regulators and market parties have reached an agreement to incorporate environmental, social and governance (ESG) factors in the investment process. On March 21, 2022, the US Securities and Exchange Commission (SEC) voted 3:1 to propose new rules that, if adopted, would require public companies to, among other things, provide audited

financial statements containing climate-related financial impact and expenditure metrics, report their greenhouse gas emissions, and disclose details of how climate change is affecting their businesses. The ESG investment philosophy in the international market has become more mature after more than ten years of development, and ESG products have become more abundant. The concept of ESG investment in China has gained the attention and support of government and regulatory authorities in recent years. Especially in 2022, Carbon Peak and Carbon Neutrality were included in the government work report for the first time. A series of ESG-related regulations and documents issued which encourage enterprises to gradually improve and enhance ESG information disclosure, and guide asset management institutions to continuously improve ESG risk management capabilities and sustainable investment capabilities. Although it has not yet become mainstream for ESG investment, it has shown a broad space for development. With the development of the economy, Chinese capital market has gradually exposed a series of different problems, which have attracted widespread attention from the society and investors. For example, some listed companies disclose false information (often referred to as green washing), discharge pollutants in violation of regulations, major shareholders and executives misbehave, and serious violations or even violations of the law occur, which have brought serious negative effects. For example, it would negatively affect the confidence of investors investing in ESG bonds and may limit future demand. These are very detrimental to the sustainable development of the capital market. Secondly, the degree of opening up of Chinese capital market is constantly improving, and the evaluation system and evaluation standards for enterprises need to be in line with international standards as soon as possible. We may refer to the Sustainable Accounting Standards since the development

of the standards in the US as a model is promoting uniform reporting standards[1]

In June 2018, MSCI included A shares into the MSCI index system and conducted ESG ratings on more than 400 listed companies. Under the two-way promotion of MSCI's inclusion of A shares and domestic pension funds entering the market, ESG investment in China will surely enter the fast lane. In recent years, the government paid highly attentions to green, low-carbon and high-quality development and issued a number of important related policies, such as "Guiding Opinions on Building a Green System" (2016), "Green Industry Guidance Catalog" (2019), "Guiding Opinions on Promoting Investment and Financing to Address Climate Change" (2020), "Green Bond Support Project Catalog" (2021) etc. In the process of mainstreaming development of ESG, market players' demand for improving ESG-related policies is gradually becoming prominent. Therefore, under the "top-down" regulatory support and policy promotion, and driven by market demand, the environmental ESG investment will usher in a broad space for development in China.

In 2020, ESG funds in the global market flourished. The growth rate of ESG assets in developed markets such as the United States and Europe is relatively fast. According to statistics, the size of US ESG ETF funds has exceeded 70 billion dollars as of 2020. Europe issued about 72 ETF funds in 2020, accounting for nearly half of all ETF funds issued in Europe in 2020. Meanwhile, Chinese asset management institutions actively deployed and issued ESG fund products, and the size of ESG thematic funds increased significantly. ESG thematic fund is an investment covering ESG-related themes (such as low carbon, environmental protection, green, sustainability, social responsibility, governance, etc.) As of the end of December 2020, there were 103 ESG thematic funds in the market, with a size of 132.9 billion yuan, an increase of 68% from 2019. The

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[1] https://www.sasb.org

investment methods are mainly active funds and partial equity funds which invest on stocks with a big portion and bonds with a small portion. In general, the development of domestic ESG thematic funds is still in its infancy. It focuses on generalized ESG thematic investments. There are few ESG funds that truly adopt ESG strategies to invest, but they have huge development potential and broad growth space. There are seven mainstream ESG investment strategies, including: positive screening, negative screening, ESG integration, active ownership norms-based screening, sustainable themed investment and impact investment. Looking at the future, the size of ESG funds is expected to usher in explosive growth.

In recent years, more and more companies have begun to pay attention to ESG concepts and gradually realize the important role of green and innovation development concepts and sustainable development concepts. The number of corporate social responsibility reports disclosed by listed companies has continued to increase. In the context of tightening regulatory policies and accelerating information circulation, companies' information transparency is facing greater challenges and tests. In recent years, China has made some progress in the construction of ESG information disclosure system. The disclosure of corporate responsible investment information has shown a clear trend of standardization, but it is still in the stage of voluntary disclosure. Chinese regulators have begun to transition to a stage where companies are required to disclose ESG-related information, effectively restrict and regulate ESG information disclosure, and gradually improve and unify the ESG information disclosure framework. We hope that improved information disclosure will help companies gain more investors' attention, while better ESG performance can obtain lower financing costs and improve corporate image and reputation. Therefore, many listed companies propose ESG issues at the board level, and gradually realize the ESG integration in various departments of

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the company, forming a relatively complete ESG organization system and management structure.

The disclosure of ESG information is a prerequisite, and the ESG ratings are the basis for ESG investment. International mainstream ESG ratings include MSCI, Thomson Reuters, FTSE, Dow Jones, Morningstar, etc. Nowadays, China is still in the early stage of ESG development. The ESG evaluation system needs to meet the characteristics of domestic capital market. A number of third-party service providers including research institutions, social organizations, market institutions, etc. have emerged to build ESG indicators. Common ones include Hexun.com, SynTao Green (SynTao), the Chine Securities Index (CSI) ESG rating, Huazheng ESG ratings and so on. It is worth noting that these "indicators" are still in their infancy. One of the most pressing problems is that there is little consistency between the major ones, which is a very big problem for the users of this information. Furthermore, this is also an ongoing problem in Europe and the U.S.

Firstly, we explore the status of ESG investment in international market and Chinese market. Secondly we mainly analyzes the operation of generalized ESG thematic funds, and applies the Fama-French five-factor model to conduct attribution research on the performance of ESG thematic funds. Finally, taking the SynTao ESG rating as the starting point, we analyze the profit improvement mechanism of different portfolios of ESG scores and the corresponding return and risk characteristics.

1.2 Research Significance and Main Conclusions

The development of ESG funds and ESG evaluation systems in Chinese asset management market are both in their infancy, which has important conceptual and practical significance for systematic research on ESG thematic funds and ESG evaluation systems in emerging markets. The empirical significance is that we make a

more systematic analysis of the operation of ESG thematic funds in the Chinese market and study the performance attribution of ESG thematic funds which complements the ESG literature. In the previous study on ESG mutual funds, there are many papers on social responsibility funds in developed markets, but there are few papers on ESG thematic funds with Chinese features. Although some studies have compared the performance of socially responsible investment funds with non-socially responsible investment funds in the market, few studies have compared the performance of funds in the field of socially responsible investment. We are the first to compare the performance between funds in this sector. This paper uses the mainstream Fama-French five-factor model to explain the excess returns of ESG funds in China, which will help to deepen the comprehensive understanding of the risk-adjusted returns of ESG thematic funds. Secondly, we use the SynTao ESG rating to analyze the profit improvement mechanism and the corresponding return and risk characteristics of different ESG score groups in the Chinese market. As an ESG rating reflects the ESG management capabilities of listed companies in China, it can provide a more comprehensive overview of the ESG performance of listed companies. The ROEs and dividend rates of the ESG high-scoring groups will be both higher than those of the ESG low-scoring groups. This shows that companies with higher ESG scores have higher and more sustainable profitability and greater willingness to pay dividends. Furthermore, the ESG high-scoring groups will have better returns and lower risks.

Finally, based on our empirical findings we will provide suggestions for investors, investment institutions, and regulators. From the perspective of investors, it helps to improve investors' awareness of the return and risk of ESG thematic funds. From the perspective of investment institutions, they should expand the layout of ESG thematic funds and diversify ESG investment strategies. From the perspective of regulators, we

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suggest to accelerate ESG information disclosure. We encourage regulators, asset owners, asset managers and third-party service providers work together to promote the construction of an "ESG ecosystem" in China.

This paper mainly adopts empirical tests. First of all, we review the literature on the relationship between the ESG criteria and corporate financial performance, the performance of ESG investment portfolio and social responsibility mutual funds. Through statistical analysis, we explore in detail the status of ESG investment in international and Chinese markets. At the same time, we investigate in-depth the performance of ESG thematic fund, as well as the effect of ESG rating on return and volatility.

Secondly, we use econometric methods to establish an empirical model by selecting dependent variables and control variables. The relevant data is obtained by Wind and CSMAR database. By using STATA to do empirical study, we draw conclusions through full-sample unbalanced panel data regression. Finally, based on the results of the empirical tests, we summarize and put forward policy suggestions.

This paper uses ESG thematic funds from Wind database to conduct a detailed statistical analysis of their operating status, including the size, the proportion of different investment types, and the characteristics of return and risk. We use the monthly fund net value data in the CSMAR database as the initial sample. The research interval is from January 1, 2010 to December 31, 2020. We identify equity ESG thematic funds and apply the OLS regressions. We investigate the applicability of the Fama-French five-factor model in Chinese mutual fund market. By applying the SynTao ESG rating, we study the profit improvement mechanism and risk-return characteristics of the ESG portfolio.

The conclusions drawn in this paper are as follows. First of all, during the entire

sample period of the study, the five-factor model better explained the excess returns of ESG thematic funds. Our test contains the period of economic recession, that is the period of stock market crashes, and the subsequent period of recovery. The results show that, despite the poor performance of ESG thematic funds in the market during certain periods, there is no significant difference between the performance of ESG thematic funds and the market during the economic crisis.

Second, the results also show that during the entire period (2010-2021), ESG themed funds have a negative alpha relative to the market, but it is not significant. However, the market risk premium factor, market value factor, and profit factor are are positively correlated with the performance. It indicates that ESG thematic funds perform well when the overall market premium rises, and they prefer to allocate small market capitalization and blue-chip stocks. Consistent with this, ESG thematic fund returns are negatively correlated with book-to-market value ratio factors and investment model factors.

Third, based on the ESG scores of the CSI 800 listed companies rated by SynTao, we can divide them into five groups. The ROE and average dividend rate of the ESG high-scoring group are higher than those of the ESG low-scoring group. This shows that companies with higher ESG scores have higher and more sustainable profitability and greater willingness to pay dividends, and it also fully reveals the impact of ESG on the profit improvement mechanism of listed companies. Finally, in the study on the return and risk characteristics, we calculated the annualized return and annualized volatility for 5 groups of ESG portfolios. We can find that different ESG portfolios have better return and risk discrimination, in which the ESG high-scoring group has better investment returns and lower risks.

1.3 Chapter Arrangement

Chapter 2 is the literature review. Chapter 3 introduces the overview of international ESG investment development. We make the statistical analysis of ESG thematic funds in Chapter 4. Chapter 5 mainly studies the performance of ESG thematic funds. We construct the theoretical framework and empirical assumptions and then study the empirical results. Chapter 6 describes the SynTao ESG rating and studies the profit improvement mechanism and risk-return characteristics of the ESG portfolios. Chapter 7 presents the conclusions and provides suggestions for policy making.

2. LITERATURE REVIEW

2.1 ESG Criteria and Corporate Financial Performance

Since the early 1970s, how ESG criteria affect corporate financial performance (CFP) has always been an area of concern for academics and practitioners. Indeed, some studies believe that incorporating ESG into the investment process will produce ambiguous, uncertain and even contradictory results, which undermine investor confidence. In the past 40 years, investors interest in ESG assets have surged. Since the early 1970s, about 2,250 academic papers have been published on the link between ESG and CFP, 70% of which were published in the past 15 years. The surge in academic literature also coincides with the growth in the size of ESG investment assets under management.

