ESG Preference and Market Efficiency: Evidence from Mispricing and Institutional Trading [†]

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Abstract

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Abstract

This paper documents that the uprising ESG investing constitutes a new "friction" for stock market efficiency after 2003. Socially responsible institutions underreact to mispricing signals when trading according to mispricing prescriptions is against their preference for ESG performance, further leading to return predictability. Specifically, most underpriced stocks with poor ESG performance have the highest risk adjusted returns, while most overpriced stocks with good ESG performance have the lowest risk adjusted returns. We rule out alternatives, such as known limits to arbitrage or difference in investment horizon. The inefficiency is not fully offset by ESG-neutral arbitrageurs due to funding liquidity constraints.

Keywords: ESG preference; stock mispricing; socially responsible institutions; market efficiency

JEL Classification: G14; G23; G41; M14

1. Introduction

ESG investing, which incorporates a firm's ESG (Environmental, Social, and Governance) performance into investment decision making process, becomes noticeably popular over the recent years.[1] U.S. institutional investors have been voicing their support to ESG and also converting such promises into practices (Starks, Venkat, and Zhu (2017)). Mutual fund investors collectively reveal the preference for good ESG performance (Hartzmark and Sussman (2018)). Hedge fund managers also see a meaningful increase in the demand for ESG (Deutsche Bank (2018)).[2] According to the report by U.S. SIF Foundation, out of every five dollars under professional management in the United States, more than one was invested according to SRI (socially responsible investment or investing) strategies—$8.72 trillion or more in aggregate, at the end of 2015.[3] The AUM of the SRI strategies represents more than 22% of total investment assets. While there is stronger revealed preference for ESG investing (SRI) among institutional investors and in assets management industry, little is known about its impacts on institution's investment decision and the stock market implication.

Institutional investors have a variety of considerations in their investment decisions.[4] Our empirical findings show the ESG preference may limit socially responsible (SR) institutions' ability to trade against mispricing signals.[5] This dampened response to information may induce price under-reaction for stocks that are affected by such preference and generate cross-sectional return predictability in certain portfolios, as the mispricing subsequently gets corrected. That is, underpriced stocks with bad ESG performance have the most positive alphas and overpriced stocks with good ESG performance have the most negative alpha. In contrast, alphas do not exist for

[1] Socially responsible investing (SRI) has a history longer than ESG investing. Through the 1980's, SRI investors screened out companies they found offensive – tobacco, weapons, or alcohol, to name a few. In the early 1990's, SRI fund managers added a "risk and return" analysis to their tool kit, but the primary goal of SRI remains an ethics-driven avoidance of certain stocks. ESG investing emerged around 2003 as a response to corporate governance scandals in early 2000s – Tyco, WorldCom, and Enron. As ESG has become a major approach to SRI, we do not distinguish ESG and SRI investing and use them interchangeably in our paper.

[2] One in five respondents currently allocates to socially responsible/environmental, social and governance (ESG) investments – up from 13% last year. Of these respondents, two-thirds (67%) are looking to increase their allocation to ESG funds in 2018 (see Deutsche Bank (2018)).

[3] The U.S. SIF foundation identifies the SRI strategies if the assets are managed using Socially Responsible Investing as guidelines.

[4] See e.g., Almazan, Brown, Carlson, and Chapman (2004), Lewellen (2001), and Cao, Han, and Wang (2017). These considerations include restrictions on the market capitalization and the style of stocks in the portfolio, position limits on a stock or an industry, and restrictions on the tracking errors, portfolio turnover, and investment strategies allowed.

[5] We use mispricing score constructed by Stambaugh, Yu, and Yuan (2015) and corroborate the results using post earnings announcement drift (PEAD).

underpriced stocks with good ESG performance or for overpriced stocks with poor ESG performance. Our paper differs from Hong and Kacperczyk (2009) that "sin" stocks deliver a positive alpha because of social norms. First, ESG investing, compared with excluding sin stocks such as tobacco and alcohol firms, better reflects the integrated approach of socially responsible investing in recent years. By directly examining the interaction between ESG performance and an uncorrelated mispricing measure, our study echoes the "double bottom lines" of SRI, that investors are seeking investments that are both financially profitable and socially beneficial. Second, we capture both positive and negative screening process in SRI decision making, while excluding "sin" stocks only reflect a small part of negative screening.[6] We highlight that both high and low ESG performances can constrain SR institutions from trading against mispricing. Last, while "sin" stocks in Hong and Kacperczyk (2009) are followed by fewer financial analysts and deliver positive abnormal return, the stocks that deliver abnormal returns in our sample are larger, more liquid, and covered by more financial analysts. Such differences demonstrate that low ESG firms in our study are very different from "sin" stocks.

Stock market contains noise traders who are subject to behavioral biases that create mispricing, and institutional investors who are supposed to trade against noise traders and correct mispricing. However, different institutions have different attitudes towards ESG when making investment decisions. Some institutions incorporate ESG into investment decisions and some do not.[7] The most important driver for institutional investors to do ESG investing is the demand from their clients, which enhances competition within assets management industry and further moves the industry towards ESG investments.[8] Clients are also willing to pay a higher management fee[9]

[6] "Sin" stocks refer to those firms having business in alcohol, tobacco, and gaming industry. The "sin" stocks only consist of 9.6% of our test sample and only 22.6% of "sin" stocks are classified in low ESG performance group in our study.

[7] As our study focuses on U.S. stock market, which is dominated by institutional investors, we use investors, institutions, and institutional investors interchangeably in our paper.

[8] According to Marie Giertz, Chief Economist at Swedish public pension fund Kåpan, the whole financial industry, the fund industry, is moving toward ESG investment. "I think the whole financial industry, the fund industry, is moving toward ESG investment. We can't be left behind — we have to follow that trend." (see State Street Global Advisors (2018)).

[9] Based on the report of Morningstar Direct, the asset-weighted average expenses ratios is higher for ESG funds comparing to Non-ESG funds for six out of seven Morningstar categories. Please refer to Appendix Table A1 for details. Riedl and Smeets (2017) also argue that investors are willing to pay significantly higher management fees on SRI funds than on conventional funds.

for the investments that are both financially profitable and socially beneficial.[10] However, financial performance and ESG performance may point to different directions of trading. For example, a socially responsible institution will shy away from a poor ESG firm, even though the stock will deliver a positive abnormal return in the future. In the opposite case, such SR investor would be reluctant to sell a socially responsible stock, even if the stock is overpriced as she believes her investment decision contributes to a better society. Consequently, inefficiency could exist under asset pricing models defined without considering the non-financial preference or taste (Fama and French (2007)). We therefore empirically test this hypothesis and examine how the uprising ESG investing affects future stock return conditional on the direction of mispricing, and ultimately affects market efficiency as a newly emerged phenomenon.

Using data from the MSCI ESG STATS database (formerly known as KLD), we construct the ESG score for more than 4,000 unique U.S. public firms over 2003 to 2013.[11] The score, by adding social benefits and subtracting social harms, captures both positive and negative screening, and therefore can better reflect the decision-making process of an average socially responsible investor.[12] The measure is comprehensively used in finance studies on corporate social performance. The single sort results using monthly stock return show that there is an insignificant cross-sectional relation between ESG score and future monthly stock return. The results indicate that a firm's social performance has little impact on future return, unconditionally.

We then formally investigate how ESG affects future stock return, conditional on the relative mispricing magnitude of the stock price. Following Stambaugh, Yu, and Yuan (2015), we rely on a composite mispricing score, which considers 11 asset-pricing anomalies, to capture the mispricing magnitude of a single stock in a given month.[13] If SR institutions are reluctant to buy

[10] Such investments are known by various terms, including "social investing", "investing with impact", and "impact investing". In this paper, we do not distinguish and refer to investors with two-bottom-lines (or multiple-bottom-lines) investment objectives as socially responsible investors.

[11] We start from 2003, when the database increased its coverage to around 3,000 unique U.S. public stocks. The data structure, however, changes again in 2014. We therefore restrict the sample to the period between 2003 and 2014.

[12] The MSCI ESG STATS (KLD) database provides detailed information on firms' CSR activities according to 13 categories: community, diversity, employment, environment, human rights, product, alcohol, gaming, firearms, military, nuclear, tobacco, and corporate governance. Within each category, the database shows whether the firm has performed a benefit ("strength") or effected a harm ("concern"), and awards one point for each relevant activity. The score therefore reflects a firm's social performance from many dimensions and is a better measure in our context as investors can have different focuses on social performance.

[13] The cross-sectional correlation between ESG score and mispricing score is as low as -0.11, which makes independent double sort an ideal framework in our analysis. The low correlation supports our assumption that the mispricing created by noise traders is exogenous to firms' ESG performance.

poor ESG stocks, we would expect the impact of underpricing to remain stronger among those stocks.[14] Following the same logic, if SR institutions are reluctant to dump stocks with good ESG performance, we would expect the impact of overpricing to be stronger among high ESG stocks. We test these hypotheses by conducting a two-dimensional sort, based on mispricing score and a firm's ESG performance. Our empirical evidence lends support to the aforementioned argument that ESG performance indeed affects the mispricing correction process.

We document that the positive abnormal return for most underpriced stocks concentrates on the portfolio with poor ESG performance. The monthly value-weighted Fama-French 3-factor alpha for the underpriced and low ESG score portfolio is as high as 47 basis points. In contrast, the alpha for the entire underpriced stock group without consideration of ESG performance, is only 14 basis points per month. The positive abnormal return is absent for a subgroup with high ESG scores, consistent with the idea that SR institutions are more willing to correct the underpricing of these stocks. In the same vein, we find the negative abnormal return for most overpriced stocks is driven by firms with good ESG performance. While the Fama-French 3-factor alpha for the most overpriced stocks is -58 basis points per month, that for the overpriced stocks with high ESG score is -86 basis points. Such negative future abnormal return is, in this case, absent in firms with low ESG score, as SR institutions are more willing to sell those stocks. The results are robust to various asset pricing models and are not due to variations in mispricing score or stock characteristics such as size, liquidity, and analyst coverage.

A natural question then is whether the effect is more prominent for institutions that have a stronger preference for ESG. We therefore classify institutional investors into socially responsible institutions (SR institutions) and non-SRI according to their revealed preference, that is the portfolio holding. If a stock is held by more SR institutions, we expect the under-reaction to correct mispricing is also larger because of stronger preference for ESG performance.

The empirical findings confirm our conjecture. Specifically, we find the positive abnormal return for underpriced-low ESG stocks is concentrated on stocks with high SR institutional ownership. The negative abnormal return for overpriced-high ESG score stocks is also driven by stocks that are held by more SR institutions. We also find consistent results using active mutual fund ownership. Our analysis of institution's holding changes further confirm that SR institutions

[14] We do not distinguish investment preference and investment constraints in our paper. Therefore, preference and constraints are used interchangeably.

underreact to mispricing signals compared with other institutions, lends additional support to the return results. We further rule out alternative hypotheses that, for example, the results are driven by different investment horizons, or differences in stock characteristics. In fact, stocks held by more SR institutions tend to be larger, more liquid, followed by more analysts, and have a lower lending fee. Therefore, the stronger abnormal returns for these stocks are unlikely to be driven by known limits to arbitrage measures, or other arbitrage risks such as jumps.

ESG investing was relatively a small part in the investment industry before 2004 but experiences a noticeably fast growth in recent years. Therefore, it is natural to compare the impact of ESG before and after 2004 and we expect the impact to be stronger in recent years. We re-do all the analysis for a sample between 1996 and 2003, when ESG concept was not popular yet. Mispricing score has strong return predictability, however, we find no impact of ESG on mispricing correction, and socially responsible institutional investors play no role in market efficiency, either. Note that the U.S. stock market has become rather efficient in recent years and most anomalies are diminishing (Chordia, Subrahmanyam, and Tong (2014)), due to better liquidity, lower transaction costs, more arbitrage forces, and academic research (McLean and Pontiff (2016)). Our paper, however, demonstrates that the fast-growing socially responsible investment has a non-negligible role on stock market efficiency as a newly emerged phenomenon.

Moreover, one could not ignore the other participants in the stock market. While SR institutions underreact to mispricing signals, why don't ESG-neutral arbitrageurs take such profits left on the table? Then we investigate the role of funding liquidity and find that our results are only significant when there is limited arbitrage capital available. During those periods, ESG-neutral arbitrageurs can hardly do leveraged arbitrage as the cost of borrowing is very high. The return predictability we have documented is an equilibrium between socially aware (pro-ESG) and unaware (ESG-neutral) investors: pro-ESG investors' under-reaction to mispricing signal leads to return predictability, while such inefficiency is not fully offset by ESG-neutral arbitrageurs due to funding liquidity constraints.

To corroborate our previous findings, we conduct similar tests for standardized unexpected earnings surprise (SUE), which is one of the long-lasting anomalies and is not included in the mispricing score. We again find supporting evidence. Specifically, for the highest (lowest) SUE group, the post earnings announcement drift (PEAD) is more positive (negative) for low (high) ESG firms. Using a calendar-time portfolio approach, the abnormal returns of long-short portfolio

sorted on SUE only comes from stocks held more by SR institutions and during low funding liquidity period. Taken together, the results point to a novel finding that ESG preference is a new source of "friction" and affects market efficiency.

To our best knowledge, the paper is the first to explore the impact of ESG investing on the decision making of asset management industry and stock market efficiency. Two recent papers are most related to our paper. Using the release of Morningstar sustainability rating, Hartzmark and Sussman (2018) find that mutual fund investors collectively put a positive view on ESG performance. There is a positive flow to mutual funds with good sustainability rating and a negative flow to mutual funds with poor rating. Our paper examines the broader stock market and our results indicate that on average, stock market investors care about ESG performance. Starks et al. (2017) document that socially responsible institutional investors are long term oriented and more patient with high ESG firms. Those institutions do not sell the stocks even after negative news or poor stock performance. Our paper directly tests the impact of such investors on stock return and market efficiency. Different from Starks et al. (2017), however, we find socially responsible institutional investors underreact to mispricing signals because of the preference, after controlling for investment horizon.

