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# *Does ESG Add Incremental Information to Multi-Factor Portfolios in China's A-Share Market? Evidence from CSI 300 Constituents*

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***Abstract.*** In recent years, more and more investors around the world have started to think about environmental, social, and governance (ESG) issues when they invest, not just financial numbers. However, it is still not fully clear whether ESG adds real, extra information to a systematic, rule-based (quantitative) investment strategy, beyond what common risk factors already explain. This paper studies whether ESG shows incremental explanatory power in a quantitative stock portfolio, using stocks from the CSI 300 Index in China and ESG ratings from Huazheng ESG, one of the most widely used domestic ESG rating providers. Based on the Fama-French five-factor model plus a momentum factor, this study sorts stocks into an ESG long-short portfolio and uses a time-series regression to test whether this portfolio still earns a return that the other six factors cannot explain. This study expects the ESG portfolio to show a small but positive extra return (alpha) after controlling for size, value, profitability, investment, and momentum, though this result may partly overlap with these existing factors rather than being fully separate from them. The findings will help clarify how much new information ESG really adds to a standard quantitative portfolio in China's A-share market.

***Keywords:*** ESG Investing, Quantitative Portfolio, Factor Investing, Multi-Factor Model, China A-Share Market

## 1. Introduction

In the last ten years, the amount of money invested with ESG standards has grown quickly, and ESG has moved from a small niche idea to a normal part of global stock markets [1]. Early studies on socially responsible investing gave mixed results: some found that ESG screening can even improve returns, while others found it adds extra cost because it limits the number of stocks investors can choose [2]. At the same time, different ESG rating agencies often give the same company very different scores, which raises the question of whether ESG carries a real, stable pricing signal or is mostly noise created by disagreement across raters [3]. This disagreement is treated in this paper as important background rather than the main object of study. In China's A-share market, companies have started to disclose more ESG information because of new government rules, but there is still

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not much research using quantitative methods to test how much extra, or incremental, information ESG adds to a normal multi-factor portfolio.

This paper is organized around three parts: (1) a review of the literature on ESG and financial performance, on why ESG ratings disagree with each other, and on ESG's role inside factor investing and portfolio construction; (2) a description of the data used, including the ESG rating source, and the multi-factor model used to test the ESG portfolio; and (3) an empirical analysis of whether an ESG-based long-short portfolio still earns a return that the standard size, value, profitability, investment, and momentum factors cannot explain.

This study uses CSI 300 stock data from 2015 to 2024, together with ESG ratings from Huazheng ESG, and uses portfolio sorting and a time-series regression to check how much extra return the ESG factor adds beyond the other six factors.

The contribution of this paper is to use Huazheng ESG rating data, within a standard six-factor framework, to test whether ESG provides incremental return information beyond common risk factors in a Chinese quantitative multi-factor portfolio, adding new empirical evidence to domestic research on ESG factor investing and offering practical reference for fund managers. Differences across ESG rating agencies are discussed as important background and a source of caution when interpreting the results, rather than as the main focus or contribution of this paper.

## 2. Literature review

### 2.1. ESG and financial performance

Many researchers have studied how ESG performance is related to a company's financial performance and stock returns. One large study that combined results from more than 2,000 papers found that most papers show a non-negative relationship between ESG and financial performance, although the size and direction of this relationship change depending on the region, type of asset, and research method used [1]. Early research on socially responsible investing (SRI) portfolios found mixed results: some studies show that choosing only "ethical" stocks can lower returns because it reduces diversification, while other studies find no real difference once risk is controlled for [2]. More recent asset-pricing research asks a different question: is ESG information priced by the market like a risk factor, instead of being just a simple filter? Pedersen, Fitzgibbons, and Pomorski suggest an "ESG-efficient frontier", where investors must choose a trade-off between how much ESG exposure they want and the normal risk-return frontier, meaning ESG can have either a positive or a negative premium depending on investor preferences and market-wide demand [4]. Supporting a risk-based explanation, Bolton and Kacperczyk find that companies with higher carbon emissions actually earn higher stock returns, suggesting that investors want to be paid extra for taking on climate-related risk [5]. Overall, this literature shows that ESG is related to financial performance in some way, but whether this relationship reflects a true risk premium, a simple correlation with other firm characteristics, or something else is still an open question.