Friede, Busch, and Bassen (2015) counted the results of about 2,200 individual studies, and about 90% of studies found a non-negative ESG-CFP relationship. Among them, 52.2% of stock assets show a significant positive correlation between ESG and CFP, and only 4.4% of studies show a negative correlation. Clark, Feiner Viehs (2015) found that based on more than 200 related literature and studies, 90% of the studies show that reasonable sustainability standards reduce the cost of capital. 88% of studies show that reliable ESG practices can improve operational performance. 80% of studies show that good sustainability practices have a positive impact on the stock price performance.

The study of Friede, Busch, and Bassen (2015) concluded that companies with higher ESG and corporate Social Responsibility ("CSR") ratings have lower cost of capital in terms of debt and equity. Friede et. al (2015) further reviewed the ESG and CFP literature published in the past 50 years and found that most academic studies show that there is a positive correlation between ESG and CFP, especially in the areas of

stocks, fixed income and real estate. Among various ESG dimensions, they found that corporate reputation is the key driving force of CFP, followed by philanthropy. In the resent paper of Atz et al. (2022), by surveying 1,141 primary peer-reviewed papers and 27 meta-reviews (based on 1,400 underlying studies) published between 2015 and 2020, they found that the financial performance of ESG investing has on average been indistinguishable from conventional investing.

Banerjee et.al(2014) studied the relationship of corporate Environmental risk and the customer-supplier. Berman et al. (2006) investigated the innovation and entrepreneurial ecosystems. Deng et al.(2013) discussed the corporate social responsibility and stakeholder value maximization. Dai et al.(2019) focused on the socially responsible corporate customers and Dimason et al. (2015) paid attention to active ownership. Filbeck et al.(2019) assessed the performance of firms following ESG principles. Khan et al.(2016) showed the materiality of Corporate sustainability. The myths and realities of ESG integration in investment management are addressed by Kotsantonis et al.(2016).

Research also shows that ESG has different impacts on performance in different regions. The two markets with the most effective ESG information are North America and emerging markets. The correlation between ESG and CFP in the North American market is 42.7%, while in emerging markets it reaches 65.4%. The results show that ESG information has a more prominent investment value in emerging markets. It is foreseeable that emerging markets will become another important ESG investment market in the future.As an emerging market, China has a lot of room for development and growth potential, and more and more domestic investment institutions have begun to attach importance to ESG investment and actively deploy ESG products, which provides a solid foundation for the development of ESG investment in China.

2.2 The Impact of ESG on Company Risk and Portfolio Performance

Eccles, Ioannou, and Serafeim (2014) found that companies with good ESG status are less susceptible to systemic risk shocks and have lower downside risks. Scholars such as Godfrey, Merrill and Hansen (2009), Oikonomou, Brooks, and Pavelin (2012) have conducted a lot of research on how ESG affects corporate risks. Their research found that companies with strong ESG management capabilities are more stable and excellent in supply chain management and corporate governance, and therefore have above-average risk control capabilities. Due to higher risk control capabilities, the company will be less affected by negative events such as fraud, corruption, or litigation, and ultimately reduce the tail risk of the company's stock price.

Starks, Venkat and Zhu (2017) show that compared with short-term investors, long-term investors are more inclined to choose companies with higher ESG scores. Investors are more patient with high-ESG companies in their portfolios than other companies. Khan, Serafeim and Yoon (2016) distinguish the impact of material and non-material ESG issues on company risk. Material factors are in compliance with SEC requirements while non-material ones are not. It is found that companies that perform well on material issues are significantly better than companies that perform poorly on these issues, suggesting that investing in material issues can increase shareholder value. Companies that perform well on material issues and not bad on non-material ESG issues have the best performance.

The performance of return and risk of portfolios implemented by ESG strategies is also the focus of the academic and industry. Verheyden, Eccles, and Feiner (2016) designed a series of tests to determine whether a portfolio that has been screened by certain ESG criteria will be at a disadvantage compared to an unscreened portfolio. They compared the performance of portfolios that were not screened and used three

different ESG screening criteria (best in class, UN Global Compact compliance, ESG momentum), and analyzed the impact of this screening on return, downside risks, and portfolio diversity. The study found that ESG screening strategies hardly reduce the return, relatively reduce risks, and have almost no negative impact on portfolio diversity. Kaiser (2017) showed that value, growth and momentum investors in the United States and Europe can improve the sustainability performance of their investment portfolios without sacrificing financial performance. Bello(2005) studied the relationship between socially responsible investing and portfolio diversification. Geczy et al. (2018) explored the forecasting Earnings and efficient ESG portfolios. Hoepner et al. (2018) investigated the ESG shareholder engagement and downside risk while Lin (2018) incorporated social activism. Pedersen et al.(2021) addressed that the solution to the investor's portfolio problem is characterized by an ESG-efficient frontier, showing the highest attainable Sharpe ratio for each ESG level.

2.3 Disagreement of ESG Ratings

There are many third-party rating agencies in the world that conduct ESG ratings on companies. The most prominent companies include MSCI, Dow Jones, Thomson Reuters, FTSE, Morningstar, etc. Therefore, some scholars have studied the differences between different ratings.

Berg, Koelbel, and Rigobon (2019) studied the differences between five well-known ESG ratings. The overall difference is broken down into three sources that is range, measurement, and weight. The empirical findings show that the measurement difference explains more than 50% of the overall difference. Berg, Koelbe, and Rigobon (2019) further used a sample of S&P 500 companies from 2013 to 2017 to study the impact of ESG rating differences on stock returns. Surprisingly, governance has the lowest average correlation while the environment has the highest average correlation.

The average correlation between the ESG ratings of six well-known rating providers is approximately 0.46. Then, they classified ESG rating providers based on the legal source of the country/region where the company's headquarters are located. Civil law countries usually adopt a stakeholder-centered corporate model. The differences in social ratings between rating providers with civil law origins are more relevant and strongly affect stock returns. Common law countries put shareholders first, and differences in governance issues between rating providers with common law origin will also affect stock returns.

Chatterji et al. (2016) recorded six well-known ratings and found that there is a lack of consensus on social ratings. There is almost no overlap in the evaluation of corporate social responsibility. The lack of consensus indicates that social responsibility is difficult to measure reliably. Users of these ratings should be cautious when drawing conclusions about companies based on these data. They encouraged rating providers to verify their data regularly to improve the measurement of CSR.

Bharali (2019) compared various ESG indexes with traditional stock indexes, and evaluates the performance of the two combinations with the basic investment philosophy, namely: return improvement and diversification. Analysis shows that ESG cannot increase any returns in absolute value or on a risk-adjusted basis. Historical data show that ESG indexes have similar losses as traditional stocks indexes during the crisis. Therefore, the author believes that there is not much value in following the ESG investment mechanism based on ratings.

2.4 ESG Standards and Fund Performance

Whether corporate social responsibility (CSR) improves or reduces the performance of mutual funds is a long-standing and important question in mutual fund literature. When studying the relationship between corporate social responsibility and

fund performance, there have always been two contradictory assumptions.

Investing in companies that implement CSR practices may reduce a series of investment opportunities (eg. Aragon et al.(2019), Geczy et al. (2005), Renneboog et al. (2008b), Cortez et al. (2009), and increase supervision costs (Bauer et al. (2005)). They found that CSR will have a negative impact on fund performance. However, fund managers having social responsibility may actually choose companies with a strong financial foundation, which in turn will translate into higher fund performance. In this case, investing in socially responsible stocks will be a value-creating strategy. SRI funds provide investors opportunities to participate in the market while investing in a portfolio of companies with high social responsibility (Haigh & Hazelton, 2004). SRI funds are expected to outperform traditional funds because they include companies that demonstrate corporate social responsibility (CSR) and transparency in their operations (Renneboog et al. 2008).

In one of the seminal papers on socially responsible funds, Hamilton, Jo, and Statman (1993) tested three different hypotheses when comparing the performance of socially responsible investment portfolios with conventional investment portfolios. The authors found that there is no significant difference between the performance of socially responsible mutual funds and traditional funds. In the United Kingdom, Mallin, Saadouni, and Briston (1995) compared the portfolio performance of "ethical" companies with the portfolio and benchmark index of non-ethical companies. They found that the "ethical" portfolio did not outperform the market. Similarly, Cortez, Silva, and Areal (2009) found that the performance of socially responsible mutual funds in the European market is not significantly different from that of traditional funds. Similarly, in the case of the Australian and Canadian markets, there is no statistically significant difference between the performance of socially responsible funds and

traditional funds (Bauer et al., 2005, 2007). Nofsinger and Varma (2012) found that although social responsibility lags behind traditional funds during non-crisis periods, social responsibility funds perform better than other traditional funds during market crises. However, most studies on U.S. mutual funds have found that there is no statistical difference in performance between SRI and traditional funds (for example, Hamilton et al. (1993), Goldreyer and Diltz (1999), Statman (2000), Schröder (2004)), Geczy et al. (2005), and Renneboog et al. (2008b)). According to Rathner (2013), social responsibility registered in the US performs better than the ones registered in non-US regions.

Tosun (2016) found that adding companies with higher CSR scores to the portfolio of socially responsible funds does not improve the performance of the portfolio. However, the research of Margolis and Walsh (2003) and Orlitzky et al. (2003) arrived at a contrary conclusion. After excluding companies with low social records, other studies found that the performance of the social index is similar to that of the big market index (Grossman & Sharpe, 1986; Sauer, 1997; Statman, 2006).

Morgan Stanley (2019) compared the median returns of traditional funds and sustainable funds in 2004-2018 and found that the returns of traditional funds and sustainable funds are very similar in the long run, even if the occasional statistical differences are not consistent in direction and magnitude. This shows that sustainable funds are closer to traditional funds in terms of returns. Moreover, although ESG funds are not significantly better than traditional investment funds, it at least shows that they are not weaker than traditional investment funds. Morgan Stanley (2019) research shows that the median downward variance of sustainable fund is significantly lower than that of traditional funds, demonstrating superior risk defense capabilities. For more papers related to ESG funds, we refer to Bollen(2007)、 Benson and Humphrey(2008)、

Brakman and Tucker(2019)、Gil-Bazo et al.(2010)、Nofsinger and Varma(2014). Bollen(2007) studied the mutual fund attributes and investor behavior and Benson and Humphrey(2008) further studied the investors reaction to current and past returns of SRI funds. Gil-Bazo et al.(2010) discussed the role of fees for the performance of SRI mutual fund and Nofsinger and Varma (2014) considered the performance of SRI funds during the periods of market crises. Brakman and Tucker (2019) investigated the performance of passive ESG funds. Hartzmark and Sussman (2019) studied the differences in performance of high sustainability and low sustainability funds and Raghunandan and Rajgopal (2022) answered whether ESG mutual funds actually invest in firms that have a stakeholder friendly track record.

2.5 Motivations and Contributions

We comprehensively review ESG related literature, which contain the study of how ESG criteria affect the corporate financial performance and portfolio risk and return, the study of the disagreement between ESG ratings, and the study of the ESG standards and performance of mutual funds. Foreign research started relatively early and relatively comprehensive, and many theoretical and empirical studies have been carried out. However, there are few systematic empirical studies on the performance of ESG thematic funds in the Chinese market and ESG rating in China. Our research fills the gap.

This paper starts with ESG thematic funds in the Chinese market, analyzes their operation in detail, and investigates the performance by applying the classic five-factor model, which provides a new perspective for related research on SRI funds. In addition, the literature review not only provides a basis for the selection of the main variables, but also lays a theoretical foundation for the empirical tests.