Our paper is also related to the frictions of trading, especially for the investment decision of institutional investors. Institutions, while more sophisticated, are also subject to diversification requirement or tracking-error restrictions (e.g., Almazan, Brown, Carlson, and Chapman (2004)); Cao, Han, and Wang (2017); Lewellen (2001)). Our paper highlights while liquidity improves and transaction costs become lower, new "frictions" emerge over time, due to the demand from clients. Anecdotal evidence and previous literature show the social awareness has spread to mutual funds and hedge funds and is no longer limited to pension fund. We empirically document the impact of such change and conclude ESG investing constitutes a new dimension for institutional investors' decision making, which affects the mispricing correction and market efficiency. Our evidence potentially helps understand Edelen, Ince, and Kadlec (2016), who find that institutions aggregate rather than correct mispricing. Socially responsible institutional investors may buy overpriced stocks because of superior ESG performance or dump underpriced stocks because of bad ESG performance.

Lastly, our paper highlights the importance of modeling investors' social preference in asset pricing. In their inspiring paper in 2007, Fama and French argue that investors' taste for

assets may lead to inefficiency defined without considering such taste or preference. One fast growing taste or preference in recent years is ESG investing. Socially responsible investors are willing to forgo financial performance in order to in accordance of their social preference (Riedl and Smeets (2017)). Such preference is absent in current asset pricing models and is even more important when the demand for positive social impact becomes non-negligible. Our paper empirically demonstrates that the preference for ESG challenges market efficiency under classical asset pricing models. We call for more research along this line.

The rest of the paper is as follows. Section 2 describes our sample and measures. We present our baseline results and the role of socially responsible institutional investors in Section 3. Section 4 explores the impact of uprising ESG investing on stock market efficiency and the role of funding liquidity. Section 5 concludes the paper.

2. Data and Measures

2.1. Data sources and sample coverage

We collect data on firms' Environmental, Social and Corporate Governance (ESG) performance from MSCI ESG STATS database (formerly known as KLD). Developed by a for-profit company, the ESG scores are similar to credit ratings. The scores measure the firm-level social performance, along the line including community relations, product characteristics, environmental impact, employee relations, workforce diversity and corporate governance.[15] The database covers both the social benefits and harms of a firm, and therefore reflects both negative and positive screening process of social responsible investing.[16] Our empirical tests focus on the period from 2003 to 2013, during which the dataset covers the top 3,000 U.S. firms.[17] Appendix Figure A1-(a) shows the stock coverage of ESG database over years. The comprehensive coverage of more than 4,000 unique U.S. public firms allows us to conduct cross-sectional tests.

To measure mispricing magnitude, we use the monthly updated MISP score in Stambough, Yu, and Yuan (2015). Stock returns, price and trading volumes, and mutual fund data are obtained

[15] ESG scans public databases such as those that have experienced employee strikes and Environmental Protection Agency (EPA) violations and uses a team of analysts to measure these and other social-responsibility dimensions of firm production. The database has been frequently used in the relevant literature for corporate social responsibility (see e.g., Flammer (2015); Lins, Servaes, and Tamayo (2017); Cao, Liang, and Zhan (2018)).

[16] Negative screening is largely used for socially responsible investment (SRI), where fund managers exclude certain stocks that are creating social harms, for example sin stocks. Positive screening, however, is seeking stocks that create social benefits. For ESG investment, both social harms and benefits are considered to better capture the risks.

[17] We do not include most updated data for 2014 since a large amount of ESG data is missing due to structure change.

from the Center for Research on Security Prices (CRSP). We take Fama-French common risk factors and risk-free rate from Kenneth French's website. The accounting data are collected from Compustat. The analyst coverage and forecast data are obtained from 1/B/E/S. We obtain quarterly institutional holding (13F) and mutual fund holding (s12) data from Thomson Reuters. The intra-day stock trades and quotes information are obtained from Trade and Quote (TAQ) database. We also obtain data on U.S. individual stock options from OptionMetrics. The stock lending fee data are from Markit for the period from 2006 to 2014.

The ESG data are published close to the end of each calendar year and we apply it to the monthly returns of the next calendar year. For our stock return test sample, we only include observations of common stocks (CRSP share code 10 and 11) traded on NYSE, AMEX, and NASDAQ. Stocks with price below five dollars on the last trading day of previous month are excluded. Appendix Table A2 reports the sample coverage of 277,573 stock-month observations from January 2004 to December 2014, with 4,324 unique stocks. On average, we have 2,103 stocks each month, covering 31.16% of universe stocks in terms of numbers and 66.43% in terms of market value. Most of them are large, growth stocks, with 72% institutional ownership and 9.43 analyst coverage on average. Relative to the full CRSP sample, the average size percentile and book to market ratio percentile are 0.72 and 0.42, respectively. Moreover, the industry distribution is quite close to the CRSP sample. Therefore, our results are not driven by small, illiquid stocks, or stocks in certain industries.

2.2. Key measures

2.2.1. ESG score

Following the relevant literature, we use the ESG score to measure a firm's social performance. As aforementioned, the database includes a firm's performance along several dimensions, and scores are updated on annual basis (at the yearend), including both strengths and concerns. Following the relevant literature, we consider five dimensions, including environment, community, diversity, employee relationship, and corporate governance.[18] To comprehensively reflect the stock picking process with social performance as guidelines, we consider both the social benefits and harms of the company. In the database, a social benefit is flagged as a strength. For example,

[18] We do not exclude corporate governance dimension, as it is one of the factors in ESG investment guidelines. The results still uphold even if we do so.

in the "environment" category, "strengths" include environmentally beneficial products and services, pollution prevention, recycling, clean energy, communication on environmental issues. Moreover, a harm is flagged as a concern. For instance, hazardous waste and ozone-depleting chemicals are environmental concerns. To capture the net social performance, we focus on the difference between strengths and concerns in each category. Then we sum up the net score for each dimension and obtain a firm-level social performance measure. The net ESG score is our baseline measure and a higher ESG score indicates better social performance.

One may be concerned about whether the measure captures confounding effects, such as firm size, which can affect the mispricing correction as well. We also conduct robustness tests using a size-adjusted ESG score.[19] The results using adjusted ESG scores are largely similar.

For robustness, we also consider an alternate data source for ESG score: Sustainalytics ESG Research and Ratings. This data source has several advantages – monthly updated, more variations in numeric value, and well used by practitioners such as Morningstar. However, it is only available from August 2009 and the coverage is much smaller. Therefore, we compute, whenever possible, a combined ESG score using the information from both datasets and all results are consistent. [20]

2.2.2. Mispricing measure (MISP)

Mispricing score (MISP) for a stock is a composite measure constructed by combining its rankings on 11 anomaly variables computed at the end of the last month. They are *Net Stock Issues*, *Composite Equity Issues*, *Accruals*, *Net Operating Assets*, *Asset Growth*, *Investment-to-Assets*, *Distress*, *O-score*, *Momentum*, G*ross Profitability Premium*, and *Return on Assets*. For each anomaly, the stocks are sorted into 100 groups and assigned with a rank according to the group it belongs to. For each anomaly, the highest rank is assigned to the stocks associated with the lowest average abnormal return, as documented in the literature. A stock's mispricing measure (MISP), ranging between 1 and 100, is the arithmetic average of its ranking percentile for each of the 11

[19] We adopt two methods to adjust for size effects. In first method, we follow Hwang, Titman, and Wang (2016) and sort the stocks into 10 deciles based on size. Then we calculate the average ESG score of stocks for each size decile. Size-adjusted ESG is the ESG scores minus the average ESG scores of stocks in its decile. In the second method, we run cross-sectional regression for ESG score on lagged firm size each year and take the residual as a firm's size-adjusted ESG score.

[20] More specifically, we first normalize the score by the maximum range of the score at that year for both datasets. Then, the combined score is calculated as

$(1_{KLD} \times KLD_{it} + 1_{Sustainalytics} \times Sustainalytics\ Score)/(1_{KLD} + 1_{Sustainalytics})$

Where 1_{KLD} is a dummy variable indicating if the score is available in the KLD data source for stock i at period t.

anomalies. According to this measure, stocks with the highest MISP scores are the most overpriced and the future expected returns are negative. Those with the lowest values are the most underpriced, with positive future abnormal returns. Our results are also robust to an alternative composite mispricing score measure covering 12 anomalies used in Chordia et al. (2014).[21]

2.2.3. Socially responsible institutional ownership measure (SR_IO)

We follow three steps to calculate the Socially Responsible Institutional Ownership (SR_IO) for a certain stock. First, we measure an institution's social preference by examining its holdings per period. Second, we define SR institutions according to certain cutoffs for all institutions. Last, we calculate SR institution ownership at the firm level.

1) Measure social responsibility scores for institutions

We measure the investment preference / style for the socially responsible institutional investors by averaging the ESG scores of all stocks according to the market capitalization in their portfolios at the end of each quarter, using equation (1).

$$ISRS_{i,q} = \sum_{j \in i} w_{j,q} ESG_j \quad (1)$$

where $ISRS_{i,q}$ is the social responsibility score for institution i at the end of quarter q . $w_{j,q}$ is the weight of stock j in institution i's portfolio at the end of quarter q. The results do not change if we instead use an equal-weighting scheme to calculate $ISRS_{i,q}$. Using a size-adjusted ESG score to calculate $ISRS_{i,q}$ does not change the results as well.

2) Define socially responsible (SR) institutions and non-socially responsible (NSR) institutions

Each quarter, we sort all institutions into three groups based on their portfolio's average social responsibility scores ($ISRS$). Institutions in the top group are defined as Socially Responsible (SR) Institutions. Institutions in the bottom score group are defined as Non-Socially Responsible (NSR) Institutions.

3) Calculate Socially Responsible Institutional Ownership (SR_IO) for all the stocks

[21] The 12 anomalies in Chordia et al. (2014) include size, book-to-market ratio, reversal, momentum, accruals, asset growth, cash holding, analyst dispersion, new equity issues, idiosyncratic volatility, profitability, and Standardized unexpected earnings.

Socially Responsible Institutional Ownership (SR_IO) on stock level is calculated as equation (2): the percentage of shares held by SR institutions divided by shares held by all institutions.

$$SR\_IO_{j,q} = \frac{\#\ of\ shares\ held\ by\ SR\ Institutions}{\#\ of\ shares\ held\ by\ all\ institutions} \quad (2)$$

This method gives more weight to those institutions with large share holdings. If those large shareholders are buy-and-hold investors and do not trade extensively, we might artificially include a constant part, making it less influential. Therefore, in order to reflect all the managers' impact equally, we also calculate the SR_IO using the alternative definition as equation (3): the number of SR institutions divided by the total number of institutions.

$$SR\_IO_{j,q} = \frac{\#\ of\ SR\ Institutions\ holding\ the\ stock}{Total\ \#\ of\ institutions\ holding\ the\ stock} \quad (3)$$

The two measures complement each other. Both measures of SR_IO are used in the empirical tests and the results are consistent and robust.

2.3. Sample summary

Table 1 reports the descriptive statistics of three main measures in this paper (MISP score, ESG score, and Socially Responsible Institutional Ownership) and other firm characteristics, from January 2004 to December 2014. On average, the mean of mispricing score is 49.56. There is, however, a reasonable cross-sectional variation. The standard deviation of MISP score in our sample firm is 12.53, large enough to identify overpriced and underpriced stocks over time. The ESG score has a mean of -0.17. It is clustered around 0 and has a small standard deviation. We therefore apply more extreme values to identify the firms that are doing poorly or well in terms of social performance. Socially Responsible Institutional Ownership (SR_IO), defined as the percentage of shares held by SR institutions divided by shares held by all institutions, has an average of 13.93%. The average value of market capitalization is 6,229 million USD. Even the smallest 10% of our sample firm has an average market cap of 262 million USD, indicating that our sample firms are quite large. The stocks on average have 9.43 analyst coverage and 72% institutional ownership, consistent with the fact that large firms are followed by more financial analysts and held by more institutional investors.

[Insert Table 1 about here]

Panel B of Table 1 shows the average of these variables across three ESG score groups: Low, Medium, and High. As illustrated in the Appendix Figure A1-(b), the distribution of ESG scores is discrete and clustered. A large portion of our sample firm has ESG scores of -1, 0, and 1.[22] We therefore apply more extreme values as cut-off points to classify our sample firms into Low, Medium, and High ESG groups. Our choice of breakpoints is a balance of distance in ESG scores and diversification. The breakpoints of ESG scores vary across years and the numbers of stocks included in the portfolio are reported in the Appendix Table A3. On average, during 2003 to 2013, 257 stocks are classified as Low ESG firms and 301 stocks as High ESG firms, consisting of 11.39% and 13.27% of the sample firm.

As shown in Panel B, Low, Medium, and High ESG score group has an average ESG score of -3.19, -0.52, and 4.10 respectively. There is little variation of MISP score across ESG score groups. An average MISP score close to 50 indicates that each portfolio is relatively fairly valued. Not surprisingly, the average SR_IO is much higher for High ESG score group since these stocks are more attractive to SR institutions. There is some variation of firm characteristics across three ESG subgroups: stocks in High ESG score group tend to be relatively bigger, followed by more analysts, and have a slightly lower idiosyncratic volatility, while Low ESG score group has the highest turnover on average.

We further report the time-series average of cross-sectional Pearson correlation and Spearman correlations between our key measures and firm characteristics in Panel A of Appendix Table A4. The Spearman correlation between ESG score and SR_IO is 0.27, which is not high, given the construction procedure of SR_IO. ESG score have a relatively low Spearman correlation with MISP score (-0.11) and other firm characteristics. Spearman correlations between SR_IO and Size, analyst coverage, and institutional ownership are 0.53, 0.42 and -0.08, respectively.

3. Results

3.1. Mispricing, ESG score, and stock return

[22] Take year 2003 for example, the Low ESG portfolio contains 326 stocks with scores ranging between -7 and -2. Releasing the breakpoint to -1 would include 543 more stocks, with a score of -1, into Low ESG portfolio. In contrast, tightening the breakpoint to -3 would only retain 114 stocks in such portfolio instead.