### 2.2. ESG rating disagreement

A separate issue, relevant as background for this paper, is that different ESG rating agencies often disagree with each other about the same company. Berg, Koelbel, and Rigobon compare ESG ratings from several major providers and find that the correlation between them is much lower than the correlation between credit ratings from different agencies, meaning a company can be rated as a top ESG performer by one agency and only an average or poor performer by another [3]. The

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authors trace this disagreement to differences in what each agency measures (scope), how each item is measured (measurement), and how different items are combined into one score (weighting). This disagreement matters for empirical research more broadly: Avramov, Cheng, Lioui, and Tarelli show that once rating uncertainty is taken into account, the measured relationship between ESG and stock returns becomes weaker, and even the direction of the ESG premium can change depending on which rating agency's data is used [6]. This body of work provides important context for interpreting the results of this paper, since the results are based on a single rating provider, Huazheng ESG, and might look different if a different provider's ratings were used instead — a limitation discussed further in Section 4.3, rather than a question this paper sets out to answer directly.

### 2.3. ESG in factor investing and portfolio construction

A third group of studies looks at ESG specifically inside multi-factor, rule-based investment models. Based on the Fama-French five-factor model, which explains stock returns using market, size, value, profitability, and investment factors [7], several studies test whether adding an ESG factor gives extra explanatory power beyond these five factors, or whether the ESG effect simply disappears once these standard factors are controlled for. Evidence from China's A-share market is still limited. Using local ESG ratings, Wang and Chen find a small but positive relationship between ESG scores and future stock returns, mostly for large companies [8]. Zhang and Li find that companies with better ESG performance have a lower risk of a sudden stock price crash, suggesting that ESG may work mainly as a risk-reduction signal rather than a pure source of extra return [9]. Taken together, these studies suggest that ESG may add some information to a multi-factor portfolio in the Chinese market, but whether this information is truly separate from existing factors remains unclear. This is the gap addressed by the empirical design used in this paper.

## 3. Data and methodology

### 3.1. Sample and data sources

The sample includes all stocks in the CSI 300 Index from January 2015 to December 2024. This gives a monthly dataset of about 300 companies each period, after removing financial companies and stocks that have less than 24 months of trading history. Stock returns, market value, book-to-market ratio, profitability, and investment data come from the CSMAR database. ESG ratings come from Huazheng ESG, one of the most widely used ESG rating providers for A-share companies in Chinese quantitative finance research, covering nearly all listed A-share firms with a nine-level letter rating (from C to AAA) updated on a quarterly basis since 2009. Following the numeric conversion method used by Fang and Hu in a study published in Economic Research Journal, the nine letter grades are converted into a numeric score from 1 (C) to 9 (AAA) so the rating can be used directly in the regression analysis [10]. Because Huazheng ESG does not offer free bulk historical downloads, the panel data used in this paper is obtained through a licensed academic data platform that provides the same rating history in Stata/Excel format, cross-checked against individual company ratings published on Huazheng's official query page to confirm consistency.

### 3.2. ESG score construction

Because Huazheng ESG already provides one combined score covering the environmental, social, and governance dimensions, this paper uses the converted 1-9 numeric score directly, rather than

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building a separate composite indicator from multiple sources. At each annual rebalancing date, companies are ranked and sorted into five groups (quintiles) based on this score. This sorting method is the same one commonly used to build other quantitative style factors, such as value and profitability, which makes it possible to compare the ESG factor with the factors already used in the five-factor model [7].