3. OVERVIEW OF INTERNATIONAL ESG INVESTMENT DEVELOPMENT

3.1 International ESG Investment Development

3.1.1 Signatories

The United Nations Principles for Responsible Investment (PRI) was officially released on the New York Stock Exchange in 2006. PRI is the most influential responsible investor organization in the world, which is constituted by Asset management (AM), Asset Owner (AO) and Service Provider constituted. They committed to developing and promoting sustainable global financial system. By signing the six responsible investment principles, the signatories promised to incorporate ESG standards into the investment and research process and make investment decisions in accordance with relevant standards for ESG topics. It can be seen that the number of global institutions that have signed PRI directly reflects the degree of adoption of global ESG concepts and future development trends. As of August 2020, there are more than 3000 PRI signatories (a total of 3,038), and the total assets under management (AUM) exceed 103.4 trillion US dollars.
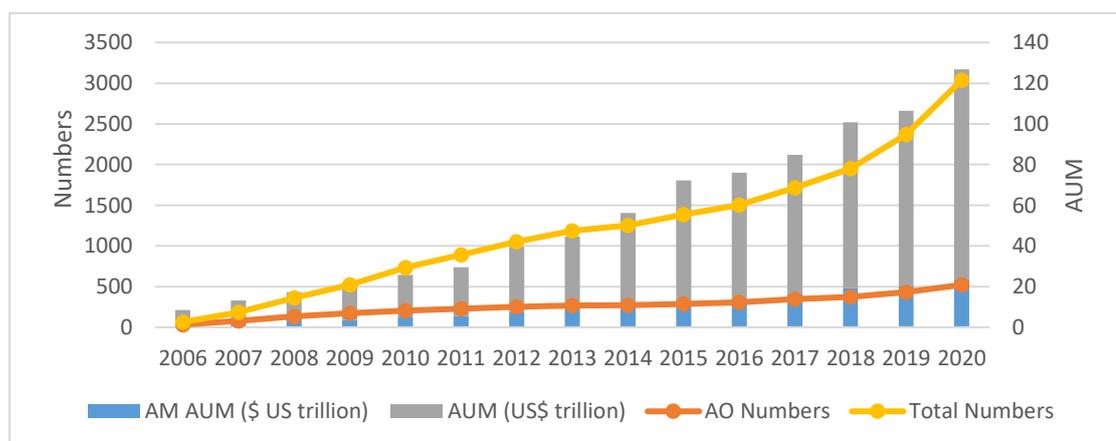

Figure 1. PRI signatories and their asset management nature

As can be seen from the above figure, first, the growth rate of the number of PRI

signatories continues to increase, with the growth rate exceeding 10% in the past four years, and the highest growth rate in 2020, reaching 28.1%. It can be predicted that in the next few years, the number of PRI institutions will maintain a relatively high growth rate. Second, the number of asset owners (AO) has increased at a steady growth rate of about 10% per year. As of 2020, the number of AOs that have signed PRIs has reached 521, with AUM 23.5 trillion.
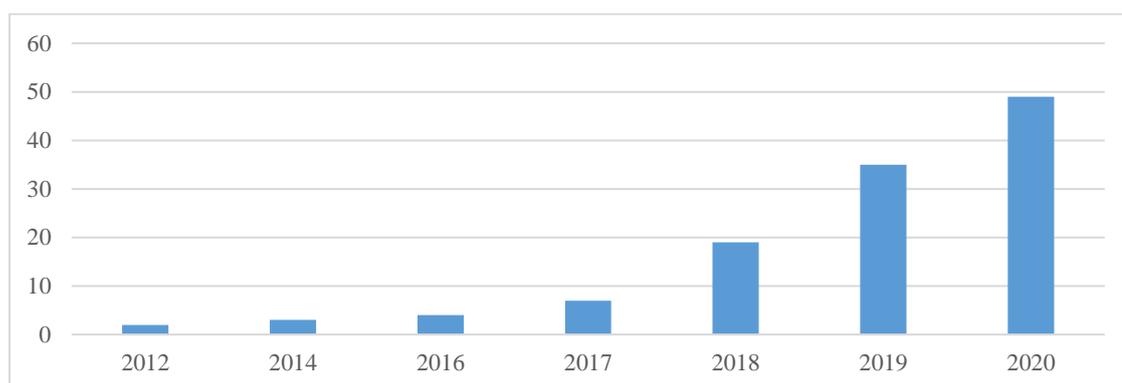
Figure 2. Number of Chinese Signatories

As of August 2020, according to statistics on the PRI official website, a total of 49 Chinese institutions have joined, including 37 asset managers, 2 asset owners and 10 service providers. Domestic asset owners have begun to take action in the ESG investment field, and in the future, they will guide market development under the encouragement of professional operation and supervision. From 2016 to 2020, the number of Chinese institutions that have joined PRI has shown a continuous growth trend. It can be seen that currently only two asset owners in China have officially joined (Shuanghu Capital and Ping An Insurance), and they have only joined in the past two years. More than 17% of the signatories in the world are asset owners, highlighting that there is still a large gap between China and the world. In addition, the number of asset managers has shown steady growth since 2018. Generally speaking, the Chinese capital market has gradually embraced ESG investment concepts, and began to integrate ESG factors into the investment process.
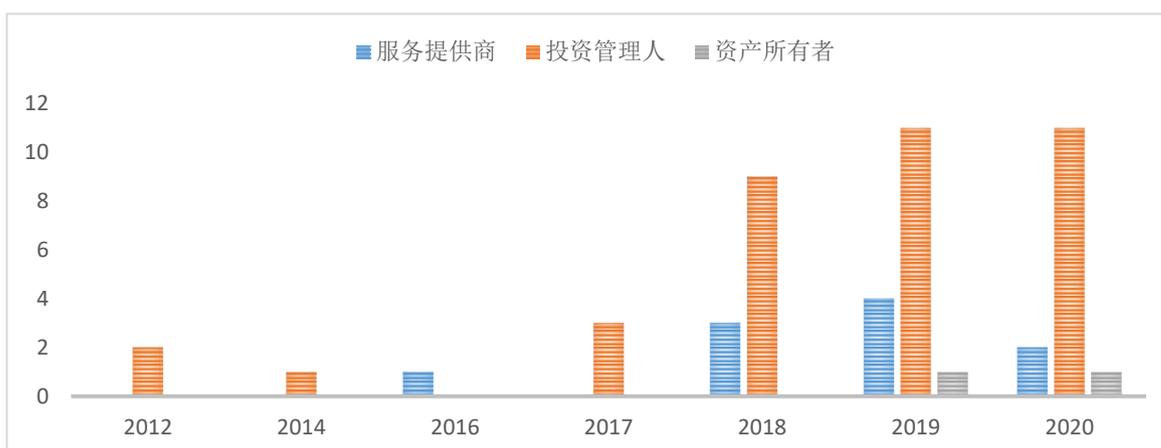
Figure 3. The number and types of new signatories in China

3.1.2 Size of Global ESG Assets

Table 1. The size of sustainable investment assets in the five major global markets (unit: billions)

Country	2014	2016	2018	2014-2016 growth rate	2016-2018 growth rate	Annual growth rate
Europe (Euro)	€9,885	€11,045	€12,306	12%	11%	6%
US (USD)	$6,572	$8,723	$11,995	33%	38%	16%
Canada (CAD)	$1,011	$1,505	$2,132	49%	42%	21%
Australia (AUD)/ New Zealand(NZD)	$203	$707	$1,033	248%	46%	50%
Japan(JPY)	¥840	¥57,056	¥231,952	6692%	307%	308%

According to a report released by the Global Sustainable Investment Alliance (GSIA 2018), the size of sustainable investment assets in five major markets in the world: Europe, the United States, Canada, Australia/New Zealand and Japan has reached 30.7 trillion US dollars. It can be seen from Table 1 that the European ESG investment asset scale is the highest, at 12.3 trillion euros, accounting for 48.8% of the total global assets under management[2]. The US asset size continues to grow and is very close to the European market, approaching 12 trillion US dollars and accounting for

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[2] We have converted all the investments into one currency of US dollars.

39%. In addition, Japan, Canada, and Australia/New Zealand account for 7%, 6%, and 2% respectively. In terms of growth rate, the average annual growth rate of the asset size of sustainable investment in five major markets around the world has remained at double digits compared to 2016. Among them, Australia/New Zealand increased by 46%, Canada increased by 42%, the United States increased by 38%, and Japan had the highest growth rate of 307%, which occupied the Asian market. As the European market has the earliest development of responsible investment, it has a large base, but it also maintains a steady growth of more than 10%.

3.2 Overseas ESG Funds

According to statistics from ETFGI, in 2020, the size of ETF investment in global ESG concepts exceeded US$100 billion for the first time. According to the statistics of Morning Star, during the global epidemic, in the second quarter of 2020, the global market's enthusiasm for ESG investment rose sharply. ESG investment increased by 72% year-on-year, and the net inflow of funds was the highest in history, reaching 71.1 billion US dollars. Europe and the United States are the two major economies where capital flows mainly.

According to the statistics of Morning Star, one of the main forms of US ESG investment is index funds. As shown in Figure 4, as of June 2020, the size of US ESG index funds has increased from US$4.1 billion in 2010 to US$50 billion now. The rapid growth shows that US investors are showing enthusiasm for sustainable investment.
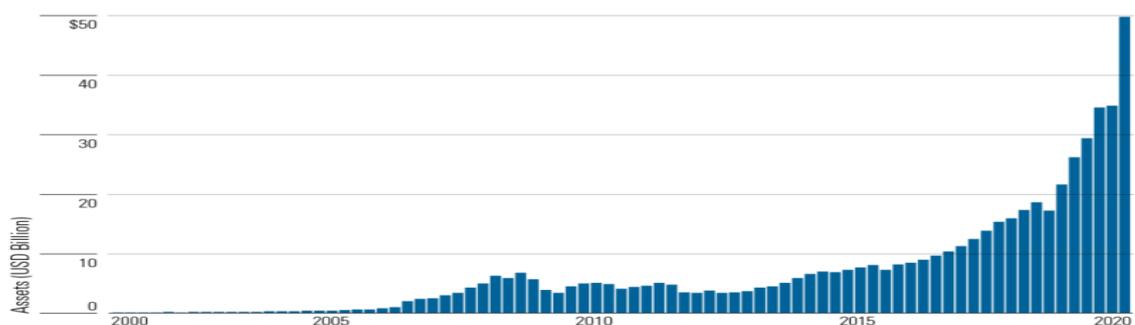
Figure 4. US ESG Index Fund Size (US$ billion, as of June 2020)

According to the statistics of Morning Star, responsible investment has the earliest development in the European market. At present, ESG has gradually become the mainstream investment concept in the European market. More than half of the world's ESG money come from Europe. As can be seen from Figure 5, as of June 2020, the continuous inflow of large amounts of funds has increased the size of European ESG index funds from less than US$2 billion in 2010 to the current US$20 billion mark that is about to break through. The rapid growth shows that European investors' recognition and active practice of ESG responsible investment. Overall, sustainable index funds in the United States and Europe grow the fastest in 2020. Among the global ESG assets, Europe still occupies the dominant position. The ESG ETF issued in Europe in 2020 is almost twice the size of the issuance in 2018, followed by the United States, but it is developing faster.
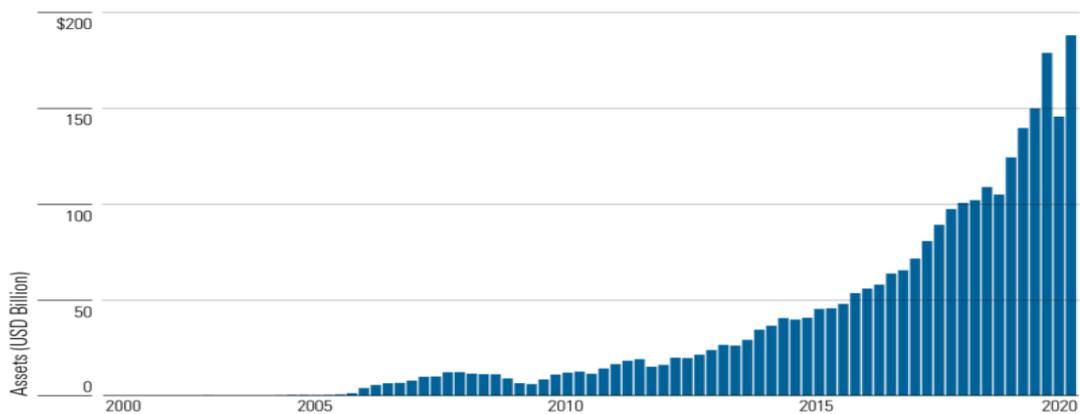
Figure 5. European ESG Index Fund Size (US$ billion, as of June 2020)

3.3 Overseas ESG Ratings

It is well known that the disclosure of ESG information is a prerequisite so that investors can identify the ESG performance of companies. Various international organizations and exchanges have formulated principles and guidelines on the disclosure and reporting of ESG information. The ESG evaluation system provides methods for evaluating and comparing ESG management capabilities of enterprises.