In this section, we formally test whether ESG preference affects SR institutions' decision of correcting mispricing and return predictability. As we have mentioned above, such impact will only be effective when trading according to mispricing signals is against the preference for ESG. Specifically, for underpriced stocks, if the ESG performance is poor, SR institutions will shy away from them, though there is a positive alpha by holding those stocks. In contract, for overpriced stocks, SR institutions are reluctant to sell the socially beneficial firms.

To test these hypotheses, we perform independent double sorting (5X3) based on MISP score and ESG score. To validate our analysis, we first confirm that MISP score predicts portfolio alphas well [23] and ESG score itself does not predict the stock return cross-sectionally in our sample [24]. Although a firm's ESG score has little impact on future return unconditionally, our hypothesis predicts a negative relation among most mispriced stocks (MISP score P1 and P5). At the end of each month, all available stocks are sorted into five mispricing quintiles based on the mispricing score. P5 refers to the stocks are the most "overpriced" and stocks in P1 are the most "underpriced". Then stocks are independently sorted into Low, Medium, and High groups, based on their ESG scores and annual breakpoints.

Panel A of Table 2 reports the value-weighted 3-factor alphas of next month for each MISP-ESG portfolio. Within the most underpriced stocks (MISP score P1), the abnormal portfolio return decreases with ESG score. Low ESG, Medium ESG, and High ESG portfolios have a monthly average 3-factor alpha of 0.47%, 0.16%, and 0.04 %, respectively. The alpha for most underpriced stocks with Low ESG scores is the highest both economically and statistically. Such results are consistent with our conjecture. On average, investors are reluctant to buy stocks that have a poor ESG performance, even when they are underpriced, leaving a significant positive alpha. In contrast, firms with good ESG performance, even though they are underpriced to a similar magnitude, have an insignificant alpha. Investors on average do not hesitate to buy those stocks and underpricing is corrected quickly.

[Insert Table 2 about here]

[23] As shown in Appendix Table A5, the value weighted CAPM alpha decreases from quintile 1 to quintile 5, generating a spread of -0.72%, significant at 1% level.

[24] Reported in Appendix Table A5, the monthly raw return decreases from 0.96% to 0.82% in ESG score. The spread between High ESG portfolio and Low ESG portfolio, however, is insignificant. The results are similar using different asset pricing models and weighting methods.

Within the most overpriced stocks (MISP score P5), the abnormal portfolio return also decreases with ESG score. Low ESG score, Medium ESG score, and High ESG score portfolios on average earn -0.20%, -0.35%, and -0.86% 3-factor alpha next month. Newey-West t-statistic for most overpriced stocks with High ESG score is -2.62. Consistent with the ESG preference rationale, SR institutions are not selling "good citizens" though there is a financial benefit of doing so. For these relatively overpriced stocks, SR institutions are much more willing to sell the "bad" companies, timely correcting the mispricing, and the portfolio alpha for these stocks is therefore insignificant.

Given that the institutions' ESG preference may amplify the impact of mispricing on future stock return, one can construct a refined trading strategy based on mispricing score and ESG score. Specifically, we long the underpriced stocks with poor ESG performance and short the overpriced stocks with good ESG performance. The long-position, short-position, and long-short spreads of the strategy are reported in Appendix Table A6. We compare our refined strategy with the trading strategy using the MISP score and full sample (Appendix Table A5) to show the incremental value. Specifically, our refined strategy doubles the value-weighted 3-factor alpha from 72 basis points to 133 basis points per month. The magnitude of alpha from both long-position and short-position increases, from 0.14% to 0.47%, and from -0.58% to -0.86%, respectively. Consistent findings are documented when we use CAPM alpha or 4-factor alpha to measure the long-short spread of our refined strategy.

3.2. The role of socially responsible institutions

Thus far, we have documented that underpriced stocks with poor ESG performance demonstrate the highest risk adjusted returns and overpriced stocks with good ESG performance demonstrate the lowest risk adjusted returns. Such results indicate that when institutions make decisions, they may also take into account the ESG performance of the stock. Naturally, one can expect the documented effects to be stronger when such preference is stronger. We focus on institutional investors and infer the level of their ESG preference according to the average ESG score of stocks in their portfolios. Institutions are then classified as socially responsible institutions and non-socially responsible institutions according to the revealed preference. We further investigate the role of Socially Responsible Institutional Ownership (SR_IO) in our aforementioned results.

We then split the sample according to SR_IO[25] and test the hypothesis that our documented MISP-ESG return results mainly come from stocks held by more SR institutions, where the ESG preference is stronger. Panel B of Table 2 reports the independent triple sort results based on SR_IO, MISP score, and ESG score. Indeed, we find the positive abnormal return of most underpriced stocks with Low ESG score to be much larger and only significant among High SR_IO group. For example, High SR_IO group generates a monthly 3-factor alpha of 0.52%, significant at the 5% level. For Low SR_IO group, we obtain no significant alpha. Similarly, the negative abnormal return for most overpriced stocks with High ESG score is also driven by High SR_IO group only, with a monthly 3-factor alpha of -0.89% and significant at the 1% level. SR institutions shy away from stocks with low ESG score even if these stocks are underpriced. Meanwhile, SR institutions are more reluctant to sell stocks with high ESG score despite of overpricing. Therefore, it causes delayed reactions to mispricing signals, especially for stocks held more by SR institutions.

In Panel C of Table 2, we perform independent double sorting (5X3) based on MISP score and ESG score, then further divide stocks into two subgroups within each portfolio. The results are similar. In the High SR_IO group, the most underpriced stocks with Low ESG score have a significantly positive alpha of 0.49 while the most overpriced stocks with High ESG score earn a significantly positive alpha of -0.99. However, there is no such pattern in the Low SR_IO group. For the rest of this paper, we mainly focus on the two portfolios of interest (underpriced stocks with low ESG score and overpriced stocks with high ESG score) and rely on the dependent sort of SR_IO within each portfolio, to make sure that the number of stocks is comparable across SR_IO subgroups.

3.3. Evidence from institutions' trading behaviors

In this session, we further investigate how institutions trade stocks across different ESG score, conditional on mispricing level. By examining (socially responsible) institutional ownership change, we provide direct evidence for our argument that ESG preference will affect institutions' trading decision against mispricing signals and supporting evidence for the return results. For each stock at the end of each quarter t, we calculate the average mispricing score (MISP) over the last month of quarter t and first two months of quarter t+1, for which institutions could react and adjust

[25] SR_IO is defined as the percentage of shares held by SR institutions divided by shares held by all institutions.

their holding between the end of quarter t and the end of quarter t+1.[26] At the end of quarter t, we reconstruct 5 (average MISP) X 3 (ESG) portfolios and examine the institutions holding change. To capture the reaction of different institutions, we categorize institutions into socially responsible institutions, non-socially responsible institutions, and neutral institutions based on their socially responsible scores at the end of quarter t [27]. Then, for each stock, we calculate the percentage of (categorical) institutions that increase (decrease) their holding the end of quarter t+1. [28]

The results are tabulated in Table 3. As our goal is to see whether ESG preference constrains institutions from correcting mispricing (i.e., increase holding for underpriced stocks and decrease holding for overpriced stocks), we focus on the difference in institutional trading between high and low ESG group, conditional on underpricing and overpricing. In Panel A, we focus on underpriced stocks and the increase of institution holding. If institutions hold neutral view towards ESG, we should find no difference of institution holding increase between high ESG and low ESG firms. In contrast, we find that high ESG stocks are more attractive than low ESG stocks to institutions that 2.32% more institutional investors increase their holdings for high ESG stocks. Importantly, such attractiveness is only significant in socially responsible institutions and decreases with neutral and non-socially responsible institutions. Panel B tabulates the results for overpriced stocks. In an opposite way to underpriced stocks, we focus on the decrease of institutional holding to see whether ESG plays a role. If ESG is attractive to institutions, especially socially responsible institutions, we expect to see the institution holding decrease to be smaller for high ESG firms, even though those firms are equally overpriced as the low ESG counterpart. The empirical analysis again confirms our previous finding. High ESG performance is attractive to socially responsible institutions and constitutes a new "constraint" for them to trade against mispricing.[29]

[26] For example, to investigate the change of institutional holding between the end of March and the end June, we use the average mispricing scores in the end of March, April, and May.

[27] To address the concern that the classification of institutions will change at the end of quarter t+1, we also use alternative measure, requiring the institutions to stay in the same category at the end of quarter t & t+1. The results are qualitatively same.

[28] For each categorical institution, the percentage is calculated as number of categorical institutions that increase (decrease) the holding scaled by number of those categorical institutions at the beginning of the quarter.

[29] Apart from using percentage of institutions that increase holding or decrease holding to measure institutions' trading behavior, we also look at the total institutional ownership change. The results are qualitatively the same. The magnitude is smaller, as we aggregate institutional ownership change from all the institutional investors.

[Insert Table 3 about here]

3.4. Further discussions

In this session, we show that our documented return predictability is not due to limits to arbitrage, or possible confounding effects of SR_IO, such as investment horizons. We further provide robustness results using various measures of SR_IO.

3.4.1. Limits to arbitrage

As shown in Panel A of Table 2, among underpriced (overpriced) stocks, positive (negative) alpha only exists for those with low (high) ESG score. One, however, may concern whether the results we have documented is driven by variation in mispricing score or the difficulty of arbitrage (Shleifer and Vishny (1997)).[30] We show the mispricing score and other firm characteristics of our long- and short-portfolios in the Panel A of Table 4. For both underpriced stocks and overpriced stocks, there is no material difference in mispricing score across different ESG score groups (Spearman correlation between MISP and ESG is as low as -0.11). Moreover, we compare several known limits to arbitrage measures including size, idiosyncratic risk (Pontiff (2006)), illiquidity proxied by stock turnover, and information uncertainty proxied by analyst coverage (Zhang (2006)). Since short-selling is generally more difficult, for overpriced stocks we also consider the short-sale constraints proxied by institutional ownership [31] and stock borrowing costs proxied by indicative lending fees (the Markit data on lending fee becomes available from 2006). In most cases, the stocks with medium ESG scores have the highest arbitrage cost measures, compared to either low ESG stocks or high ESG stocks. This may partially address such concern and confirm that the ESG score is unlikely to be overlapped with known limits-to-arbitrage measures.

In Panel B and C of Table 2, we show the MISP-ESG return predictability mainly come from stocks with high SR_IO. To further mitigate the possibility that the large abnormal returns among high SR_IO and mispriced stocks are due to the difficulty of arbitrage, we compare several known limits to arbitrage measures across high SR_IO and low SR_IO group. If the difficulty of

[30] Lewellen (2011) also provides evidence that institutions' investment decisions are constrained by the limits of arbitrage considerations.

[31] Nagel (2005) argue that short-sale constraints are most likely to bind among stocks with low institutional ownership. Evans, Ferreira, and Prado (2016) argue that fund managers, even if not allowed to sell, tend to lend shares to earn lending fees.

arbitrage is confounding the effect of SR_IO and driving the results we have documented, we would expect the high SR_IO group to have smaller size, lower liquidity, higher idiosyncratic risk, or higher information uncertainty.

[Insert Table 4 about here]

Here we focus on the two portfolios of interest only, which is underpriced-low ESG portfolio and overpriced-high ESG portfolio. The results are tabulated in Panel B and Panel C of Table 4, respectively. The analysis, however, shows that stocks with high SR_IO are bigger, more liquid, and have lower idiosyncratic volatility. They are also followed by more financial analysts. For overpriced-high ESG score portfolio, high SR_IO and low SR_IO stocks have little difference in terms of institutional ownership. Moreover, high SR_IO stocks have a lower lending fee on average. Therefore, it is unlikely that the impact of SR_IO on stock return is due to the confounding effects of known limits to arbitrage measures. Again, the results show that ESG preference is likely to cause under-reaction to mispricing signals, especially for socially responsible institutions. For stocks with high SR_IO, there could be more under-reaction to mispricing signals and hence larger absolute abnormal returns as we observe.

In addition, there might be other risks involved during the arbitrage process. Good (bad) ESG stocks might have a high chance of price jumps (drops), driven by SR institutions' demand shock to level up the social performance of their portfolios when rebalancing. It might make buy-on-margin and short-selling activities risky due to the embedded leverage effect. We investigate this possibility by first looking at option-implied jump risk measures.[32] Results in Appendix Table A7 show there is no material difference between high SR_IO stocks and low SR_IO stocks. Implied skewness is a little more negative for high SR_IO stocks while implied excess kurtosis is larger for low SR_IO stocks. Besides option-implied jump risk measures, we also look at the relative signed jump risk measures as it indicates the direction of price jumps.[33] As shown in the

[32] Following Bakshi, Kapadia, and Madan (2003), we proxy the stock return jump risk with forward-looking measures of model-free option implied risk-neutral skewness and kurtosis at the end of the last month.

[33] Following Patton and Sheppard (2013), we use all 15-mininte stock returns within a month to calculate "realized semi-variance" estimators, which decomposes the usual realized variance into two components that relates only to either positive returns or negative returns. The relative signed jump risk is defined as the difference between the two components and further scaled by the total variance.

last two columns of Appendix Table A7, the pattern of such relative signed jump risk measures is unlikely to drive the results we documented.

3.4.2. Socially responsible institutional ownership vs. investment horizon

As we use portfolio ESG score to define socially responsible institutions, one may concern that we might have captured other confounding effects rather than real preference of the institutions. For example, institutions that choose to hold high ESG stocks are likely to be long horizon oriented (Starks et al. (2017)). These institutions may forego short-term profits and focus on long-term value, leading to under-reaction to mispricing signals. To address such concern, we further control for investment horizon. Following the procedure used by Gaspar et al. (2005), we calculate a "churn ratio" for each institution each quarter. A higher churn ratio indicates shorter investment horizon. Then, we take a share-weighted average of churn ratio across all the institutions holding that stock, and obtain an aggregate churn ratio at stock level. We report the average churn ratio for the constrained portfolios on the left hand side of Appendix Table A8. Indeed, high SR_IO group has a lower churn ratio than the low SR_IO group.