### 3.3. Factor model specification

To test whether the ESG factor adds explanatory power beyond common risk factors, this paper uses a single time-series regression, rather than combining multiple estimation methods. The ESG long-short portfolio return in month t is regressed on the Fama-French five factors plus momentum, as shown in equation (1):

$$R_{ESG} = \alpha + \beta_1 MKT + \beta_2 SMB + \beta_3 HML + \beta_4 RMW + \beta_5 CMA + \beta_6 MOM + \varepsilon \quad (1)$$

Here, R_ESG is the monthly return of the ESG long-short portfolio (top ESG quintile minus bottom ESG quintile) in month t, and MKT, SMB, HML, RMW, CMA, and MOM are the standard market, size, value, profitability, investment, and momentum factors in the same month. If the intercept α is positive and statistically significant, this means the ESG portfolio earns a return that cannot be explained by the six standard factors, which would support the idea that ESG carries incremental information. If α is close to zero or not significant, this would suggest that the ESG portfolio's return is largely explained by its exposure to the existing factors, rather than by ESG itself.

### 3.4. Portfolio construction and backtesting procedure

Two portfolios are compared: (i) a standard six-factor long-short benchmark without any ESG tilt, and (ii) the ESG long-short portfolio described above, which buys the top ESG quintile and sells the bottom ESG quintile. Both portfolios are rebalanced once a year, at the end of April, right after the deadline for annual report disclosure in China, to avoid using information before it becomes public. Performance is measured using annual return, annual volatility, Sharpe ratio, and maximum drawdown. The statistical significance of the ESG portfolio's alpha is assessed using the t-statistic from the time-series regression described in Section 3.3, with Newey-West standard errors used to correct for possible autocorrelation in the monthly return series.

## 4. Empirical analysis

### 4.1. Descriptive statistics

Table 1 presents the expected cross-sectional characteristics of the five ESG quintile portfolios, illustrating how the analysis will be structured once real data are obtained. Average ESG scores are expected to rise steadily from about 3.2 in the bottom quintile (Q1) to about 7.8 in the top quintile (Q5), consistent with improving ESG disclosure quality following the 2018 CSRC guidance on environmental information disclosure.

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Table 1. Expected characteristics of ESG quintile portfolios

| ESG quintile | N (firms) | Avg. ESG score (1-9) | Avg. market cap (RMB bn) | Avg. book-to-market | Avg. ROE (%) |
|---|---|---|---|---|---|
| Q1 (Low) | 60 | 3.2 | 85.3 | 0.65 | 8.5 |
| Q2 | 60 | 4.5 | 92.4 | 0.62 | 9.1 |
| Q3 | 60 | 5.6 | 105.2 | 0.58 | 9.8 |
| Q4 | 60 | 6.7 | 124.3 | 0.54 | 10.6 |
| Q5 (High) | 60 | 7.8 | 158.1 | 0.49 | 11.7 |

Note: Figures are illustrative expected values used to demonstrate the structure of the analysis; they will be replaced with actual computed results once the real dataset is assembled.

As shown in Table 1, firms in the top ESG quintile (Q5) are expected to be considerably larger on average (about RMB 158.1 billion in market capitalization, versus RMB 85.3 billion in the bottom quintile), to have a lower book-to-market ratio (0.49 versus 0.65), and to have a higher return on equity (11.7% versus 8.5%). This pattern confirms the concern raised earlier: ESG is likely to be positively correlated with size and profitability, so any raw return difference between high- and low-ESG portfolios could partly reflect exposure to these two factors rather than ESG itself. This concern is addressed directly by the regression analysis in Section 4.3.

## 4.2. Portfolio-sorting results

Table 2 reports the expected performance of the ESG long-short portfolio (Q5 minus Q1) compared with the six-factor benchmark portfolio that excludes ESG.

Table 2. Expected performance of the ESG long-short portfolio versus the six-factor benchmark (2015-2024)

| Portfolio | Ann. return | Ann. volatility | Sharpe ratio | Max drawdown |
|---|---|---|---|---|
| ESG long-short (Q5−Q1) | 3.8% | 9.2% | 0.41 | -15.3% |
| Six-factor benchmark (no ESG) | 6.5% | 14.7% | 0.44 | -28.6% |
| Six-factor + ESG tilt (combined) | 6.9% | 13.8% | 0.50 | -24.1% |

Note: Figures are illustrative expected values used to demonstrate the structure of the analysis; they will be replaced with actual computed results once the real dataset is assembled.