ESG investment is based on the practices of both. Major international investment institutions have issued ESG investment guidelines.

The ESG concept includes various environmental, social, and governance issues. Mainstream global rating companies (MSCI, Dow Jones, Thomson Reuters, FTSE, Morning Star) combined their own understanding of ESG and carry out a characteristic design of the evaluation system. Generally, they adopt a three-level indicator system. The first-level indicators contain environmental, social, and governance. The second-level indicators are extend to 10-20 topics,. The third-level indicators describe the ESG level of listed companies and the number of indicators ranges from 20 to 100 plus. For example, the MSCI rating covers 10 themes and 37 main risk issues; the Dow Jones rating covers six areas of environment and society; the Thomson Reuters ESG rating covers 10 areas and 178 indicators; the UK FTSE rating covers 12 areas and 300 indicators which the Morning Star rating involves 6 fields, a total of 18 fields. In terms of the calculation method, the weighted average is basically the main method. The rating companies assign certain index weights and adjust the weights according to industry conditions. Among them, Morning Star and Thomson Reuters also introduced deductions in their calculations. In view of the incomplete disclosure of domestic social responsibility reports, the coverage of domestic A shares by these rating companies is not enough, thus it is difficult to measure the ESG performance of all listed companies.

At present, the domestic ESG rating work is still in its infancy and exploratory stage. There are not many ESG rating institutions serving the domestic market, mainly including evaluation systems provided by SynTao, Hexun.com, Social Investment Alliance, Harvest Fund and other institutions, as well as CSI ESG rating and Huazheng ESG rating etc. It is worth noting that due to the lack of standardized ESG information disclosure standards, ESG-related information of listed companies is difficult to obtain,

the information is incomplete or low in credibility. Also since the data across asset classes are inconsistent, the data foundation in the ESG evaluation system is relatively weak. On the other hand, some ESG information is difficult to quantify, which poses a greater challenge to the collection and application. It is a common sense that a completeESG evaluation system needs to overcome different technical difficulties also require higher maintenance costs. The above reasons challenges the improvement of ESG ratings coverage and consistency in the domestic market.

4. STATISTICAL PROFILES OF ESG THEMATIC FUNDS

4.1 Generalized ESG Funds

At present, the size of funds that adopted ESG strategies in the Chinese asset management market is relatively small. The overall focus is on generalized ESG thematic funds, which mainly invest on the ESG-related themes (such as low carbon, environmental protection, green, sustainability, social responsibility, governance, etc.) We refer to them as ESG thematic funds. In the world, it is generally called Socially Responsible Investment Fund (SRIF). As an investment tool, it selects investment portfolios based on environmental, social and governance ESG standards. According to Wind "ESG Investment Funds", ESG thematic funds (excluding non-initial and ETF feeder funds) were selected. As of the end of 2020, there were 103 ESG thematic funds on the market, with a total fund size of 132.9 billion yuan, which has an 68% increase from 2019.

Figure 6. Size of generalized ESG thematic funds China (as of December 2020, hundred million yuan)

According to statistics, most of these ESG thematic funds are "ESG concept" funds, involving several themes. Although the ESG investment criteria has not been explicitly incorporated into the investment process and decision-making, it has considered any or two related ESG themes. According to the statistics of fund names,

there are the most ESG thematic funds involving environmental themes whose key words include low-carbon, environmental protection, energy, green, beautiful China, ecology, environment, energy saving, cleanliness, etc. There are fewer products that involve the social (such as social responsibility) and governance (such as governance).

We have summarized the main investment forms of ESG thematic funds in the domestic market. As shown in Figure 7 and 8, ESG thematic funds are mainly active investment and partial equity funds. As of December 2020, the active investment in ESG funds is the leading factor, with a larger size, accounting for 89%, and the passive investment in ESG funds is only 14.9 billion yuan. In terms of investment types, partial-equity ESG investment dominates, with a size of 121.4 billion yuan, accounting for 91%, while partial-debt ESG investment size is only 11.5 billion yuan.
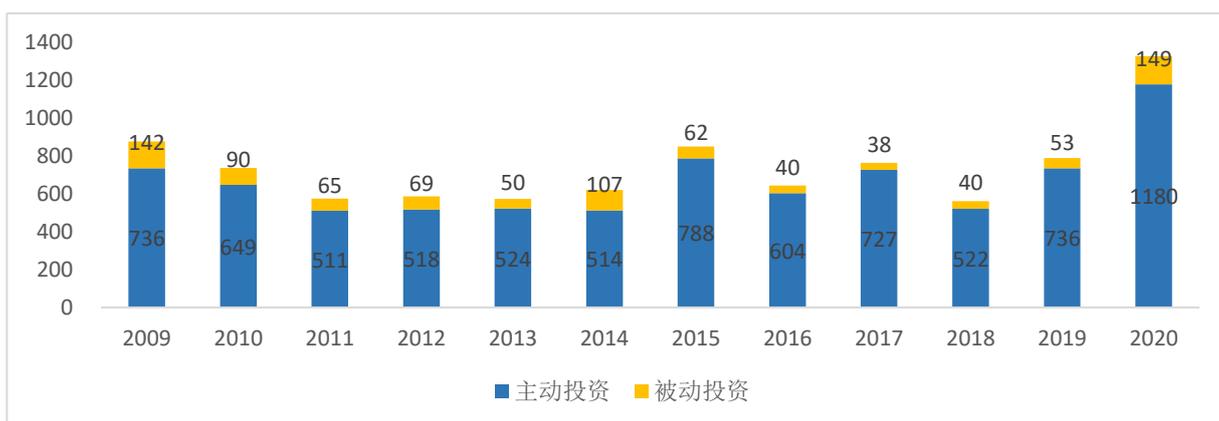
Figure 7. Sizes of active and passive ESG thematic funds (100 million yuan, as of December 2020)
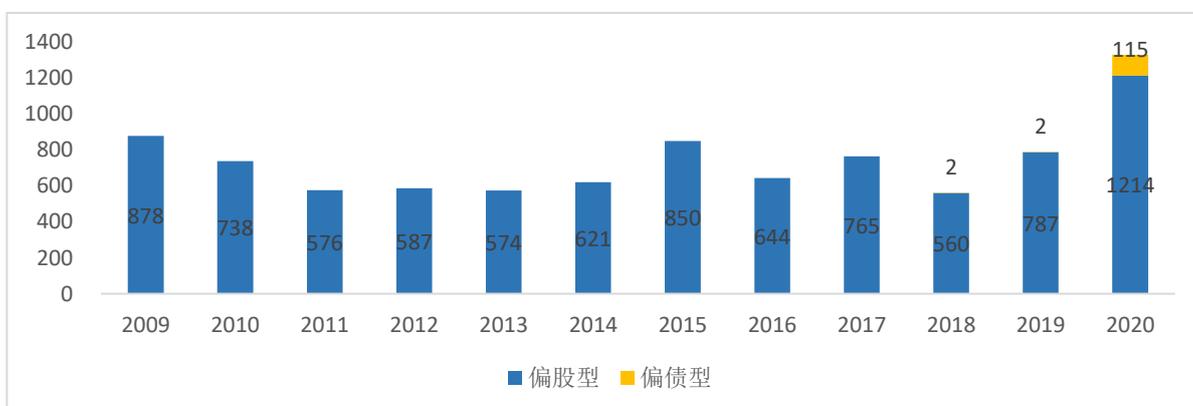
Figure 8. Sizes of Partial-equity and partial-debt ESG thematic funds (100 million yuan, as of December 2020)

4.2 ESG Funds

"ESG Fund" refers to the funds that adopt ESG investment strategy according to the fund contract. As of April 2021, there are 13 ESG funds in the domestic mutual fund market, including 2 index ESG funds and 11 active ESG funds, with a total fund size of approximately 13.6 billion yuan.

4.2.1 Index ESG Funds

Table 2. The domestic index and fund size

Abbreviation	Establishment date	Investment type	Fund size (100 million yuan)
Fortune MSCI China A Shares International Link ESG	2019-08-21	Passive Index Fund	0.3391
Caitong CSI 100 Index Enhanced A	2013-03-22	Enhanced Index Fund	1.9757

At present, the variety and quantity of domestic index ESG funds still need to be developed. There are only two index ESG funds, including an enhanced index fund and a passive index fund. Among them, the earliest and largest is the Caitong CSI 100 Index Enhancement Fund, which was established in March 2013, with a fund size of approximately 198 million yuan. Another Huabao MSCI China A Shares International Link ESG was established in August 2019. The size is only 33.91 million yuan.

4.2.2 Active ESG Funds

As of April 2021, a total of 11 active ESG funds have been counted, with a total fund size of approximately 13.4 billion yuan, including 8 partial-share hybrids and 3

common stocks. The oldest qualified Xingquan Social Responsibility Fund was established in April 2008. The fund is also the largest ESG fund in China so far, with a size of more than 6 billion yuan. The latest establishment is SPDB-AXA ESG Responsible Investment A, established in March 2021. The fund size reached 1.484 billion yuan. The smallest is Chuangjin Hexin ESG Responsible Investment A, with a fund size of only about 0.05 billion yuan.