Although socially responsible institutions tend to have longer investment horizon, institutions with longer investment horizon are not necessarily socially responsible investors. To rule out the alternative that our documented results are driven by investment horizon, we further control for investment horizon before splitting the firms into high and low SR_IO group. For the two constrained portfolios, we first sort stocks into quintiles based on churn ratio. Then within each churn ratio quintile, we further sort stocks based on SR_IO. Low (high) SR_IO portfolio contains all the stocks in low (high) SR_IO group across churn-ratio quintiles. The results still hold and are tabulated in Appendix Table A8, which suggest that our findings are driven by ESG preference, not by longer investment horizon. In a similar way, we also control for firm size in Appendix Table A9 to rule out the alternative that SR_IO is confounded with the preference for size or reputation of a firm.

3.4.3. Alternative measures of SR_IO

So far, we mainly focus on share-weighted SR_IO. For this measure, we first calculate a Social Responsibility Score (ISRS) for all institutions each quarter, based on value-weighted ESG score of stocks in their portfolio. Then we define institutions with a score in the highest tercile as Socially

Responsible Institutions. Then Socially Responsible Institutional Ownership (SR_IO) on stock level is calculated as the number of shares held by Socially Responsible institutions divided by the shares held by all the institutions. The other five alternative measures differ from each other in terms of 1) the way of weighting ESG to institutional level; 2) the definition of ESG; 3) the definition of ownership. Detailed definitions can be found in Appendix 1. In Panel B of Appendix A4, we report the time-series average of cross sectional correlations among different measures of SR institutional ownership. The correlations are very high in general, though the exact value varies across different measures.[34]

Using different measures of SR_IO as a robustness check, we repeat the test in Panel C of Table 2 and focus on the subsample results for two portfolios (nderpriced stocks with low ESG score and overpriced stocks with high ESG score). As shown in Appendix Table A10, the results are also highly robust across different measures. For example, equal-weighted SR_IO (second measure) is defined as the number of SR institutions holding the stock divided by number of all the institutions holding the stock. This measure gives the same weight to all the institutions. Using this measure, the positive alpha for underpriced stocks with low ESG scores is again mainly driven by those High SR_IO stocks, with a monthly 3-factor alpha of 0.57%, significant at 5% level for dependent triple sort. Similarly, when overpriced stocks with high ESG scores are held more by socially responsible institutions, who are less willing to sell them compared to overpriced bad stocks, we obtain a 3-factor alpha of -0.96%, significant at 1% level.

We also conduct robustness check using active mutual funds holding data. Such test allows us to focus on funds that seek for alpha and better capture the trading decision made at individual fund level. [35] We apply the same rule to define socially responsible mutual fund ownership (SR_MO). [36] Then we re-do analysis using six measures of SR_MO and the results are tabulated in Appendix Table A11. Consistent with our previous finding, the positive (negative) abnormal return of most underpriced (overpriced) stocks with low (high) ESG score only comes from high

[34] For example, on average, the SR_IO is 24.74% when defined as the number of SR institutions divided by the total number of institutions, using value-weighted ESG.

[35] Within the same institution, there might a great many different funds. For example, Vanguard has a total of 129 mutual funds with different investment goals. They may have various investment objectives and investment styles.

[36] First of all, we eliminate index funds by deleting those whose name includes the word "index" or the abbreviation "ind", "S&P", "Wilshire", and/or "Russell" (Amihud and Goyenko (2013)). We further calculate a SR score for each mutual fund each quarter. Then we divide them into socially responsible mutual fund, ESG-neutral mutual fund and non-socially responsible mutual fund. After that, we calculate a socially responsible mutual fund ownership (SR_MO) for each stock. In unreported results, SR_MO has quite high correlation with SR_IO, ranging from 0.7 to 0.84, which shows the validity of SR_IO measure.

SR_MO group and is highly significant, with 62 (95) basis points per month using share-weighted SR_MO for example. And the results are robust across other five alternative measures of SR_MO.

4. ESG Preference, Funding Liquidity, and Market Efficiency

In this session, we attempt to further explore the documented return predictability based on mispricing and ESG performance. Specifically, we investigate 1) how the uprising of ESG investing affects stock market efficiency as a newly emerged phenomenon; 2) how the funding capital constraints prevent ESG-neutral arbitrageurs from fully correcting the price inefficiency; 3) whether the results are consistent with our hypothesis using standardized unexpected earnings (SUE) as an alternative mispricing measure.

4.1. The impact of uprising ESG investing on stock price: Before and after 2004

The concept of ESG emerged as a response to the corporate scandals in early 2000. Before 2004, ESG investing was relatively a small part in the investment industry. After that, ESG investing gradually increases and experiences a noticeably fast growth in recent years. As argued by Fama and French (2007), a particular investors' preference or taste has little price impact if such preference is limited to a small part of the market. Therefore, it is natural to compare the impact of ESG before and after 2004 and we expect the impact to be stronger in recent years. Such comparison also echoes the changes in the asset management industry.

We therefore do the 5X3 independent double sort based on MISP and ESG scores again from 1996 to 2003 and present the results for "constrained" portfolios in Table 5. In contrast to the high alpha (0.47%) in the period after 2004, the average monthly 3-factor alpha for the underpriced-low ESG stocks is insignificant. The overpriced-high ESG stocks have a negative alpha of -0.72% and significant at 10% level. We further split each portfolio according to Socially Responsible Institutional Ownership (SR_IO). The results, however, show that high SR_IO has little impact on the risk adjusted returns in an earlier period. [37] Therefore, ESG preference as a dimension of investment decision, especially to socially responsible institutions, is a new phenomenon and starts affecting stock market efficiency in recent years.

[37] One potential concern is that before 2004, the coverage of ESG database is relatively small (around 500 unique firms), which might prevent us from finding any statistical power.

[Insert Table 5 about here]

As we previously demonstrate, ESG only constrains socially responsible institutions and delays their reactions to mispricing signals. So one can also expect on average, the abnormal return driven by mispricing is stronger among stocks with higher Socially Responsible Institutional Ownership (SR_IO), if the preference of socially responsible institutions for ESG is strong enough and cause under-reaction to correct mispricing. In Panel B of Table 5, we show the abnormal return for long-short portfolio sorted on mispricing score, for all stocks and conditional on SR_IO, during period 1996-2003 and 2004-2014.

At the end of each month, we rank all stocks into quintiles based on their mispricing score and construct the long-short portfolio. In the early period, the long-short spread is -1.04%, significant at 1% level. The magnitude is larger than the later period (-0.73%), consistent with the literature that market has become more efficient in recent years. However, we only observe the impact of SR_IO in the later period. Before 2004, the mispricing score sorted long-short return spreads have similar magnitudes and statistical significance in low SR_IO group (-1.10%, t-stat -2.30) and high SR_IO group (-0.97%, t-stat -2.92). The difference between high and low SR_IO group is only 0.13 and insignificant. In contrast, after 2004 the long-short spread is only significant and much larger in high SR_IO group (-0.80%, t-stat -2.72). The long-short spread almost disappears in the low SR_IO group (-0.29%, t-stat -1.53). The difference between high SR_IO group and low SR_IO group is -0.51 and significant. It suggests that the under-reaction driven by ESG preference has become a major force for return predictability after 2004.

Note that the U.S. stock market has become rather efficient in recent years and most anomalies are diminishing (Chordia et al. (2014)), due to better liquidity, lower transaction costs, more arbitrage forces (e.g., hedge funds, high frequency trading, algorithmic trading, etc.), and academic research (McLean and Pontiff (2016)). However, the sharp contrast before and after 2004 supports that the surge of ESG investing influences socially responsible institutions' trading decision and has a significant impact on the "traditionally" defined stock market efficiency.

4.2. Funding liquidity and "ESG-neutral" arbitrageurs

Though ESG investing has become rather popular in recent years, it is not fair to ignore the market participants that do not care about ESG. While socially responsible investors are constrained by

the preference, why don't "ESG-neutral" arbitrageurs take the high profits? What constrains those investors? We therefore explore the role of funding liquidity condition on our documented results. There is a still growing literature about the impact of funding liquidity on asset pricing and arbitrage efficacy. The stock market is not frictionless and arbitrageurs are constrained when there is a demand or supply shock on the capital. When such friction exists, asset prices will not convert to the fundamental value immediately (Duffie (2010)). Such shock may come from redemption of the clients (Shleifer and Vishny (1997)) or the difficulty to leverage with borrowing capital (Adrian, Etula, and Muir (2014). Empirical studies indeed find that when there are high capital inflows to hedge funds, hedge funds can better correct mispricing (Akbas, Armstrong, Sorescu, and Subrahmanyam (2015 and 2016)).

One might argue that large hedge funds are not subject to the constraints of funding liquidity. However, according to a survey to hedge fund managers (Unigestion (2015)), large hedge funds are more likely to adopt ESG or SRI strategies as part of their investing guidelines than smaller funds. [38] Hence, small hedge funds are more likely to be ESG-neutral arbitrageurs, which unfortunately are more subject to the constraints of funding liquidity.

We use broker-dealer capacity (Adrian et al. (2014)) to proxy for the level of arbitrage capital and split our sample period into high and low funding liquidity periods.[39] Panel A of Table 6 reports the risk-adjusted returns for MISP-ESG double-sorted portfolios, conditional on the level of broker-dealer leverage. Consistent with the notion that ESG-neutral investors are less capable to correct mispricing when arbitrage capital is limited, we find our aforementioned pattern only occurs during low funding liquidity period. The high alphas of "constrained" portfolios are concentrated in the low funding liquidity period. For example, the overpriced-high ESG portfolio has an alpha of -1.43% (t-stat 3.82) in low funding liquidity period, and an insignificant alpha of -0.12% during high funding liquidity period. Meanwhile, the underpriced-low ESG portfolio has an alpha of 1.17% (t-stat 4.62) in low funding liquidity period, and an insignificant alpha of -0.33%

[38] Although we expect hedge funds to be ESG-neutral arbitrageurs, they might also care about the social performance of stocks. In fact, hedge funds are becoming increasingly influenced by social norms. According to Deloitte (2016), hedge fund managers are slowly adopting impact investment. The analysis of PREQIN hedge fund data shows that at midyear of 2016, 18 hedge fund managers offered 29 SRI /ESG investment strategies with an AUM of around $10 billion USD.

[39] The broker-dealer quarterly leverage is defined as total financial asset / (total financial asset - total financial liability) by Adrian et al. (2014). The leverage factor is seasonally adjusted log changes in the level of broker-dealer leverage. The data are obtained from Table L.129 of the Federal Reserve.
http://www.federalreserve.gov/releases/z1/current/data.htm

during high funding liquidity period. The monotonic pattern that alphas decrease in ESG among mispriced stocks is also stronger in low funding liquidity period.

[Insert Table 6 about here]

In Panel B of Table 6, we again explore the impact of Socially Responsible Institutional Ownership (SR_IO) on the abnormal return sorted on mispricing score, in the same way as Panel B of Table 5. We focus on 2004-2014 period, when SR_IO starts affecting market efficiency, and further examine the results conditional on the funding liquidity. The results show that the abnormal stock return, as evidence of market inefficiency, is only from high SR_IO group, which have the most underraction to mispricing signal. In particular, such abnormal return for high SR_IO group only exists during the low funding liquidity period when arbitrage capital is limited (-1.23%, t-stat -3.48), while disappears during the high funding liquidity period (-0.05, t-stat -0.18). Such evidence suggests that the phenomenal return predictability we have documented is an equilibrium between socially aware (Pro-ESG) and unaware (ESG-neutral) investors. Pro-ESG investors' under-reaction to mispricing signal lead to return predictability, while such inefficiency is not fully offset by ESG-neutral arbitrageurs due to funding liquidity constraints.

4.3. Evidence from standardized unexpected earning surprise (SUE)

In this session, we use standardized unexpected earnings surprise (SUE) as a news-based measure for mispricing, to test the conditional relationship between ESG performance and future stock return, as well as its impact on market efficiency.

As one of the long-lasting anomalies, SUE provides an ideal alternative setting for our study. Investors underreact to earnings surprises, leaving a post-earnings-announcement-drift (PEAD) afterwards (see for example, Bernard and Thomas (1989); Hirshleifer, Lim, and Teoh (2009)). SUE shows a change in corporate fundamental, which is plausibly orthogonal to a firm's social performance, measured by ESG score. Then we can investigate investors' reaction to such change in a firm's fundamental, conditional on the firm's previous social performance. We expect the investors' under-reaction to be stronger for two cases: 1) low ESG score stocks with good news (positive SUE); 2) high ESG score stocks with bad news (negative SUE).

Following the related literature, we classify quarterly earnings announcements into quintiles according to the magnitude of SUE. SUE is defined as the difference between a firm's announced EPS in the current quarter and its earnings four quarters prior, adjusted by the standard deviation of unexpected earnings over the last eight quarters.[40] We then group all earning announcements into five groups based on SUE.[41] Figure 1-(a) plots the equal-weighted cumulative abnormal returns (CARs) over [-60, +60] trading day window, for five standardized unexpected earnings (SUE) portfolios. The figure shows the estimated post-earning-announcement drift increases monotonically in SUE quintiles.

[Insert Figure 1 about here]

Next, within highest quintile and lowest quintile of SUE, we further divide the earning announcements into Low, Medium, and High ESG portfolios using ESG score and the annual cutoff in Appendix Table A3. We expect the PEAD of the Low ESG portfolio to be larger than that of the High ESG portfolio in highest SUE quintile (good news) and the PEAD of High ESG portfolio to be more negative than low ESG portfolio in the lowest SUE quintile (bad news). Figure 2-(b) visually illustrates the results. Two upward lines represent PEAD for the portfolio of highest SUE, where the stocks with Low ESG score always lie above those with High ESG score, with CAR of 5.75% versus 2.88%. Investors are less willing to buy stocks with bad social performances, although there is a very positive earnings surprise. It slows the speed of information incorporation into stock price, leading to a larger post-earning-announcement drift. Similarly, two downward lines represent PEAD for the portfolio of lowest SUE, where the stocks with High ESG score always lie below those with Low ESG score, with CAR of -5.36% versus -2.57%. Even though there is negative earnings surprise, showing an unexpected weakening fundamental, the stock

[40] Our results are qualitatively the same if we use consensus analysts' forecast from I/B/E/S as the benchmark to define SUE.