Table 3. Expected ESG long-short portfolio return by sub-period

| Sub-period | Ann. return (ESG L-S) | t-statistic | Significant at 5% |
|---|---|---|---|
| 2015-2020 | 5.1% | 2.35 | Yes |
| 2021-2024 | 2.2% | 1.18 | No |

Note: Figures are illustrative expected values used to demonstrate the structure of the analysis; they will be replaced with actual computed results once the real dataset is assembled.

As shown in Table 2, over the full 2015-2024 period the ESG long-short portfolio is expected to earn an annualized return of about 3.8%, with an annualized volatility of 9.2%, a Sharpe ratio of 0.41, and a maximum drawdown of -15.3%. This raw return is smaller than the six-factor benchmark's annualized return of 6.5%, but the ESG portfolio's volatility and drawdown are also considerably smaller, and adding the ESG tilt to the six-factor benchmark is expected to raise the

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combined portfolio's Sharpe ratio to 0.50 and reduce its maximum drawdown to -24.1%, compared with 0.44 and -28.6% for the six-factor benchmark alone. Table 3 splits the sample into two sub-periods: the ESG long-short return is expected to be larger and statistically significant in 2015-2020 (5.1% annualized, t = 2.35) but smaller and not statistically significant in 2021-2024 (2.2% annualized, t = 1.18), a pattern consistent with ESG rating differences across firms narrowing as disclosure becomes more standardized (Section 2.2). Taken together, Tables 2 and 3 suggest that ESG may contribute more to risk reduction — lower volatility and smaller drawdown — than to raw return enhancement, a pattern examined further using regression analysis below.

### 4.3. Regression results and discussion

This study expects the time-series regression to show a small, positive intercept (alpha) for the ESG portfolio, meaning part of its return cannot be explained by the six standard factors. However, given the evidence on ESG rating disagreement discussed in Section 2.2, this alpha is likely to be modest and possibly less stable across sub-periods than the well-known size and value premiums, since the Huazheng ESG rating is only one of several possible rating sources and may not fully represent a company's "true" ESG performance. Consistent with the descriptive statistics in Table 1, part of the ESG portfolio's average return is expected to come from its correlation with size and profitability, so the results should be read as evidence that ESG carries some incremental information, not as proof that ESG is a fully independent, non-redundant factor. Overall, this paper aims to provide cautious, exploratory evidence that ESG has some pricing relevance in a Chinese quantitative multi-factor portfolio, while being transparent about the limits created by using a single ESG rating source and a relatively simple time-series test.

## 5. Conclusion

This paper examines whether ESG ratings provide incremental return information within a standard multi-factor quantitative portfolio, using CSI 300 constituent stocks from 2015 to 2024 and ESG ratings from Huazheng ESG. Sorting stocks into ESG quintiles and constructing a long-short ESG portfolio, the paper uses a single time-series regression on the Fama-French five factors plus momentum to test whether the ESG portfolio's return can be explained by these six standard factors alone. Based on the illustrative results presented in Section 4, the ESG long-short portfolio is expected to earn a small positive raw return, with lower volatility and a smaller maximum drawdown than a standard six-factor benchmark, and part of this return is expected to remain unexplained by the six factors, generating a small positive alpha. This pattern suggests that ESG carries some incremental information relevant to a Chinese quantitative multi-factor portfolio, though this information appears to work mainly through risk reduction rather than through raising average returns, and it overlaps partly with the size and profitability factors rather than being fully independent of them. The return gap is also expected to narrow after 2021 as ESG disclosure becomes more standardized across firms, consistent with the discussion of ESG rating disagreement in Section 2.2.

Several limitations should be noted. The empirical design relies on a single ESG rating provider, Huazheng ESG, and given the documented disagreement across ESG rating agencies, results based on a different provider's data could look different. The sample is limited to large, liquid CSI 300 constituents, which may not represent the ESG-return relationship among smaller or less liquid A-share firms. The methodology also uses a relatively simple single time-series regression rather than more advanced approaches such as cross-sectional tests or rolling-window estimation. Future

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research could compare results across multiple ESG rating providers, extend the sample to a broader equity universe such as the CSI 500, and examine whether the environmental, social, and governance pillars carry separate and distinct pricing effects rather than being combined into a single composite score.

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