Table 3. The Establishment date, Investment type and Fund size of ESG fund

Abbreviation	Establishment date	Investment type	Fund size (100 million yuan)
Caitong Sustainable Development Theme	2013-03-27	Partial-stock	5.5170
E Fund ESG Responsible Investment	2019-09-02	Common stock	7.7823
Southern ESG Theme A	2019-12-19	Common stock	10.7668
Damo ESG quantification first	2020-07-16	Partial-stock	5.1806
Wanjia Social Responsibility Set A	2019-03-21	Partial-stock	10.1034
Xingquan Social Responsibility	2008-04-30	Partial-stock	63.7692
Huitianfu Social Responsibility	2011-03-29	Partial-stock	14.6281
CCB Social Responsibility	2012-08-14	Partial-stock	0.2268
Chuangjin Hexin ESG Responsible Investment A	2020-12-30	Common stock	0.0513

Table 3. (continued)

Abbreviation	Establishment date	Investment type	Fund size (100 million yuan)
SPDB AXA ESG Responsible Investment A	2021-03-16	Partial-stock	14.8392
Founder Fubon ESG Theme Investment A	2020-12-28	Partial-stock	1.1206

4.2.3 Partial Stock Hybrid ESG Funds

Partial stock hybrid ESG funds have performed well in calendar year 2020, and the performance of different funds varies greatly. According to the average level of comparison, from the annualized return statistics on Wind, the average annualized return of the 9 partial-equity ESG funds is slightly higher than that of other funds of the same type and the benchmark Shanghai and Shenzhen 300 Index, which has certain advantages. Compared with other similar funds, ESG funds have not shown advantages in volatility and Sharpe ratio, and even partial-share hybrid ESG funds have shown greater disadvantages in Sharpe ratio. However, because the number of ESG funds is too small, and some of them have a short establishment time as well as the performance of different funds also shows large differences, the average value may not be very representative.

Judging from the performance of a single fund, the Wanjia responsibility fixed-open A achieved the highest annualized return of 68.70% and ranked second among the 9 funds in terms of the Sharpe ratio. The return and Sharpe ratio of CCB Social Responsibility, established in 2012, is also much higher than the average, with outstanding performance. Xingquan Social responsibility, which was established the earliest whose compounded annualized return is 48.36%, nearly 10 percentage points

lower than the average.
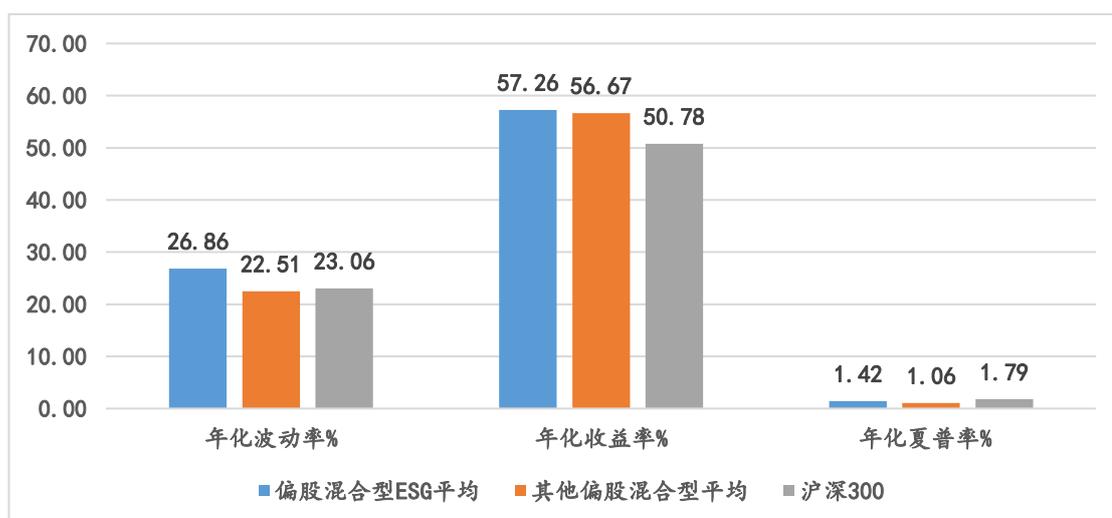
Figure 9. Performance of partial stock hybrid performance

4.2.4 Common Stock ESG Funds

Table 4. Common Stock ESG Funds

Abbreviation	Establishment date	Annualized volatility %	Annualized return %	Sharpe (annualized) (Before tax)%
E Fund ESG Responsible Investment	2019-09-02	27.2380	93.46	2.3767
Southern ESG Theme A	2019-12-19	28.6764	69.80	1.7986
Chuangjin Hexin ESG Responsible Investment A	2020-12-30	31.9231		-0.6801
Average common stock ESG		29.2792	81.63	1.1651
Average of other common stocks		24.3619	59.5957	1.2689

Among the common stock funds, the best performer is E Fund ESG Responsible Investment Fund. Its annualized volatility is slightly higher than the average of other common stock funds, but the annual yield and Sharpe ratio are both higher than the market average. From the perspective of the stock allocation ratio, the concentration of these active ESG funds is relatively scattered. Only Xingquan socially responsible

holds single stock investment exceeding 10% of the net value (for Kanghong Pharmaceutical (002773.SZ), accounting for up to 10.19%). Among the top ten holdings of the ESG funds, the industry configuration is mainly for pharmaceutical and biological, commercial trade, food and beverage, electronics, etc., which reflects the industry orientation of ESG responsible investment. At present, ESG investment in the Chinese market is developing vigorously. With the development of ESG investment, another two, four and four core ESG thematic funds were established in 2019, 2020 and 2021 respectively. One can believe that ESG thematic fund investment will usher in explosive growth in the future.

5. PERFORMANCE OF ESG THEMATIC FUNDS

The method to evaluation of fund performance have gone through a developmental process from a single-factor model to a multi-factor model, form simply considering market premium risks to introducing size factors, book-to-market value ratio factors, momentum factors, operating profitability factors, and investment style factors. In 1952, Markowitz proposed the modern asset portfolio theory in his seminal work, using the CAPM model to measure the risk and return of assets, laying the foundation for asset pricing theory. Subsequently, based on the capital asset pricing model, Treynor (1965), Sharpe (1966), and Jensen (1968) respectively proposed the classic single-factor performance evaluation index. This simplifies the investment evaluation process for investors, but there are still strict constraints on assumptions. It is not proper to explain the difference in the return of the investment portfolio with different characteristics of the stock. The arbitrage pricing theory (APT) proposed by Ross (1976) greatly overcomes this problem by introducing other factors besides systemic risks. Fama and French (1993) conducted an empirical study on the average return of stocks in the US stock market and found that market risk, size factors and book-to-market value ratio factors can better explain the changes in the cross-sectional data of stock returns. The famous Fama-French three-factor model thus was developed, which has been widely accepted by academia and industry. However, the three-factor model cannot effectively explain the momentum phenomenon that is common in the asset market. Along this line, Cahart (1997) proposed a four-factor model, adding a momentum factor to the three-factor model. With the development of the securities market, Fama and French further studied the data of the US market for more than 50 years and constructed a five-factor model. The profitability factor and investment style factor were additionally introduced to better simulate the expected return of the

combined cross-sectional stock portfolio. The applicability of the five-factor model has been tested in the international market. Research on the application of the five-factor model in the Chinese mutual fund market has important practical significance.

The purpose of this paper is to concentrate on the research on the adaptability of the five-factor model in the Chinese securities market. We aim to conduct empirical tests of the Chinese fund market and explain the excess returns of ESG thematic funds. We will give a detailed discussion on this important issue. We will also investigate whether there is a significant difference in the performance of ESG thematic funds relative to the market during the stock market crash or not. Therefore, we propose our hypotheses:

Hypothesis H1: The performance of Chinese ESG thematic funds can be explained by the five-factor model.

Hypothesis H2: There is no significant difference between the performance of ESG thematic funds and that of the market.

5.1 Model Data and Variables

5.1.1 Model Description

The Fama-French five-factor model is defined as follows:

$$R_{i,t} - R_{Ft} = a_i + b_i(R_{Mt} - R_{Ft}) + s_i SMB_t + h_i HML_t + r_i RMW_t + c_i CMA_t + \varepsilon_{i,t}$$

（1）

Where $R_{i,t}$ is the return of portfolio i in period t, R_{Ft} is the risk-free interest rate, and R_{Mt} is the return of market portfolio which is weighted average by market value. $R_{Mt} - R_{Ft}$ indicates the market risk premium. SMB_t is the market value factor that is the difference of the monthly return between a small market value portfolio and a large market value stock portfolio. HML_t is the book-to-market value ratio factor which is

the difference of the monthly return between the high book-to-market value ratio stock portfolio and the low book-to-market value ratio stock portfolio. RMW_t is the profitability factor, that is, the difference of the monthly return between the high-profit stock portfolio and the low-profit portfolio. CMA_t is the investment style factor, that is, the difference of monthly returns between the low investment ratio stock portfolio and the high investment ratio stock portfolio. $\varepsilon_{i,t}$ is the residual term with zero mean. If the coefficient of five factors can explain the excess return of ESG thematic funds, then the constant term a_i which is also called alpha in formula (1) will be zero.

This paper examines the adaptability of the Fama-French five-factor model in ESG thematic funds and uses it to explain the excess return of the funds which is mainly depending on the number of the constant term a_i. According to the t statistic of the constant term: if the null hypothesis cannot be rejected and it is not equal to 0, i it indicates that the Fama-French five-factor model can well explain the excess returns. By doing that, we are to explore whether there was a significant difference between the performance of ESG thematic funds and the market during the period before and after the crisis. In the middle of 2015, The Chinese stock market experienced a slump, forming a stock market crash.

5.1.2 Sample Selection and Data

In this paper, we used the data in Wind and CSMAR database for analysis. The overall study period is from January 1, 2010 to December 31, 2020. The selection of this period is based on the fact that the stock price of the Chinese market has experienced downward shocks, rapid rises and sharp declines, as well as a recovery of market. In addition, ESG thematic funds have experienced a certain amount of growth after 2010.
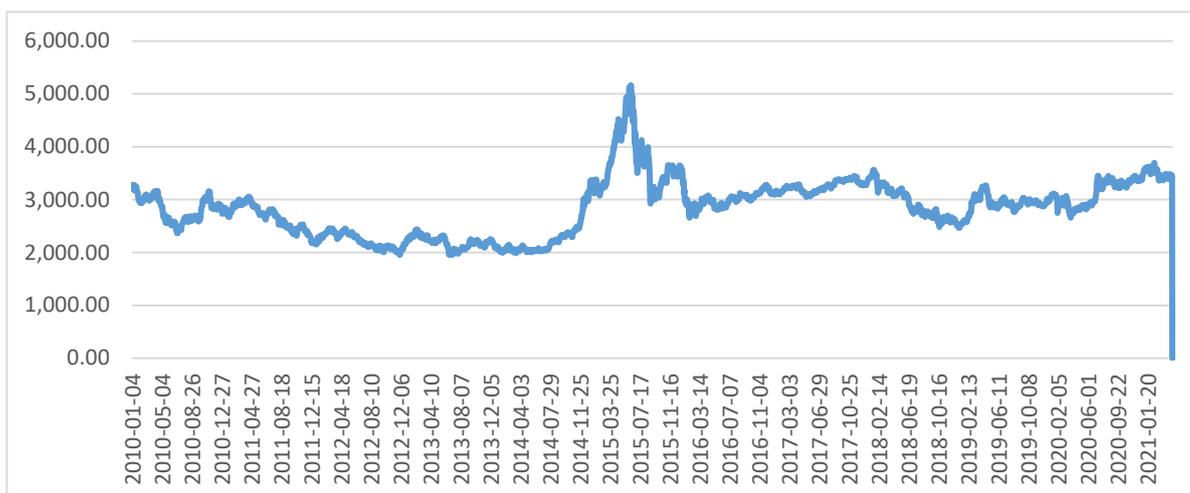
Figure 10. Daily trend of Shanghai Composite Index

The period from January 2010 to May 2014 is the downward phase. From June 2014 to June 2015, the market experiences a rapid rise. During the period from July 2015 to June 2016, one can find a sharp decline. From July 2016 to December 2020, the market gradually recovers. The true performance of the funds can be reflected in the entire market thus the conclusions would be reliable.