[41] To capture the response of investors to the earnings news, we calculate the daily return for [-60, +60] trading day window, with earnings announcement day as day 0. By doing so, we can also control for potential information leakage before the earnings announcement drift. Nevertheless, we obtain similar results if we focus on the post-earnings-announcement drift only such as [0, +60] trading day window. The cumulative adjusted return (CARs) is the raw buy-and-hold returns adjusted for the contemporaneous value-weighted return of a size-matched portfolio (sorted by NYSE breakpoints).

prices for firms with good social performances do not drop immediately. Investors are reluctant to dump the "good citizens", causing a relatively more negative post-earning-announcement drift.

Moreover, we examine the impact of SR_IO on the long-short calendar-time portfolio return spread sorted on SUE. At the end of each month, we divide all stocks into quintiles based on its SUE in recent three months. Stocks in quintile 1 (quintile 5) have lowest (highest) SUE and are most overpriced (underpriced). Then we form the portfolio of longing the stocks in quintile 5 and shorting the stocks in quintile 1.

[Insert Table 7 about here]

The results in Table 7 shows that from 2004 to 2014 the abnormal return of such long-short portfolio is 45 basis points per month at the 10% significance level, which mainly comes from stocks with high SR_IO (0.59%, t-stat 2.15). It is consistent with our hypothesis that socially responsible investors are more likely to under-react to the mispricing signal, proxied by SUE. We further divide full sample into two sub-periods, based on broker-dealer quarterly leverage (Adrian, Etula, and Muir (2014)). The abnormal return of long-short portfolio for high SR_IO stock is only significant during low funding liquidity period (1.00%, t-stat 2.90), when the arbitrageurs are lack of capital to correct the mispricing. As a result, alpha due to under-reaction of socially responsible investors is not fully offset by the arbitrageurs. While during high funding liquidity period, there is enough capital for arbitrage activities, and we do not observe any alpha at all.

In summary, we find consistent results using SUE as an alternative mispricing measure. We observe more prominent abnormal returns among high SR_IO stocks where the ESG preference is stronger, especially during low funding liquidity period when arbitrage capital is limited. These results again support our hypothesis that Pro-ESG investors' under-reaction to mispricing signal lead to return predictability, while such inefficiency is not fully offset by ESG-neutral arbitrageurs due to funding liquidity constraints.

5. Conclusion

As socially responsible institutions incorporate ESG performance into investment process, they underreact to mispricing signals and lead to return predictability. Specifically, SR institutions are reluctant to buy underpriced-low ESG stocks, leaving a positive risk-adjusted portfolio return in

the future. Similarly, the selling of overpriced stocks is insufficient for high ESG stocks, leaving a negative risk-adjusted portfolio return in the future. Such return predictability is absent when mispricing prescription is in accordance with investors' preference for ESG. For example, there is no significant alpha for underpriced-high ESG score stocks or for overpriced-low ESG score stocks. We corroborate the results by examining investors' responses to earnings announcements and analyzing the changes in institutional ownership. We further show that the results are driven by socially responsible institutions and are only significant and enhanced when arbitrage force is insufficient. The results are absent before 2004 when ESG investing was not popular yet. We further rule out alternatives including the preference for horizon and heterogeneity in stock characteristics such as limits to arbitrage.

Such results highlight the impact of changes in assets management industry on stock market efficiency. The U.S. stock market has become rather efficient in recent years and most anomalies are diminishing. Our paper points out that inefficiency could exist due to the popularity of ESG investing. Our results echo the argument in Fama and French (2007) that investors' taste for assets may lead to inefficiency defined without considering such taste or preference. we call for more research along this line.

References:

Adrian, Tobias, Erkko Etula, and Tyler Muir, 2014, Financial intermediaries and the cross-section of asset returns, *Journal of Finance* 69, 2557-2596.

Almazan, Andres, Keith C. Brown, Murray Carlson, and David A. Chapman, 2004, Why constrain your mutual fund manager?, *Journal of Financial Economics* 73, 289-321.

Amihud, Yakov, 2002, Illiquidity and stock returns: Cross-section and time-series effects, *Journal of Financial Markets* 5, 31-56.

Amihud, Yakov, and Ruslan Goyenko, 2013, Mutual fund's R^2 as predictor of performance, *Review of Financial Studies* 26, 667-694.

Ang, Andrew, Robert J. Hodrick, Yuhang Xing, and Xiaoyan Zhang, 2006, The cross-section of volatility and expected returns, *Journal of Finance* 61, 259-299.

Bakshi, Gurdip, Nikunj Kapadia, and Dilip Madan, 2003, Stock return characteristics, skew laws, and differential pricing of individual equity options, *Review of Financial Studies* 16, 101-143.

Bernard, Victor L., and Jacob K. Thomas, 1989, Post-earnings-announcement drift: Delayed price response or characteristic premium?, *Journal of Accounting Research* 27, 1-36.

Cao, Jie, Bing Han, and Qinghai Wang, 2017, Institutional Investment Constraints and Stock Prices, *Journal of Financial and Quantitative Analysis* 52, 465-489.

Cao, Jie, Hao Liang, and Xintong Zhan, 2018, Peer effects of corporate social responsibility, *Management Science* forthcoming.

Carhart, Mark, 1997, On persistence in mutual fund performance, *Journal of Finance* 52, 57-82.

Chordia, Tarun, Avanidhar Subrahmanyam, and Qing Tong, 2014, Have capital market anomalies attenuated in the recent era of high liquidity and trading activity?, *Journal of Accounting and Economics* 58, 41-58.

Coval, Joshua C., and T. Moskowitz, 1999, Home bias at home: Local equity preference in domestic portfolios, *Journal of Finance* 54, 2045-2073.

Deloitte, 2016, Impact investing: A sustainable strategy for hedge funds. Retrieved from: https://www2.deloitte.com/us/en/pages/financial-services/articles/impact-investments-hedge-funds-esg-business.html

Deutsche Bank, 2018, 16th annual alternative investment survey, Back on track: Hedge funds deliver, investors commit. Retrieved from: https://www.db.com/newsroom_news/2018/deutsche-bank-s-alternative-investment-survey-reveals-investors-renewed-optimism-towards-hedge-funds-in-2018-en-11492.htm

Duffie, Darrell, Presidential address: Asset price dynamics with slow-moving capital, *Journal of Finance* 65, 1237-1267.

Edelen, Roger M., Ozgur S. Ince, and Gregory B. Kadlec, 2016, Institutional investors and stock return anomalies, *Journal of Financial Economics* 119, 472-488.

Evans, Richard, Miguel A. Ferreira, and Melissa Porras Prado, 2017, Fund performance and equity lending: Why lend what you can sell?, *Review of Finance* 21, 1093-1121.

Fama, Eugene F., and James D. MacBeth, 1973, Risk, return and equilibrium: Empirical tests, *Journal of Political Economy* 81, 607-636.

Fama, Eugene F., and Kenneth R. French, 1993, Common risk factors in the returns on stocks and bonds, *Journal of Financial Economics* 33, 3-56.

Fama, Eugene F., and Kenneth R. French, 2007, Disagreement, tastes, and asset prices, *Journal of Financial Economics* 83, 667-689.

Flammer, Caroline, 2015, Does corporate social responsibility lead to superior financial performance? A regression discontinuity approach, *Management Science* 61, 2549-2568.

Gaspar, Jose´-Miguel, Massimo Massa, and Pedro Matos, 2005, Shareholder investment horizons and the market for corporate control, *Journal of Financial Economics* 76,135-165.

Hartzmark, Samuel M., and Abigail Sussman, Do investors value sustainability? A natural experiment examining ranking and fund flows, Working Paper.

Hirshleifer, David, Sonya Seongyeon Lim, and Siew Hong Teoh, 2009, Driven to distraction: Extraneous events and underreaction to earnings news, *Journal of Finance 64*, 2289-2325.

Hong, Harrison, and Marcin Kacperczyk, 2009, The price of sin: The effects of social norms on markets, *Journal of Financial Economics* 93, 15-36.

Hwang, Chun Yang, Sheridan Titman, and Ying Wang, 2016, Investor tastes, corporate behavior and stock returns: An analysis of corporate social responsibility, Working Paper.

Lewellen, Jonathan, Institutional investors and the limits of arbitrage, 2011, *Journal of Financial Economics* 102, 62-80.

Lins, Karl, Henri Servaes, and Ane Tamayo, 2017, Social capital, trust, and firm performance: The value of corporate social responsibility during the financial crisis, *Journal of Finance* 72, 1785-1824.

McLean, David, and Jeffrey Pontiff, 2016, Does academic publication destroy stock return predictability?, *Journal of Finance* 71, 5-32.

Nagel, Stefan, 2005, Short sales, institutional investors, and the cross-section of stock returns, *Journal of Financial Economics* 78, 277-309.

Newey, Whitney, and Kenneth D. West, 1987, A simple positive semi-definite, heteroskedasticity and autocorrelation consistent covariance matrix, *Econometrica* 55, 703-708.

Patton, Andrew J., and Kevin Sheppard, 2015, Good volatility, bad volatility: Signed jumps and the persistence of volatility, *The Review of Economics and Statistics* 97, 683-697.

Pontiff, Jeffrey, 2006, Costly arbitrage and the myth of idiosyncratic risk, *Journal of Accounting and Economics* 42, 35-52.

Ridel, Arno, and Paul Smeets, 2017, Why do investors hold socially responsible mutual funds?, *Journal of Finance* 72, 2505-2550.

Shleifer, Andrei, Robert W. Vishny, 1997, The limits of arbitrage, *Journal of Finance* 52, 35-55.

Stambaugh, Robert, Jianfeng Yu, and Yu Yuan, 2015, Arbitrage asymmetry and the idiosyncratic volatility puzzle, *Journal of Finance* 70, 1903-1948.

Starks, Laura, Parth Venkatz, and Qifei Zhu, 2017, Corporate ESG profiles and investor horizons, Working Paper.

State Street Global Advisors, 2018, ESG institutional investor survey: ESG's place in investment portfolios. Today and tomorrow. Retrieved from: https://www.ssga.com/investment-topics/environmental-social-governance/2018/04/esg-institutional-investor-survey.pdf2018

Unigestion, 2015, Hedge fund and private equity ESG survey. Retrieved from: https://www.unigestion.com/publication/unigestions-2015-hedge-fund-and-private-equity-esg-survey/

Zhang, Frank, 2006, Information uncertainty and stock returns, *Journal of Finance* 61, 105-136.

Table 1. Summary Statistics

This table reports the descriptive statistics of ESG score, Mispricing score, SR_IO and other firm characteristics for the whole sample and three ESG subgroups. The statistics is the time-series average of cross-sectional summary from January 2004 to December 2014. Panel A reports summary statistics for Mispricing score, ESG scores, and major firm characteristics. Mispricing score (MISP) for a stock is constructed by combining its rankings on 11 anomaly variables computed at the end of each month. ESG score is the raw net scores of last year from ESG STATS database. Socially Responsible Institutional Ownership (SR_IO) is defined as the number of shares held by SR institutions divided by the total number of shares held by all institutions. Other firm characteristics include market capitalization in million, stock turnover in the previous month, AXHZ (2006) idiosyncratic risk (IVOL) of last month, analyst coverage of last month, institutional ownership of most recent quarter-end. Panel B reports the ESG score, Mispricing score, SR_IO, CRSP size percentile ranking, and other firm characteristics for high, mid and low ESG subgroups. The stocks are sorted into Low, Medium, and High groups, based on their ESG scores and annual breakpoints.

Panel A: Mispricing Score, ESG Score, and Other Firm Characteristics

Jan 2004 – Dec 2014	Mean	Std	10-Pctl	Q1	Med	Q3	90-Pctl
ESG score	-0.17	2.30	-2.36	-1.64	-0.64	0.91	2.64
Mispricing score (MISP)	49.56	12.53	33.64	40.68	49.13	57.91	66.17
SR_IO (%)	13.93	10.10	4.72	6.73	10.64	18.18	81.28
Market capitalization (million)	6,229	21316	262	488	1,219	3,664	12,144
Turnover (%)	21.15	20.32	5.71	9.72	15.86	25.97	41.22
IVOL (%)	8.40	5.04	3.89	5.21	7.27	10.23	14.02
Analyst coverage	9.43	6.90	2.16	4.08	7.58	13.16	19.33
Institutional ownership	0.72	0.23	0.39	0.58	0.76	0.87	0.96

Panel B: Average Mispricing Score, ESG Score, and Other Firm Characteristics in ESG Sub-groups

	ESG score	MISP	SR_IO (%)	Size (%) ranking	Turnover (%)	IVOL (%)	Analyst coverage	Institutional ownership
Low ESG Score	-3.19	50.34	12.71	75.80	24.65	8.52	9.92	0.75
Med ESG Score	-0.52	50.12	12.32	69.43	20.54	8.58	8.51	0.71
High ESG Score	4.10	46.15	24.04	84.04	20.09	6.92	14.08	0.69

Table 2. Monthly Returns for MISP–ESG Portfolios and MISP–ESG–SR_IO Portfolios

Panel A presents the average monthly abnormal returns (in percentage) of portfolios double sorted by mispricing score (MISP) and ESG score from January 2004 to December 2014. Mispricing score (MISP) for a stock is constructed by combining its rankings on 11 anomaly variables computed at the end of each month. ESG score is the net score (positive score minus negative score) of last year from ESG STATS database. At the end of each month, all available stocks are sorted into five mispricing quintiles based on the mispricing scores. P5 refers to the stocks are the most "overpriced" and stocks in P1 are the most "underpriced". Then stocks are independently sorted into Low, Medium, and High groups, based on their ESG scores and annual breakpoints. We report value-weighted Fama-French (1993) three-factor alpha for the next month. Panel B and C present the Fama-French (1993) three-factor alpha of MISP–ESG portfolios among low and high Socially Responsible Institutional Ownership (SR_IO) subgroup, respectively. SR_IO is defined as the number of shares held by SR institutions divided by the total number of shares held by all institutions. In panel B, at the end of each month all available stocks are independently sorted into two SR_IO groups, five mispricing quintiles, and three ESG score groups. In Panel C, we first form MISP–ESG portfolios by independent double sort, and then further divide stocks within each portfolio into two sub-groups based on their SR_IO. To adjust for serial correlation, robust Newey-West (1987) t-statistics are reported in brackets.

Panel A: Independent Double Sort on MISP and ESG Score

	All	ESG Score		
Mispricing Score	Stocks	Low	Medium	High
P1	0.14	**0.47****	0.16**	0.04
(Most Underpriced)	(1.59)	**(2.05)**	(2.04)	(0.29)
P2	0.05	0.01	0.08	0.02
	(0.71)	(0.04)	(0.82)	(0.23)
P3	-0.13*	-0.24	-0.01	-0.26*
	(-1.66)	(-0.78)	(-0.13)	(-1.92)
P4	-0.02	0.31	0.01	-0.20
	(-0.20)	(1.18)	(0.08)	(-0.68)
P5	-0.58***	-0.20	-0.35**	**-0.86****
(Most Overpriced)	(-2.96)	(-0.56)	(-2.25)	**(-2.62)**
(P5-P1)	-0.72***			
	(-2.67)			

Panel B. Independent Triple Sort Based on MISP, ESG Score, and SR_IO

Value-Weighted FF-3 Alpha (%) among low SR_IO Stocks				
	All	ESG Score		
Mispricing Score	Stocks	Low	Medium	High
P1	0.05	-0.05	0.05	0.77
(Most Underpriced)	(0.38)	(-0.16)	(0.42)	(1.64)
P2	0.13	0.16	0.23*	-0.21
	(0.77)	(0.42)	(1.67)	(-0.56)
P3	-0.01	-0.03	0.07	0.56*
	(-0.05)	(-0.07)	(0.61)	(1.73)
P4	0.15	0.15	0.16	-0.16
	(1.05)	(0.45)	(1.07)	(-0.36)
P5	-0.26*	-0.27	-0.26*	0.02
(Most Overpriced)	(-1.87)	(-1.07)	(-1.86)	(0.04)
(P5-P1)	-0.30*			
	(-1.85)			

Value-Weighted FF-3 Alpha (%) among High SR_IO Stocks				
	All	ESG Score		
Mispricing Score	Stocks	Low	Medium	High
P1	0.14	**0.52****	0.18**	0.03
(Most Underpriced)	(1.57)	**(2.05)**	(2.20)	(0.27)
P2	0.05	0.10	0.05	0.03
	(0.69)	(0.36)	(0.46)	(0.28)
P3	-0.15*	-0.24	-0.03	-0.24*
	(-1.88)	(-0.75)	(-0.30)	(-1.73)
P4	-0.04	0.28	-0.02	-0.18
	(-0.38)	(0.92)	(-0.12)	(-0.57)
P5	-0.65***	-0.43	-0.39**	**-0.89*****
(Most Overpriced)	(-2.84)	(-0.84)	(-2.00)	**(-2.61)**
(P5-P1)	-0.80**			
	(-2.61)			

Panel C. Independent Double Sort on MISP and ESG Score, then Dependent Sort on SR_IO

Value-Weighted FF-3 Alpha (%) among low SR_IO Stocks				
	All	ESG Score		
Mispricing Score	Stocks	Low	Medium	High
P1	0.18	0.26	0.12	0.17
(Most Underpriced)	(1.55)	(0.74)	(1.00)	(0.81)
P2	0.32*	0.55*	0.32**	-0.03
	(1.65)	(1.96)	(2.31)	(-0.17)
P3	0.10	0.58	-0.10	0.35
	(0.84)	(1.63)	(-0.80)	(1.64)
P4	0.14	-0.24	0.25*	-0.04
	(1.02)	(-0.66)	(1.96)	(-0.16)
P5	-0.04	0.18	-0.14	0.05
(Most Overpriced)	(-0.28)	(0.58)	(-0.86)	(0.13)
(P5-P1)	-0.22			
	(-1.26)			

Value-Weighted FF-3 Alpha (%) among High SR_IO Stocks				
	All	ESG Score		
Mispricing Score	Stocks	Low	Medium	High
P1	0.13	**0.49***	0.17**	0.03
(Most Underpriced)	(1.45)	**(1.93)**	(2.19)	(0.23)
P2	0.03	-0.02	0.04	0.03
	(0.38)	(-0.07)	(0.38)	(0.24)
P3	-0.17	-0.44	-0.02	-0.25*
	(-1.98)	(-1.34)	(-0.15)	(-1.73)
P4	-0.04	0.33	-0.04	-0.19
	(-0.39)	(1.14)	(-0.23)	(-0.60)
P5	-0.67***	-0.33	-0.41**	**-0.99*****
(Most Overpriced)	(-3.12)	(-0.85)	(-2.33)	**(-2.89)**
(P5-P1)	-0.81***			
	(-2.77)			

Table 3. The Impact of ESG Score on Institutions' Trading Behavior towards Mispriced Stocks

This table reports the summary of quarterly trading behavior among different types of institutions, towards underpriced stocks and overpriced stocks, respectively. One month before the end of each quarter, we calculate the average mispricing scores of preceding three months for each stock, as the quarterly mispricing measure. Then for each stock per quarter, we separate its holding institutions into three types based on the weighted average of ESG scores of their portfolios: socially responsible institutions, neutral institutions, and non-socially responsible institutions, respectively. Within each type of institution, we further divide them into three categories: increasing the weight, decreasing the weight, and remaining unchanged, based on their trading activities. For underpriced stocks, Panel A reports the difference in percentage of institutions increasing the weight next quarter, between high ESG stocks and low ESG stocks. For overpriced stocks, Panel B reports the difference in percentage of institutions decreasing the weight next quarter, between high ESG stocks and low ESG stocks. Column (1) shows the difference for all the institutions. Column (2) - (4) report the difference for three types of institutions, respectively. To adjust for serial correlation, robust Newey-West (1987) t-statistics are reported in brackets.

	(1)	(2)	(3)	(4)
	All Institutions	Socially Responsible Institutions	Neutral Institutions	Non-Socially Responsible Institutions
	Panel A: Institutions **Increasing** Weight on **Underpriced** Stocks			
Difference in Percentage (High ESG Stocks - Low ESG Stocks)	2.32***	2.54**	1.31	0.99
	(2.70)	(2.48)	(1.38)	(1.59)
	Panel B: Institutions **Decreasing** Weight on **Overpriced** Stocks			
Difference in Percentage (High ESG Stocks - Low ESG Stocks)	-2.21**	-2.65**	-1.63	-0.40
	(-2.20)	(-2.11)	(-1.36)	(-0.56)

Table 4. Characteristics of MISP-ESG Portfolios and MISP–ESG–SR_IO Portfolios

Panel A reports the average of stock characteristics of portfolios independently double sorted by Mispricing score and ESG score from January 2004 to December 2014. Mispricing score (MISP) for a stock is constructed by combining its rankings on 11 anomaly variables computed at the end of each month. ESG score is the net score (positive score minus negative score) of last year from ESG STATS database. At the end of each month, all available stocks are sorted into five mispricing quintiles based on the mispricing scores. The stocks then independently sorted into Low, Medium, and High groups, based on their ESG scores and annual breakpoints. VW FF-3 α is the Fama-French (1993) three-factor alpha of next month return for each portfolio. Stock characteristics include MISP score, ESG score, the size percentile ranking at the end of last month, stock turnover in the previous month, AXHZ (2006) idiosyncratic risk (IVOL) of last month, analyst coverage of last month, institutional ownership of most recent quarter-end, and indicative lending fee (2006-2014) at the end of last month. Panel B reports the average of stock characteristics of portfolios triple sorted by Mispricing score, ESG score, and Socially Responsible Institutional Ownership (SR_IO) from January 2004 to December 2014. At the end of each month, we first independently sort stocks into 5 by 3 portfolios based on Mispricing score and ESG score. Then, within each portfolio, we further dependently sort stocks into two subgroups based on SR_IO. Only portfolio & subgroups of most underpriced stocks with low ESG score (Panel B) and portfolio & subgroups of most overpriced stocks with high ESG score (Panel C) are reported.

Panel A: Stock Characteristics

	P1: Most Underpriced Stocks			P5: Most Overpriced Stocks		
	ESG Score			ESG Score		
	Low	Medium	High	Low	Medium	High
VW FF-3 α (%)	0.47**	0.16**	0.04	-0.20	-0.35**	-0.86***
MISP score	32.91	32.57	32.18	67.41	67.72	67.15
ESG score	-3.18	-0.42	4.77	-3.24	-0.59	3.56
Size ranking (%)	78.48	74.60	88.80	70.76	65.00	78.03
Turnover (%)	22.32	21.00	19.10	29.60	23.60	23.70
IVOL (%)	7.65	7.77	6.24	9.89	9.95	8.30
Analyst coverage	10.17	9.66	16.23	9.04	8.08	12.01
Institutional ownership	0.74	0.75	0.71	0.75	0.69	0.68
Lending fee (%)	0.70	0.64	0.43	0.99	1.30	0.90

Panel B: Portfolio of Most Underpriced Stocks with Low ESG Score

	VW FF-3 α (%)	Size (%) ranking	Turnover (%)	IVOL (%)	Analyst coverage	Institutional ownership	Stock lending fee (%)
All stocks	0.47**	78.48	22.32	7.65	10.17	0.74	0.70
Low SR_IO	0.26	68.91	22.24	8.70	6.91	0.75	0.56
High SR_IO	0.49*	87.81	22.41	6.62	13.15	0.73	0.83

Panel C: Portfolio of Most Overpriced Stocks with High ESG Score

	VW FF-3 α	Size (%) ranking	Turnover (%)	IVOL (%)	Analyst coverage	Institutional ownership	Stock lending fee (%)
All stocks	-0.86***	78.03	23.70	8.30	12.01	0.68	0.90
Low SR_IO	0.05	69.33	23.59	9.19	9.23	0.70	1.04
High SR_IO	-0.99***	86.48	23.83	7.43	14.67	0.65	0.77

Table 5. The Rise of ESG Investing and Market Efficiency:

1996 – 2003 vs. 2004 – 2014

This table reports the main results comparison between the period of 1996–2003 and the period of 2004–2014. Panel A presents the average monthly abnormal return (in percentage) of underpriced low ESG score portfolio and overpriced high ESG score portfolios, sorted independently by mispricing score (MISP) and ESG score, and their subgroups sorted on Socially Responsible Institutional Ownership (SR_IO), for period 1996–2003 and 2004–2014. Panel B presents the average monthly abnormal return (in percentage) of high minus low portfolio spread sorted on mispricing scores (MISP). Each month, we sort all stocks into quintile based on MISP. H-L is the spread portfolio of buying most underpriced stocks (quintile 1) and shorting most overpriced stocks (quintile 5). We also first divide stocks into two sub-groups based on their SR_IO and construct long-short portfolio within high and low SR_IO group, respectively. We report value-weighted (VW) Fama-French (1993) three factor-alpha of the next month for all the portfolios. To adjust for serial correlation, robust Newey-West (1987) t-statistics are reported in brackets.

Panel A: Underpriced Stocks with Low ESG Score & Overpriced Stocks with High ESG Score

VW FF-3 α (%)	1996–2003			2004–2014		
	All Stocks	Low SR_IO	High SR_IO	All Stocks	Low SR_IO	High SR_IO
Most underpriced stocks with Low ESG Score	0.38	-0.08	0.43	0.47**	0.26	0.49*
	(1.18)	(-0.15)	(1.19)	(2.05)	(0.74)	(1.93)
Most overpriced stocks with High ESG	-0.72*	-0.67	-0.68	-0.86***	0.05	-0.99***
	(-1.72)	(-1.22)	(-1.42)	(-2.62)	(0.13)	(-2.89)

Panel B: (H-L) Return Spread Sorted on MISP Score

VW FF-3 α (%)	1996–2003				2004–2014			
	All Stocks	Low SR_IO	High SR_IO	Diff	All Stocks	Low SR_IO	High SR_IO	Diff
(H-L) Spread Sorted on MISP	-1.04***	-1.10**	-0.97***	0.13	-0.73***	-0.29	-0.80***	-0.51**
	(-3.22)	(-2.30)	(-2.92)	(0.31)	(-2.69)	(-1.53)	(-2.72)	(-2.12)

Table 6. The Role of Funding Liquidity

This table reports the main results for low and high securities broker-dealer's leverage sub-periods between 2004 and 2014. The broker-dealer's quarterly leverage is defined by Adrian, Etula, and Muir (2014) and obtained from the Federal Reserve. Panel A presents the average monthly abnormal return (in percentage) of underpriced low ESG score portfolio and overpriced high ESG score portfolios, sorted independently by mispricing score (MISP) and ESG score, and their subgroups sorted on Socially Responsible Institutional Ownership (SR_IO), for Low and High broker-dealer leverage sub-period, respectively. Panel B shows the results for High minus Low return spread based on MISP for all stocks, low SR_IO subgroup, and high SR_IO subgroup, during two broker-dealer leverage sub-periods, respectively. Each month, stocks are sorted into two subgroups based on SR_IO, then we independently sort stocks into quintile based on MISP. H-L is the spread portfolio of buying most underpriced stocks (quintile 1) and shorting most overpriced stocks (quintile 5). We report value-weighted (VW) Fama-French (1993) three factor-alpha of the next month for all the portfolios. The sample period is from January 2004 to December 2014. To adjust for serial correlation, robust Newey-West (1987) t-statistics are reported in brackets.