According to "ESG Investment Fund" caliber in Wind database, ESG thematic funds are selected (excluding non-initial and ETF feeder funds). QDII funds are deleted since they invest in the global market and we mainly study the A-share market. We exclude that bond funds which have no factor characteristics. Passive index funds track the underlying index and the factor characteristics are not significant, we also remove it. The number of our equity fund sample is 85, including 17 stock funds and 68 hybrid funds. Considering that Wind's collection of ESG thematic funds may not be complete, the ESG thematic funds discussed in this paper can be regarded as a representative subset of the entire market.

The monthly return data of the sample funds comes from the CSMAR database, and we select the month-end net value of the funds in the sample range. The return is $R_{i,t} = \ln(V_t / V_{t-1})$, where V_t represents the unit net value of the fund at time t, and

V_{t-1} represents the unit net value of the fund at time t-1. The risk-free rate data is also from the CSMAR database. We use the three-month fixed deposit interest rate announced by the central bank. Since the fund return data is monthly, it is necessary to adjust the three-month interest rate to be monthly, that is $R_{Ft}=\ln(1 + r/12)$, where r is the three-month fixed deposit interest rate. The purpose of our logarithmic calculation of fund returns and risk-free rates is to satisfy the basic assumption that the fund returns follow a normal distribution. Due to the differential nature of the logarithmic return, we do not need to do the stationary test of the data. At the same time, there will be no "false regression" phenomenon in the OLS test.

5.1.3 Factor Construction

Fama and French (2015) proposed three methods to construct risk factors. We choose a 2×3 construction method. First, we can divide all stocks into small market capitalization (S) and large market capitalization (B) groups. According to the 30% and 70% points of book-to-market value ratio, all stocks can be divided into three groups: high book-to-market value ratio (H), medium book-to-market value ratio (N), and low book-to-market value ratio (L). Secondly, by crossing the two indicators of market value and book-to-market value ratio, all stocks with six combinations of SH, SN, SL, BH, BN, and BL can be grouped; again, the profitability (OP) and investment style (INV) can be grouped separately. Instead of book-to-market value ratio, repeat the above steps to divide all stocks into 12 combinations of SR, SN, SW, BR, BN, BW, SC, SN, SA, BC, BN, BA. Here, R represents robust profitability and W represents weak profitability, C represents conservative investment style and A represents aggressive investment style, and N represents middle profitability or investment style.

After grouping, we can calculate the market value weighted average return for each period of the above different combinations, and finally, use the difference of the

different combinations of returns to construct four factors. Similar to the calculation of Fama and French (2015), we grouped the stocks according to the quantile points of each indicator at the end of June of year t, and used them to determine the portfolio of stocks from July of year t to June of year t + 1. For stock i, we take its market value in circulation at the end of June of year t as an indicator. "Book-to-market value ratio" (BE/ME) is the book value at the end of year t-1 divided by market value in circulation of stock i at the end of December of year t-1. We exclude stocks with a book-to-market value ratio less than or equal to zero. According to the operating profitability (OP), the R, N, and W portfolios are divided into strong profitability stock portfolios, medium profitability stock portfolios, and weak profitability stocks. The OP of t-1 years is used. We can divide the C, N, and A portfolios according to the investment style (INV), corresponding to conservative, neutral and aggressive style respectively.

- **Market risk premium $R_M - R_F$**

$$R_M - R_F = \text{Market return considering cash dividend reinvestment} -$$

$$\text{three-month fixed deposit interest rate}$$

- **Market value factor(SMB)**

$$SMB = （SMB_{B/M} + SMB_{OP} + SMB_{INV}）/3,$$

where

$$SMB_{B/M}=（SH+SN+SL）/3-（BH+BN+BL）/3,$$

$$SMB_{OP}=（SR+SN+SW）/3-（BR+BN+BW）/3,$$

$$SMB_{INV}=（SC+SN+SA）/3-（BC+BN+BA）/3.$$

- **Book-to-market value ratio（HML）**

$$HML=（SH+BH）/2-（SL+BL）/2.$$

- **Profitability factor（RMW）**

$$HML=（SR+BR）/2-（SW+BW）/2.$$

- **Investment style factor（CMA）**

$$CMA=（SC+BC）/2-（SA+BA）/2.$$

5.2 Descriptive Statistics

Table 5. Descriptive statistics of variables

Variable	N	Mean	Sd.	Min	Median	Max
RP	6136	0.007	0.074	-1.035	0.008	0.258
Return	6136	0.009	0.074	-1.034	0.010	0.260
Rate	6136	0.001	0.001	0.00100	0.001	0.003
RP1	6136	0.006	0.061	-0.243	0.006	0.175
SMB1	6136	0.004	0.046	-0.221	0.002	0.229
HML1	6136	-0.002	0.037	-0.144	0.000	0.160
RMW1	6136	0.003	0.027	-0.082	0.003	0.100
CMA1	6136	-0.002	0.021	-0.047	-0.003	0.055

According to the monthly net value matching the corresponding risk-free factor, the monthly return premium factor (Return premium) can be obtained, and then the corresponding market risk premium factor, market value factor, book-to-market value ratio factor, profitability factor and investment style factor can be matched.

Table 5 describes the descriptive statistical results of the sample population. The results show that the model (1) has a total of 6316 observations. Return represents the monthly return, rate represents the monthly risk-free rate and return premium is the monthly return premium of funds, that is, Return premium=Return-Rate(RP). RP1 represents the market risk premium factor, which uses the weighted average method of circulating market value to calculate the monthly market return considering the reinvestment of cash dividends. SMB1, HML1, RMW1 and CMA1 indicate that the calculation of the monthly return of the combination is weighted by the circulating market value. The overall average return of ESG thematic funds is 0.009, with a standard deviation of 0.074. After removing the risk-free return, the average return

premium is 0.007, with the standard deviation unchanged. The average return of the

market risk premium factor is 0.006, and the standard deviation is 0.061, which is

slightly smaller than the ones of the overall fund, indicating that the volatility of the

fund is greater than that of the overall market. For market value factor, book-to-market

value ratio factor, profitability factor and investment style factor, their average values

are 0.004, -0.002, 0.003, and -0.002, respectively.

Table 6. Correlation analysis among variables

	RP	MRP	SMB1	HML1	RMW1	CMA1
RP	1					
RP1	0.7400*	1				
SMB1	0.3059*	0.1811*	1			
HML1	-0.4718*	-0.2800*	-0.7361*	1		
RMW1	-0.2847*	-0.3279*	-0.7782*	0.4819*	1	
CMA1	-0.1570*	0.0079	0.1024*	0.3180*	-0.4031*	1

Note: * means significant at the 5% level.

Table 6 lists the correlation coefficient matrix of the variables. It can be seen that

the overall return premium of the fund is mainly related to the market risk premium

factor, and the correlation is positive. Secondly, the correlation coefficient between the

return premium and the market value factor is positive while the return premium is

negative to the book-to-market value ratio factor, the profitability factor and the

investment style factor. The above analysis did not consider the influence of the control

variables, and then the regression model was used for further testing.

5.3 Analysis of the Empirical Results of the Five-factor Model

Based on the model (1) constructed above, we adopt the OLS model to estimate the

correlation between the return premium and the five factors through STATA software

for conducting regression analysis. The overall period is 2010.01-2020.12. The

regression results are shown in Table 7 below.

Table 7. Basic regression results

	(1) 2010.01 -2020.12 Sample period	(2) 2010.01 -2014.05 Downward phase	(3) 2014.06 -2015.06 Rapid rise	(4) 2015.07 -2016.06 Sharp decline	(5) 2016.07 -2020.12 Recover
	RP	RP	RP	RP	RP
RP1	0.826***	0.727***	0.976***	1.012***	0.732***
	(44.298)	(36.301)	(17.506)	(12.502)	(40.555)
SMB1	0.135***	0.422***	0.528***	0.225**	-0.061
	(4.169)	(7.759)	(3.145)	(2.353)	(-1.313)
HML1	-0.518***	-0.300***	-0.274**	0.297*	-0.688***
	(-14.260)	(-5.419)	(-2.205)	(1.655)	(-13.168)
RMW1	0.311***	-0.053	0.592**	-0.108	0.395***
	(7.265)	(-0.577)	(2.138)	(-0.515)	(7.678)
CMA1	-0.155***	-0.721***	-0.376**	-0.013	-0.035
	(-4.018)	(-9.626)	(-2.431)	(-0.081)	(-0.702)
a	-0.000	-0.005***	-0.014***	-0.004	0.002**
	(-0.483)	(-5.001)	(-3.356)	(-1.417)	(2.341)
r2	0.632	0.647	0.632	0.698	0.578
N	6136.000	1340.000	514.000	619.000	3663.000
F	707.544	571.235	112.319	145.704	946.981
="* p<0.1	** p<0.05	*** p<0.01"			

Note: ***, **, and * indicate significant at the level of l%, 5%, and 10%, respectively. The Z statistics

are in parentheses.

The analyses for this study are conducted in two phases. To test Hypothesis H1, the

first phase compares the performance of ESG thematic funds with market indexes

through the overall period 2010-2020. In order to test Hypothesis H2, after controlling

for Fama-French five factors, the four sub-periods of 2010.01-2014.05, 2014.06-

2015.06, 2015.07-2016.06, and 2016.06-2016.12 are followed. These four sub-periods

contain a complete stock market operating cycle, including the period from the Great

Recession to the economic recession and the subsequent recovery period. We are

therefore broken down into four stock market cycles: shock downward, rapid rise, sharp

decline, and recovery.

The regression result (1) shows that the goodness of fit $R^2=0.632$, indicating that the fitting effect is good. It shows that the five factors explain the performance of ESG thematic funds, which achieves the purpose of attributing the fund return. The five factors are all significant at the 1% confidence level. The constant a=-0.0002 and is not significant thus the assumption that the constant is 0 cannot be rejected. There is no significant difference between the performance of ESG thematic funds and the market which shows that ESG funds have almost no excess returns. The assumption of the five-factor model is that the intercept term of the regression model is required to tend to zero. Hypothesis H1 is justified. The market risk premium factor coefficient is positive, the coefficient is 0.826, and is significant at the 1% confidence level. It shows that during the sample period, the performance of the ESG thematic funds is consistent with the overall market. The market value factor coefficient is positive, with a coefficient of 0.135, It is significant at the 1% confidence level, indicating that this type of fund prefers to allocate small-cap stocks. The coefficient of the book-to-market ratio factor is negative, with a coefficient of -0.518, and is significant at the 1% confidence level. One can imagine that the funds prefer allocation of growth stocks (i.e., stocks with relatively low book to market value). The profit factor coefficient is positive with a coefficient equal to 0.311, which is significant at the 1% confidence level. This result suggests that the funds prefer to allocate robust blue-chip stocks. One can also find that the investment factor coefficient is negative and significant at the 1% confidence level, implying that they allocate stocks with a relatively high annual growth rate of total assets, and their investment methods are slightly more aggressive. In general, the factor coefficients of the five-factor model are consistent with the fact that ESG thematic funds allocate more high-tech, environmental protection, and new energy-related stocks.