Panel A: Underpriced Stocks & Overpriced Stocks

VW FF-3 α (%)	Low Broker-Dealer Leverage Period (High Funding Liquidity)			High Broker-Dealer Leverage Period (Low Funding Liquidity)		
	ESG Score			ESG Score		
MISP	Low	Med	High	Low	Med	High
P1	-0.33	0.10	-0.15	1.17***	0.18**	0.14
	(-1.03)	(0.87)	(-0.99)	(4.62)	(2.01)	(0.84)
P5	0.05	-0.01	-0.12	-0.15	-0.40*	-1.43***
	(0.10)	(-0.07)	(-0.43)	(-0.43)	(-1.95)	(-3.82)

Panel B: (H-L) Return Spread Sorted on MISP Score

VW FF-3 α (%)	All Stocks	Low SR_IO	High SR_IO	Diff
Entire period (2004–2014)	-0.73***	-0.29	-0.80***	-0.51**
	(-2.69)	(-1.53)	(-2.72)	(-2.12)
High funding liquidity period	-0.05	-0.07	-0.05	0.01
(More arbitrage capital)	(-0.19)	(-0.24)	(-0.18)	(0.05)
Low funding liquidity period	-1.23***	-0.46*	-1.36***	-0.90**
(Less arbitrage capital)	(-3.47)	(-1.96)	(-3.48)	(-2.49)

Table 7. Long-Short Calendar-Time Portfolio Return Spread Sorted on Earnings Surprise

This table reports the long-short calendar-time portfolio return spread based on standardized unexpected earnings (SUE), for all stocks, low SR_IO subgroup, and high SR_IO subgroup, from 2004 to 2014 and during two broker-dealer leverage sub-periods, respectively. At the end of each month, we sort the stocks into two subgroups based on Socially Responsible Institutional Ownership (SR_IO), then we independently sort stocks into quintile based on its SUE in recent three months. Standardized unexpected earnings (SUE) is computed as the difference between current quarter's earnings and earnings four quarter prior and divided by the standard deviation of unexpected earnings over the last eight quarters. A long-short (H-L) calendar-time portfolio is buying the most underpriced stocks (quintile 5) and shorting the most overpriced stocks (quintile 1). The broker-dealer's quarterly leverage is defined by Adrian, Etula, and Muir (2014) and obtained from the Federal Reserve. We report value-weighted (VW) Fama-French (1993) three factor-alpha of the next month for all the portfolios. The sample period is from January 2004 to December 2014. To adjust for serial correlation, robust Newey-West (1987) t-statistics are reported in brackets.

(H-L) Return Spread Sorted on SUE

VW FF-3 α (%)	All Stocks	Low SR_IO	High SR_IO	Diff
Entire period (2004–2014)	0.45*	-0.17	0.59**	0.76*
	(1.77)	(-0.49)	(2.15)	(1.93)
High funding liquidity period	-0.02	0.10	-0.00	-0.10
(More arbitrage capital)	(-0.06)	(0.26)	(-0.01)	(-0.32)
Low funding liquidity period	0.77**	-0.29	1.00***	1.29**
(Less arbitrage capital)	(2.38)	(-0.60)	(2.90)	(2.57)

Figure 1. The Impact of ESG Preference on Post-Earnings-Announcement Drifts (PEAD)

Figure 1-(a) plots the equal-weighted cumulative adjusted return (CARs) for five SUE portfolios over the [-60, +60] trading days relative to the earnings announcement day. SUE (standardized unexpected earnings) is the difference between current quarter's earnings and earnings four quarter prior divided by the standard deviation of unexpected earnings over the last eight quarters. All earning announcements during 2004 and 2014 in our sample are assigned to quintiles based on SUE relative to prior-quarter SUE distribution. CARs are raw buy-and-hold returns adjusted for the contemporaneous value-weighted return of a size-matched portfolio (sorted by NYSE breakpoints). Rank1 (rank 5) are the stocks with lowest (highest) SUEs relative to prior-quarter SUE distribution. Figure 1-(b) plots the equal-weighted cumulative adjusted return (CARs) for high and low ESG score subgroups within the lowest and highest SUE quintiles, respectively. Within the two extreme portfolios (Rank 1 and Rank 5), earning announcements are then divided into high, medium, and low ESG score subgroups, based on the cut-off points of last yearend.

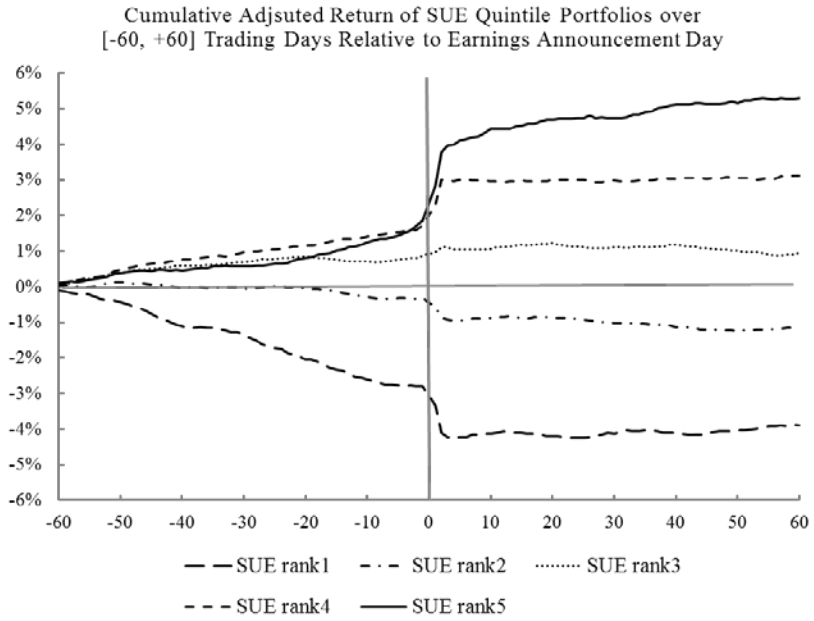

Figure 1-(a)

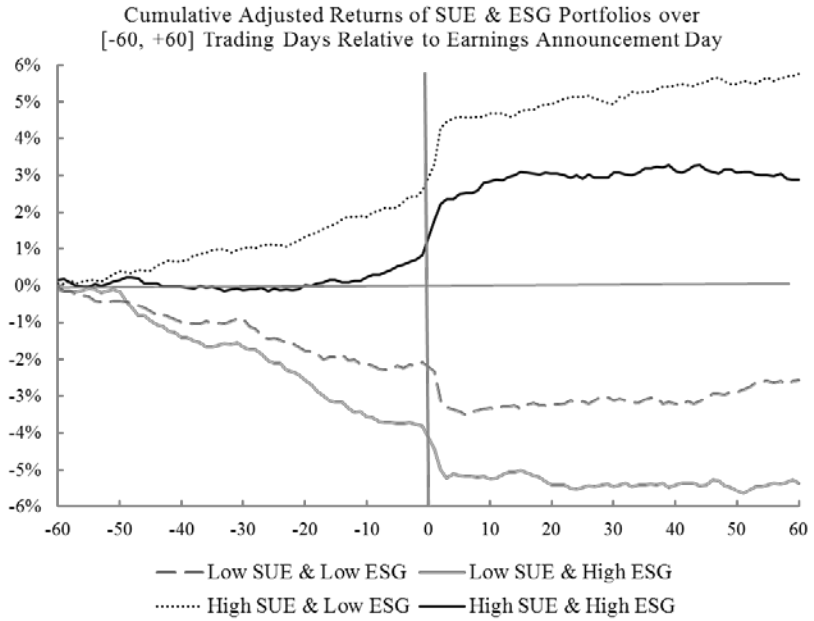

Figure 1-(b)

Supplementary Appendix for
ESG Preference and Market Efficiency:
Evidence from Mispricing and Institutional Trading

Variable Definitions

Mispricing Measures	
MISP	Mispricing measure, as in Stanbaugh, Yu, and Yuan (2015), defined as the arithmetic average of its ranking percentile for each of the 11 anomalies. Stocks with highest values are most "overpriced" and those with the lowest values are the most "underpriced".
SUE	Standardized unexpected earnings is computed as the difference between current quarter's earnings and earnings four quarter prior, and divided by the standard deviation of unexpected earnings over the last eight quarters.
Corporate Social Performance (ESG) measures	
ESG	Net score provided by MSCI ESG STATS (formerly known as KLD), calculated as the sum of Strength minus sum of Concerns. Five dimensions are considered, including Corporate Governance, Community, Diversity, Employee Relations and Environments.
Socially Responsible Institutional Ownership (SR_IO) measures	
SR_IO_ESG	Percentage of SR institutions out of all institutions, using raw ESG score to calculating value-weighted SR scores
SR_IO_ADESG	Percentage of SR institutions out of all institutions, using size-adjusted ESG score to calculating value-weighted SR scores
SR_IO_ewESG	Percentage of SR institutions out of all institutions, using raw ESG score to calculating equal-weighted SR scores
NSR_IO_ESG	Percentage of Non-SR institutions out of all institutions, using raw ESG score to calculating value-weighted SR scores
Share-weighted SR_IO	Percentage of shares held by SR institutions out of shares held by all institutions, using raw ESG score to calculating value-weighted SR scores
Share-weighted SR_IO * IO	Percentage of shares held by SR institutions out of all shares outstanding, using raw ESG score to calculating value-weighted SR scores

Stock Characteristics	
Size	The market value of the firm's equity at the end of previous month.
Size ranking (%)	The size percentiles are defined using the full CRSP sample each month.
Institutional ownership	The percentage of common stocks owned by institutions in the previous quarter.
Stock lending fee	The indicative lending fee at the end of last month.
Analyst coverage	The number of analysts following the firm in the previous month.
Amihud measure	The average daily Amihud (2002) illiquidity measure over the previous month.
IVOL	Idiosyncratic volatility, as in Ang, Hodrick, Xing, and Zhang (2006), computed as the standard deviation of the regression residual of individual stock returns on the Fama and French (1993) three factors using daily data in the previous month.
Turnover	The total stock trading volume scaled by the average daily shares outstanding in the previous month.
Churn ratio	The investment horizon of a firm's institutional investors is defined as the weighted average of the churn ratios of the holding institutions in the previous quarter. The churn ratio for each institution each quarter is calculated using the procedure by Gaspar, Massa, and Matos (2005).
Implied Skew / Kurt	The risk-neutral skewness and kurtosis of stock returns, as in Bakshi, Kapadia, and Madan (2003), are inferred from a cross section of out of the money calls and puts at the end of previous month.
Relative signed jump	All 15-mininte stock returns within a month are used to calculate "realized semi-variance" estimators, which decomposes the usual realized variance into two components that relates only to either positive returns or negative returns. The relative signed jump is defined as the difference between the two components and further scaled by the total variance.

Table A1. Asset-Weighted Average Expense Ratios of ESG Funds and Non-ESG Funds

This table reports the asset-weighted average expense ratios of ESG funds and non-ESG funds based on Morningstar Direct, accessed on March 15th, 2017. We divide funds within each Morningstar category into two groups, tagged as "socially conscious" (ESG), and all others (Non-ESG). Using the most recent annual reports, this table compares the asset-weighted average net expense ratio for ESG funds and non-ESG funds within each category.

Asset-Weighted Average Expense Ratios by Morningstar Category

	ESG Funds	Non-ESG Funds
Large Blend	0.73%	0.69%
Large Growth	0.91%	0.74%
Large Value	0.56%	0.68%
World Stock	0.94%	0.90%
Foreign Large Blend	0.80%	0.79%
Allocation – 50% to 70% Equity	0.83%	0.60%
Intermediate-Term Bond	0.57%	0.50%

Source: Morningstar Direct, data as 03/15/2017

Table A2. Coverage of Stock Return Test Sample

This table provides details about the stock-month sample from January 2004 to December 2014. Our sample covers common stocks with last month-end price above $5. In addition, we exclude stocks with missing ESG scores or the composite mispricing measure. Panel A reports the time-series summary statistics and Panel B reports the time-series average of cross-sectional distributions. Panel C reports the time series average of Fama-French twelve industry distribution for the stocks in our sample. Percent coverage of stock universe (EW) is the number of sample stocks, divided by the total number of CRSP stocks. The percent coverage of the stock universe (VW) is the total market capitalization of sample stocks divided by the total market value of all CRSP stocks. Firm size is the firm's market capitalization. Book-to-market is the fiscal year-end book value of common equity divided by the calendar year-end market value of equity. The size and book-to-market percentiles are defined using the full CRSP sample. Institutional ownership is the percentage of common stocks owned by institutions in the previous quarter. Analyst coverage is the number of analysts following the firm in the previous month.

Panel A: Time-Series Distribution (132 Monthly Obs)

Jan 2004 – Dec 2014	Mean	Std	10-Pctl	Q1	Med	Q3	90-Pctl
Number of stocks in the sample each month	2,103	233	1,781	1,979	2,032	2,238	2,467
Stock % coverage of stock universe (EW)	31.16	3.51	25.94	29.58	30.22	32.59	36.69
Stock % coverage of stock universe (VW)	66.43	6.46	61.15	61.63	64.72	66.47	78.99
Stock % traded at NYSE/AMEX	51.36	1.52	50.07	50.39	50.98	51.95	52.94

Panel B: Time-Series Average of Cross-Sectional Distributions (277,573 Stock-Month Obs)

Jan 2004 – Dec 2014	Mean	Std	10-Pctl	Q1	Med	Q3	90-Pctl
Size CRSP percentile	0.72	0.18	0.46	0.59	0.74	0.87	0.95
Book-to-market CRSP percentile	0.42	0.25	0.09	0.21	0.40	0.61	0.77
Institutional ownership	0.72	0.23	0.39	0.58	0.76	0.87	0.96
Analyst coverage	9.43	6.90	2.16	4.08	7.58	13.16	19.33

Panel C: Time-Series Average of Industry Distribution

FF-12 Industry	This Sample	CRSP sample	FF-12 Industry	This Sample	CRSP sample
Consumer nondurables	5.26%	4.85%	Telecom	2.78%	3.01%
Consumer durables	2.54%	2.25%	Utilities	3.91%	2.55%
Manufacturing	10.29%	8.57%	Wholesale	10.89%	9.38%
Energy	4.34%	3.93%	Healthcare	9.00%	11.02%
Chemicals	2.56%	2.06%	Finance	17.79%	19.58%
Business Equipment	15.60%	16.55%	Others	15.05%	16.27%

Table A3. Breakpoints for ESG Score Portfolios by Year

This table reports the annual breakpoints and sore ranges for Low, Medium, and High ESG score group, from 2003 to 2013. We use ESG scores from ESG STATS database as a measure of ESG performance of the firm. For both Low ESG score group (Panel A) and High ESG score group (Panel B), we report the breakpoints and score ranges, the number of stocks included, and the corresponding percentage in Column (1)-(3). For comparison, a looser range and a stricter range are reported in Column (4)-(6) and (7)-(9), respectively.