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The regression result (2) shows that from January 2010 to May 2014, the stock market was in a downward phase. The five-factor model explains the fund return (R^2=0.647). The constant term a is -0.005 and is significant at the 1% confidence level, indicating that the overall performance of the fund is not as good as the market within this interval. Among the five factors, the market risk premium factor, the market value factor, the book-to-market value ratio factor and the investment factor have significant impacts while the profitability factor has no significant impact. Among them, the market risk premium factor coefficient is positive, equal to 0.727, and extremely significant. It also shows that the overall fund is positively correlated with the market level. The performance is obvious, and the risk is relatively concentrated. A positive market value factor indicates that ESG funds often choose stocks with a small market value (for small and medium-cap investment), a negative book-to-market value ratio factor indicates that ESG funds prefer to allocate growth stocks while a negative investment factor indicates that ESG Fund investment methods are slightly aggressive.

The regression result (3) shows that from June 2014 to June 2015, the stock market experiences a rapid rise. The model is generally better at explaining the fund return (R^2=0.632), where the constant term a is -0.014, and is significant at the 1% confidence level. Thus the overall performance of the fund is inferior to the market within this interval. Among the five factors, the market risk premium factor, market value factor, and book-to-market value ratio factor have a significant impact at the 1% confidence level, and the profitability factor and investment model factor have a significant impact at the 5% confidence level. All of them can explain the performance of the fund. Among them, the market risk premium factor coefficient is positive, equal to 0.976, and extremely significant. The overall funds are positively correlated with the market level, and its performance is obvious, and they follow the overall rise of the stock market. A

positive market value factor indicates that ESG funds often choose stocks with a smaller market value to construct a portfolio. A negative book-to-market value ratio factor indicates that the fund prefers to allocate growth stocks (that is, stocks with a relatively low book market value). A positive profitability factor coefficient indicates that the funds prefer to allocate high-quality stocks. A negative investment factor coefficient indicates that the funds choose stocks with a relatively high annual growth rate of total assets and are slightly aggressive. During the overall upswing of the stock market, funds often make more aggressive investments to increase the return.

The regression result (4) shows that from July 2015 to June 2016, the stock market fell sharply. The model can better explain the fund return (R^2=0.698). The constant term is -0.005, but it is not significant, indicating that there is no significant difference in the performance of ESG thematic funds compared with the market during the Great Depression. This verified Hypothesis H2. During the stock market crash, there was no significant difference between the performance of ESG thematic funds and the market. During the economic crisis, ESG thematic funds demonstrated their ability to resist downside risks. Among the factors, the market risk premium factor has an extremely significant impact, followed by the market value factor. The book-to-market value ratio factor has a significant impact at the 10% confidence level, while the profitability factor and investment model factor have no significant impact. Among them, the market risk premium factor coefficient is slightly greater than 1 and extremely significant, indicating that during the sample period, the operating trend of the funds is consistent with the overall operating trend of the market. They may be aggressive.

The regression results (5) show that from July 2016 to December 2020, the stock market oscillated and corrected, and the economy gradually recovered. The model can partially explain the fund return (R^2=0.578). The constant term is 0.002, and it is

significant at the 1% confidence level, indicating that in the sample interval, ESG funds perform slightly better than the market. Among the factors, the market risk premium factor, the book-to-market value ratio factor, and the profitability factor have a significant impact, while the market value factor and investment model factor have no significant impact. Among them, the market risk premium factor coefficient is less than 1. The market value factor is negative, and the fund prefers large market value stocks at this phase. The coefficient of the book-to-market value ratio factor is negative. The coefficient of the profitability factor is positive. Excess income Alpha shows high significance. One can find that the ability to select stocks in this range may benefit from the gradual diversification of ESG investment strategies.

The findings from this study informs the literature on ESG thematic funds performance leading to and through the period of Great Recession and through the subsequent recovery and economic expansion periods following the Great Recession. The results of this study are consistent with our hypothesis. During the entire sample period of the study, the five-factor model can explain the excess returns of ESG themed funds and can be used for attribution analysis of performance. ESG thematic funds performed poorly during periods of market volatility and rapid growth. However, many investors participating in ESG thematic funds have sustainable or socially responsible motives. For these investors, exceeding market performance is usually not the most important criterion. The results show that, despite the poor performance of ESG thematic funds in the market during certain periods, there is no significant difference between the performance of ESG thematic funds and the market during the economic crisis. Even during the economic recovery, performance was slightly better than market performance.

The results also show that during the entire study period (2010-2021), ESG thematic

funds have a negative alpha value relative to the market, but it is not significant. However, the market risk premium factor, market value factor and profitability factor are related to the return.

Chinese stock market policies are different from foreign stock market policies. The first is the difference in the system. The Chinese stock market has strict requirements for companies before listing, and the threshold for listing is relatively high; the second is the trading system. The United States implements the T+0 trading system, which can be shorted, and there is no limit on the rise and fall, while Chinese stock market implements the T+1 trading system. The T+1 trading system has no short-selling mechanism, and there is a 10% limit on the daily rise and fall. Regulatory policies have a relatively large impact on the domestic stock market, and the regulator's continuous attention and promotion of low-carbon economy and green finance has also become the reason why ESG thematic funds are sought after by the market. However, given that the mutual fund market in China has available data for more than 20 years, the existence period of ESG thematic funds and the period covered by this study are relatively short. We need to do further study to check whether the performance of ESG thematic funds remains consistent over a longer period. Our limitation is the limited number of funds and the availability of past data. However, with the rapid development of ESG thematic funds in China and more diverse investment strategies, more data will become available to permit additional research opportunities.

6. EMPIRICAL TESTS OF ESG RATING

In recent years, under the dual drive of supervision and the market demand, Chinese asset managers have gradually incorporated ESG factors into their investment processes, which has increased the demand for ESG information and data. Now emerging technologies such as financial technology are constantly developing and progressing, including machine learning, natural language processing (NLP), semantic recognition, web scraping and so on. It will greatly broaden the collection methods of ESG information and data, and promote the efficiency of data collection. Many third-party ESG data providers have emerged in the market. There are three main data sources for ESG. One is a database built by the data service provider, which can export structured data, the other is semi-structured data such as XML, XBRL, and RDF, and the third is unstructured data such as the disclosure report of the Securities Regulatory Commission, news and web pages, etc. According to GISR statistics, there are more than 150 ESG providers worldwide, including ESG data providers, specific data providers, global data providers (Bloomberg, Reuters) and index providers (MSCI, FTSE Russell), etc. Some third-party ESG data providers have also emerged in China. Based on the methodology of foreign ESG data providers, they have incorporated characteristic indicators that satisfy the specific market conditions in the Chinese market.

Driven by policies and the market, listed companies in China have gradually realized the importance and feasibility of ESG concepts. Meanwhile, the ESG information disclosure reports issued by companies have continued to increase. We have counted the release of ESG reports on A shares from 2009 to 2020. The number of ESG reports issued by all A-share listed companies has grown from 371 in 2009 to 1021 in 2020, and the proportion has expanded to 27%. We further calculated the ESG release status of representative listed companies composed of 300 constituent stocks in

Shanghai and Shenzhen. In 2020, the number reaches to 259, accounting for more than 86%. This signal indicates that leading domestic listed companies have a strong sense of ESG disclosure. The improvement of ESG information disclosure will improve the quality of ESG data, laid an important foundation for the development of the domestic ESG evaluation system.

6.1 The ESG Ratings

As summarized in the previous literature review, many literature have studied the relationship and influence between ESG standards and CFP, and investment performance. They found that the ESG rating has a positive correlation with CFP and investment performance. Companies with excellent ESG not only have a stable corporate governance system but also produce better operational performance, then it enables to positively promote investment performance. We use the classic stock DCF model as a starting point to analyze the impact of ESG factors on the overall valuation of stocks. In the DCF model, the stock price P is equal to the discount of future cash flow CF: $P = \sum_{t=1}^{n} \frac{CF_t}{(1+R)^t}$, which is determined by the cash flow CF received by investors in each period and the discount rate R. Generally speaking, the cash flow CF of each period is the stock dividend received by investors, which can be simplified as net profit per share $\times$ dividend rate. The profit improvement mechanism of ESG comes from the cash flow CF of each period in the numerator of the formula P. ESG can affect the stock price by improving the profitability and dividend rate of listed companies. The risk transmission mechanism comes from the discount rate R. The discount rate is related to the degree of risk of stocks. If the systemic risk of listed companies is at a high level, the discount rate will also be at a high level. Through the transmission of profit and risk mechanisms, ESG factors have an impact on the overall valuation of stocks.

6.2 SynTao Green ESG Rating

Established in February 2015, SynTao Green Finance (SynTao) is a professional third-party service provider of green finance and responsible investment with market influence in China. Based on their long-term research experience on ESG, they launched a self-developed ESG rating system in 2015. First of all, ESG ratings were conducted for CSI 300 listed companies, and gradually expanded to CSI 800 listed companies, and then to achieve ESG ratings for A-share listed companies full coverage. SynTao's ESG evaluation system is based on the core connotation and development experience of ESG, with reference to the United Nations Sustainable Development Goals (SDGs) internationally, and important issues of concern to UNPRI, such as climate change, sustainable development of land resources, labor standards, etc.

In the local adaptation, referring to theoretical research on domestic situations and the market environment, by collecting ESG data of domestic listed companies, a three-level indicator system is constructed. The first-level indicators include three dimensions of environmental E, socail S, and governance G. The second-level indicators include 14 topics, the third-level indicators cover 200+ detailed points, and the underlying data exceeds 700 data points. In the ESG evaluation process, using public data, NLP technology and manual verification combined with dual guarantees, 52 industry models were established, including indicators and corresponding weights of different industries, and finally the ESG score of each company was obtained. The total score of SynTao's ESG evaluation has ten grades from high to low, which are A+, A, A-, B+, B, B-, C+, C, C- and D. The higher the score, the higher the company's ESG practice and management capabilities.

6.3 Profit Improvement Mechanism

According to the rating data at the end of 2020 provided by WIND, we divided

the CSI 800 constituent stocks into five groups from high to low. Each portfolios consists of 160 stocks. ESG1 is the group with the highest ESG score, that is, the group with the best ESG p. ESG5 is the group with the lowest ESG score. We further collected the financial and stock price information of the CSI 800 listed companies in 2020, where the data is provided by CSMAR database, then matched the information of different ESG groups. We calculated the ROE and dividend rate of different groups. As shown in Figures 11 and 12, since 2020, compared with the low-scoring group, the ROE and dividend rate of ESG1 and ESG2 in the ESG high-scoring groups are higher than those in the ESG low-scoring group ESG4 and ESG5. It shows that companies with higher scores have higher and more sustainable profitability and greater willingness to pay dividends thus it fully reveals profit improvement mechanism of ESG for listed companies.
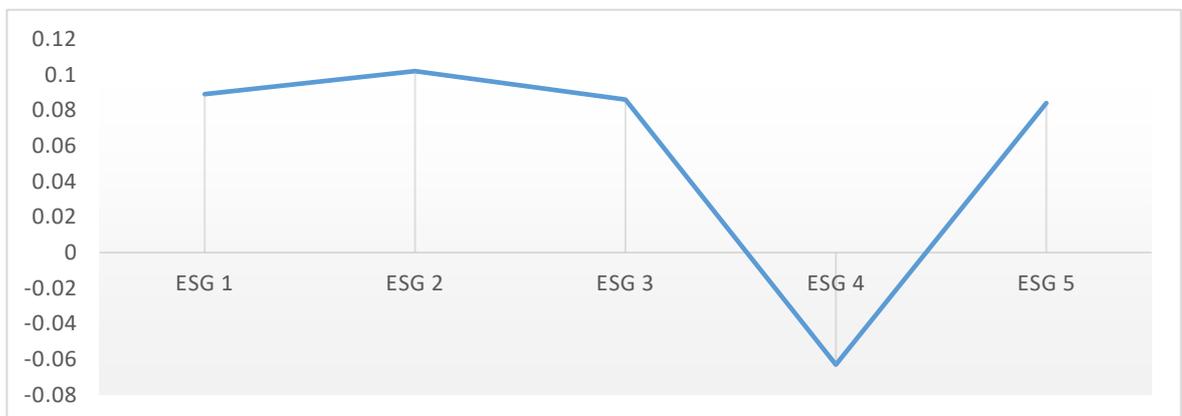

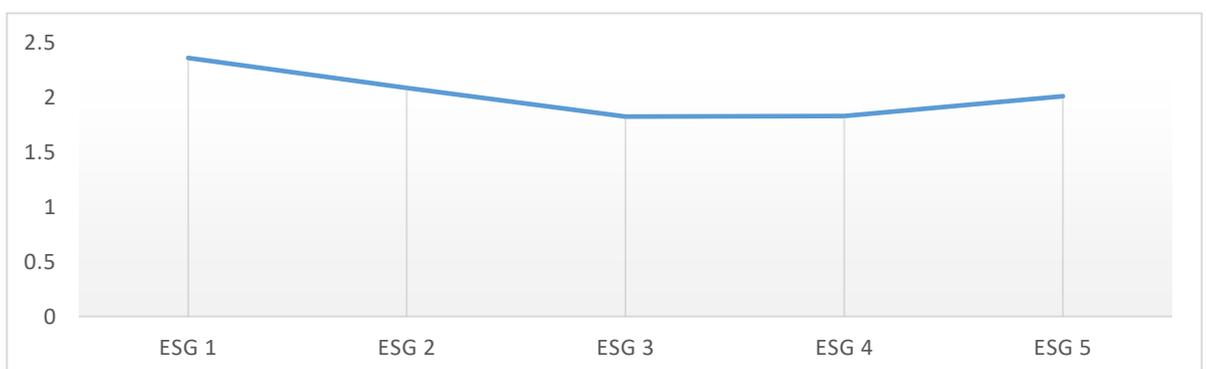Figure 11. ROE comparison of ESG groups

Figure 12. Comparison of the dividend rate of ESG groups

6.4 Return Risk of ESG Portfolio

In what follows, we explore the return and risk of different ESG portfolios. We calculated the annualized return and annualized volatility for the 5 groups of ESG portfolios. As can be seen from Figures 13 and 14, different ESG portfolios show a clear distinction between returns and risks. The high ESG score group has better investment returns and lower risks. ESG scores have a significant effect on portfolio returns and risks. In the CSI 800, the ESG highest-scoring group has an annualized return of 31.7%, which is significantly better than the lowest-scoring group which is of 25.5%. Moreover, the ESG high-scoring group has an annualized volatility rate of 39.3%, which is lower than the low-scoring group's 44.5%.
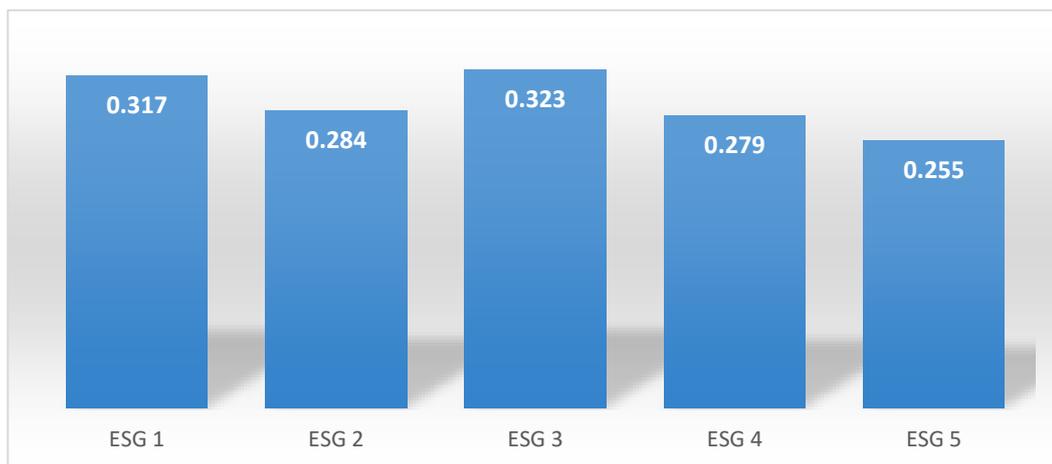

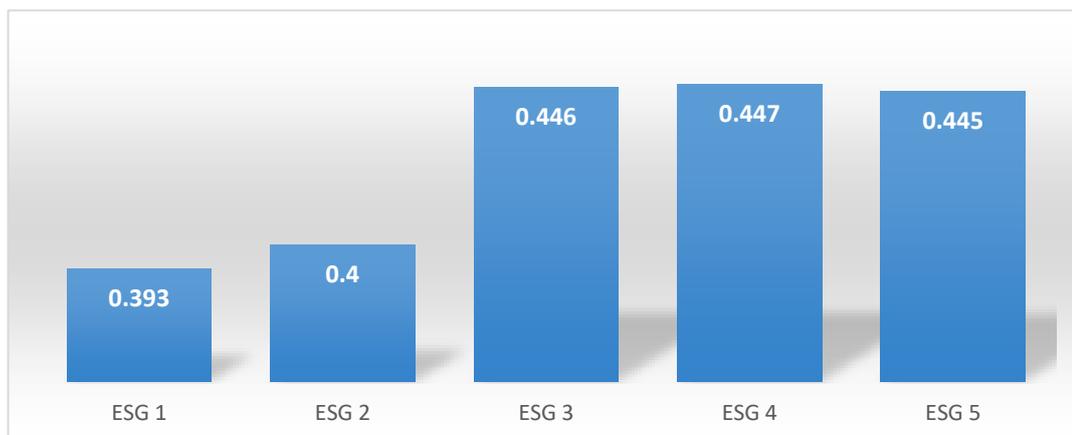Figure 13. Comparison of annual returns of ESG group

Figure 14. Comparison of annual volatility of ESG groups

Since the SynTao ESG rating only includes the CSI 800 constituent stocks, our study is still relatively preliminary and shallow. With the advancement of ESG disclosure policies by domestic supervision, the availability of data provided by ESG data providers will increase, the coverage of A-share listed companies by the ESG rating system will also be higher, and the reliability of its scores will be further improved. More correlations and differences between ratings can be analyzed to verify the effectiveness of ESG factors in investing. We also acknowledge that endogeneity of ESG investment is a potential concern here. That is, it is possible that better performance leads companies to invest more in ESG rather than more ESG investment leading to better performance.

7. CONCLUSIONS AND POLICY SUGGESTIONS

7.1 Main Conclusions

This paper uses ESG thematic funds from Wind database to conduct a detailed statistical analysis of their operating status, including the size, the proportion of different investment types, and the characteristics of return and risk. We use the monthly fund net value data in the CSMAR database as the initial sample. The research interval is from January 1, 2010 to December 31, 2020. We match equity ESG thematic funds to do OLS regressions. We apply the Fama-French five-factor model in Chinese mutual fund market. By applying the SynTao ESG rating, we study the profit improvement mechanism and risk-return characteristics of the ESG portfolio.

The conclusions drawn in this paper are as follows. First, during the entire sample period of the study, the five-factor model better explained the excess returns of ESG thematic funds and can perform attribution analysis on the fund performance. Our test contains the period of economic recession, that is the period of stock market crashes, and the subsequent period of recovery. The results show that, despite the poor performance of ESG thematic funds in the market during certain periods, there is no significant difference between the performance of ESG thematic funds and the market during the economic crisis.

Second, the results also show that during the entire period (2010-2021), ESG themed funds have a negative alpha relative to the market, but it is not significant. However, the market risk premium factor, market value factor, and profit factor are positively correlated with the performance. It indicates that ESG thematic funds perform well when the overall market premium rises, and they prefer to allocate small market capitalization and blue-chip stocks. Consistent with this, ESG thematic fund returns are negatively correlated with book-to-market value ratio factors and investment

model factors.

Third, based on the ESG scores of the CSI 800 listed companies rated by CSI, we can divide them into five groups. The ROE and average dividend rate of the ESG high-scoring group are higher than those of the ESG low-scoring group. This shows that companies with higher ESG scores have higher and more sustainable profitability and greater willingness to pay dividends, and it also fully reveals the impact of ESG on the profit improvement mechanism of listed companies.

Finally, in the study on the return and risk characteristics, we calculated the annualized return and annualized volatility for 5 groups of ESG portfolios. We can find that different ESG portfolios have return and risk discrimination, in which the ESG high-scoring group has better investment returns and lower risks. Prior studies in this area have focused on social responsibility funds in developed markets, but there are few papers on Chinese ESG funds. Although some studies have compared the performance of socially responsible investment funds with non-socially responsible investment funds in the market, few studies have compared the performance of funds within the field of socially responsible investment. We are the first to compare the performance between funds in this sector and thus our paper adds to the ESG literature.

7.2 Future Research

For the ESG thematic funds, we can also evaluate the ESG scores of the ESG funds based on the ESG ratings, then analyze the annualized return rates and annualized volatilities to find whether ESG funds with high ESG performance have better returns and lower risks. We leave this for future research.

As part of future research, we also plan to calculate the annualized return rates and annualized volatilities of different portfolios in each ESG field. For example, we can calculate portfolios with high and low corporate governance scores, high and low social

responsibility scores, etc.

7.3 Policy Suggestions

Although there is a large gap between domestic ESG responsible investment and overseas developed capital markets, it still shows a broad development space and growth potential. Looking forward to the future, regulators, asset owners, asset managers and third-party service providers need to work together to promote the construction of "ESG ecosystem" in China.

7.3.1 Suggestions to the Government

The high attention paid by government regulators to ESG is the core motivation of market development. In the ESG field, supervision should continue to steadily promote top-down mandatory data disclosure policies, urge companies to improve the disclosure of ESG information, promote listed companies to implement ESG responsible investment concepts, and at the same time promote and encourage ESG responsible investing in the asset management market. One of the most important impacts would be on the climate, which is probably of great concern to the government. Stimulating demand could incentivize companies to engage in more climate friendly manufacturing practices.

7.3.2 Suggestions to the Institutional Investors

For asset owners, the funders represented by insurance should actively follow the market development trend and integrate ESG into the investment process. With the growth of size, the improvement of marketization and the adjustment of the assessment cycle, social security and pension institutions will become leaders in ESG investment in the future. It drives institutional investors to attach importance to ESG concerns.

For asset managers, the long-term investment capability represented by ESG is a weapon to stand out in the fierce market competition in the future. It is recommended

that institutional investors systematically build their leading ESG investment capabilities, including improving the analytical capabilities in big data at the level of business construction. Meanwhile they should strengthen ESG talent investment, and provide support in organizational structure and management assessment, and actively deploy the diversification of ESG products.

In addition, the development of ESG is inseparable from the support of solid industry infrastructure. Domestic third-party data providers should further learn and use advanced technologies such as financial technology, explore the collection, quantification and analysis of ESG data, and continuously improve professional knowledge and algorithm models. It also helps the development of ESG in academic empirical research and industry practices.

7.3.3 Suggestions to Individual Investors

Individual investors should strengthen the learning of ESG investment knowledge. Investors should fully learn ESG-related investment knowledge, receive investor training and education, and improve investment judgment and risk identification capabilities. Investors should also objectively evaluate their own investment capabilities, determine appropriate investment objectives based on their own capabilities, and select matching investment targets.

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