	Selected Range	# of Stocks	Percent	Looser Range	# of stocks	Percent	Stricter Ranger	# of stocks	Percent
Pane A: Breakpoints and Score Ranges for Low ESG Score Portfolio									
2003	[-7, -*2*]	326	12.05%	[-7, -*1*]	869	32.11%	[-7, -*3*]	114	4.21%
2004	[-8, -*3*]	191	7.20%	[-8, -*2*]	549	20.69%	[-8, -*4*]	60	2.26%
2005	[-8, -*3*]	181	7.54%	[-8, -*2*]	567	23.61%	[-8, -*4*]	71	2.96%
2006	[-8, -*3*]	266	11.12%	[-8, -*2*]	666	27.84%	[-8, -*4*]	104	4.35%
2007	[-8, -*3*]	246	11.05%	[-8, -*2*]	618	27.75%	[-8, -*4*]	99	4.45%
2008	[-9, -*3*]	237	11.13%	[-9, -*2*]	583	27.38%	[-9, -*4*]	93	4.37%
2009	[-9, -*3*]	249	11.39%	[-9, -*2*]	605	27.68%	[-9, -*4*]	99	4.53%
2010	[-8, -*3*]	218	9.64%	[-8, -*2*]	1,137	50.29%	[-8, -*4*]	71	3.14%
2011	[-7, -*4*]	111	5.17%	[-7, -*3*]	976	45.44%	[-7, -*5*]	30	1.40%
2012	[-7, -*1*]	555	25.75%	[-7, *0*]	1,446	67.10%	[-7, -*2*]	82	3.81%
2013	[-8, -*2*]	248	13.29%	[-8, -*1*]	747	40.03%	[-8, -*3*]	23	1.23%
Pane B: Breakpoints and Score Ranges for High ESG Score Portfolio									
2003	[*2*, 8]	312	11.53%	[*1*, 8]	838	30.97%	[*3*, 8]	143	5.28%
2004	[*2*, 10]	317	11.95%	[*1*, 10]	744	28.04%	[*3*, 10]	163	6.14%
2005	[*2*, 12]	302	12.57%	[*1*, 12]	637	26.52%	[*3*, 12]	161	6.70%
2006	[*2*, 15]	320	13.38%	[*1*, 15]	613	25.63%	[*3*, 15]	170	7.11%
2007	[*2*, 15]	320	14.37%	[*1*, 15]	608	27.30%	[*3*, 15]	179	8.04%
2008	[*2*, 14]	302	14.19%	[*1*, 14]	591	27.76%	[*3*, 14]	157	7.37%
2009	[*2*, 14]	303	13.86%	[*1*, 14]	599	27.40%	[*3*, 14]	155	7.09%
2010	[*2*, 17]	299	13.22%	[*1*, 17]	472	20.88%	[*3*, 17]	230	10.17%
2011	[*2*, 19]	284	13.22%	[*1*, 19]	380	17.69%	[*3*, 19]	235	10.94%
2012	[*3*, 15]	296	13.74%	[*2*, 15]	427	19.81%	[*4*, 15]	230	10.67%
2013	[*4*, 17]	261	13.99%	[*3*, 17]	350	18.76%	[*5*, 17]	203	10.88%

Table A4. Correlations

This table presents cross-sectional correlations. The Pearson correlations are shown below the diagonal with Spearman correlations above the diagonal. Panel A reports the time-series average of cross-sectional Pearson correlation and Spearman correlation among ESG score, Mispricing score, Socially Responsible Institutional Ownership (SR_IO), and other firm characteristics. Panel B reports the time-series average of cross-sectional correlations among different measures of SR institutional ownership. Mispricing score (MISP) for a stock is constructed by combining its rankings on 11 anomaly variables computed at the end of each month. ESG score is the raw net scores of last year from ESG STATS database. SR_IO_ESG is defined as the number of SR institutions divided by the total number institutions. SR score of institutional is calculated based on the value-weighted raw ESG scores. Firm characteristics include market capitalization (Size) of previous month, analyst coverage of last month, and institutional ownership of recent quarter. SR_IO_ADESG and SR_IO_ewESG is defined as the number of SR institutions divided by the total number institutions, using value-weighted and size-adjusted ESG score or equal-weighted raw ESG score respectively, when calculating SR ranking for institutions. NSR_IO_ESG is defined as the number of non-SR institutions divided by the total number institutions, using value-weighted raw ESG score when calculating SR ranking for institutions. Share-weighted SR_IO is defined as the number of shares held by SR institutions divided by the total number of shares held by all institutions. Share-weighted SR_IO*IO is the percentage of shares held by SR institutions divided by total shares outstanding.

Panel A: Correlations among Alternative Measures of Socially Responsible Institutional Ownership

Pearson \ Spearman	Mispricing score	ESG core	Share-weighted SR_IO	Market capitalization	Analyst coverage	Institutional ownership
Mispricing score	1.00	-0.11	-0.13	-0.24	-0.11	-0.07
ESG score	-0.13	1.00	0.27	0.19	0.17	-0.08
Share-weighted SR_IO	-0.14	0.38	1.00	0.53	0.42	-0.08
Market capitalization (million)	-0.15	0.31	0.42	1.00	0.69	0.20
Analyst coverage	-0.14	0.25	0.45	0.41	1.00	0.25
Institutional ownership	-0.08	-0.06	-0.08	-0.05	0.21	1.00

Panel B: Correlations among Alternative Measures of Socially Responsible Institutional Ownership

Spearman / Pearson	SR_IO _ESG	SR_IO _ADESG	SR_IO _ewESG	NSR _IO_ESG	**Share-weighted SR_IO**	Share-weighted SR_IO * IO
SR_IO_ESG	1.00	0.95	0.76	-0.67	0.68	0.57
SR_IO_ADESG	0.97	1.00	0.77	-0.64	0.67	0.57
SR_IO_ewESG	0.82	0.84	1.00	-0.55	0.60	0.55
NSR_IO_ESG	-0.67	-0.64	-0.50	1.00	-0.53	-0.34
Share-weighted SR_IO	0.72	0.72	0.66	-0.52	1.00	0.85
Share-weighted SR_IO * IO	0.62	0.62	0.59	-0.36	0.85	1.00

Table A5. Monthly Returns for Portfolios Sorted on Mispricing Score or ESG Score

This table presents the average monthly returns (in percentage) of portfolios sorted by ESG score (Panel A) or Mispricing score (Panel B). ESG score is the net score (positive score minus negative score) of last year from ESG STATS database. Mispricing score (MISP) for a stock is constructed by combining its rankings on 11 anomaly variables computed at the end of each month. For ESG score, the stocks are sorted into Low, Medium, and High groups, based on their ESG scores and annual breakpoints. For MISP, At the end of each month, all available stocks are evenly sorted into five mispricing quintiles based on the mispricing score. P5 refers to the stocks with the highest values of MISP, which are most "overpriced" and stocks in P1 are the most "underpriced." For each portfolio, we report raw return, CAPM alpha, Fama-French (1993) three-factor alpha, and Carhart (1997) four-factor alpha of next month, using equal weighted return (Panel A) and value weighted return (Panel B). In addition, we report difference between extreme portfolios for two sorting variables respectively. The sample period is from January 2004 to December 2014. To adjust for serial correlation, robust Newey-West (1987) t-statistics are reported in brackets.

Panel A: Single Sort on ESG Score

	Low	Medium	High	H-L	Low	Medium	High	H-L
	Equal-weighted Return (%)				Value-weighted Return (%)			
Raw Return	0.96*	0.89*	0.82*	-0.14	0.90**	0.85*	0.64	-0.26
	(1.72)	(1.76)	(1.78)	(-0.63)	(2.16)	(1.89)	(1.62)	(-1.10)
CAPM α	-0.01	-0.03	-0.03	-0.01	0.16	0.03	-0.09	-0.24
	(-0.06)	(-0.24)	(-0.22)	(-0.06)	(0.81)	(0.48)	(-1.10)	(-0.97)
FF-3 α	-0.01	-0.03	-0.02	-0.02	0.16	0.03	-0.09	-0.24
	(-0.04)	(-0.62)	(-0.27)	(-0.07)	(0.80)	(0.59)	(-1.19)	(-0.98)
Carhart-4 α	0.01	-0.01	0.00	-0.01	0.11	0.03	-0.08	-0.19
	(0.07)	(-0.33)	(0.04)	(-0.04)	(0.59)	(0.48)	(-1.04)	(-0.78)

Panel B: Single Sort on MISP Score

	P1	P2	P3	P4	P5	H-L	P1	P2	P3	P4	P5	H-L
	Equal-weighted Return (%)						Value-weighted Return (%)					
Raw Return	0.93**	1.02**	0.95*	0.93*	0.62	-0.32	0.79**	0.82**	0.71	0.83*	0.40	-0.38
	(2.13)	(2.18)	(1.93)	(1.74)	(1.03)	(-1.49)	(2.36)	(1.99)	(1.51)	(1.70)	(0.64)	(-1.04)
CAPM α	0.11	0.14	0.04	-0.02	-0.42**	-0.52***	0.14	0.05	-0.13*	-0.02	-0.58***	-0.72***
	(0.87)	(1.07)	(0.32)	(-0.15)	(-2.27)	(-3.56)	(1.62)	(0.71)	(-1.71)	(-0.16)	(-3.09)	(-2.81)
FF-3 α	0.11**	0.15**	0.05	-0.02	-0.41***	-0.52***	0.14	0.05	-0.13*	-0.02	-0.58***	-0.72***
	(2.00)	(2.40)	(0.93)	(-0.22)	(-3.61)	(-3.73)	(1.59)	(0.71)	(-1.66)	(-0.20)	(-2.96)	(-2.67)
Carhart-4 α	0.10*	0.14**	0.05	0.01	-0.34***	-0.44***	0.11	0.04	-0.13	0.01	-0.51***	-0.62**
	(1.78)	(2.30)	(0.99)	(0.13)	(-3.48)	(-3.48)	(1.33)	(0.56)	(-1.64)	(0.10)	(-3.02)	(-2.61)

Table A6. A Refined Trading Strategy based on Mispricing and ESG Score

This table presents the results of a refined trading strategy based on Mispricing score and ESG score from January 2004 to December 2014. Mispricing score (MISP) for a stock is constructed by combining its rankings on 11 anomaly variables computed at the end of each month. ESG score is the net score (positive score minus negative score) of last year from ESG STATS database. At the end of each month, all available stocks are sorted into five mispricing quintiles based on the mispricing scores. P5 refers to the stocks are the most "overpriced" and stocks in P1 are the most "underpriced." The stocks then independently sorted into Low, Medium, and High groups, based on their ESG scores and annual breakpoints. Then we construct the trading portfolio of longing the most underpriced stocks with low ESG and shorting the most overpriced stocks with high ESG. We report value-weighted CAPM alpha Fama-French (1993) three-factor alpha and Carhart (1997) four-factor alpha for the next month. To adjust for serial correlation, robust Newey-West (1987) t-statistics are reported in brackets.

Value-Weighted Return (%)	Most Underpriced & Low ESG Stocks	Most Overpriced & High ESG Stocks	Difference
CAPM α	0.48**	-0.86**	-1.34***
	(2.08)	(-2.44)	(-2.78)
FF-3 α	0.47**	-0.86***	-1.33***
	(2.05)	(-2.62)	(-2.78)
Carhart-4 α	0.39*	-0.75***	-1.14***
	(1.77)	(-2.63)	(-2.83)

Table A7. Jump Risk Measures

This table reports the summary statistics for four jump risk measures of portfolios triple sorted by Mispricing scores, ESG score, and Socially Responsible Institutional Ownership (SR_IO) from January 2004 to December 2014. At the end of each month, we first independently sort stocks into 5 by 3 portfolios based on Mispricing score and ESG score. Then, within each portfolio, we further dependently sort stocks into two subgroups based on SR_IO. Only portfolio & subgroups of most underpriced stocks with low ESG score (Panel A) and portfolio & subgroups of most overpriced stocks with high ESG score (Panel B) are reported. For each portfolio, the table reports option implied skewness, option implied kurtosis at the end of last month as well as the relative signed jump measure of last month and current month, respectively.

	Stock Option Implied Skew	Stock Option Implied Kurt	Lagged Relative Signed Jump	Current Relative Signed Jump
Panel A: Portfolio of Most Underpriced Stocks with Low ESG Score				
All stocks	-2.34	0.20	0.012	0.013
Low SR_IO	-2.15	0.37	0.011	0.013
High SR_IO	-2.49	0.04	0.014	0.012
Panel B: Portfolio of Most Overpriced Stocks with High ESG Score				
All stocks	-2.44	0.13	0.018	0.016
Low SR_IO	-2.37	0.15	0.020	0.017
High SR_IO	-2.50	0.11	0.017	0.015

Table A8. Investment Horizon Controlled Triple Dependent Sort

This table reports the value weighted Fama-French (1993) three factor-alpha and average churn ratios (proxy for investment horizon) for the triple sorted portfolio. Stock churn ratios is defined as the weighted average of the churn ratios of the holding institutions in the previous quarter. At the end of each month, all available stocks are sorted into five mispricing quintiles based on the mispricing score. The stocks then independently sorted into Low, Medium, and High groups, based on their ESG score and annual breakpoints. For each independently double sorted portfolio, we further divide stocks into two sub-portfolios based on Socially Responsible Institutional Ownership (SR_IO). Also, for each independently double sorted portfolio, we first divide stocks into quintiles based on its churn ratio, and then within each churn ratio quintile, we further divide them based on SR_IO, and combine stocks across churn ratio quintiles. We report value-weighted Fama-French (1993) three factor-alpha of the next month for underpriced stocks with Low ESG score and overpriced stocks with High ESG score. The sample period is from January 2004 to December 2014. To adjust for serial correlation, robust Newey-West (1987) t-statistics are reported in brackets.

VW FF-3 Alpha (%)	Dependent Sort		Investment Horizon-Adjusted Dependent Sort	
	Low SR_IO	High SR_IO	Low SR_IO	High SR_IO
Most underpriced stocks with Low ESG score	0.26	0.49*	0.22	0.54**
	(0.76)	(1.93)	(0.68)	(2.12)
Churn Ratio (%)	25.3	23.4	24.4	24.3
Most overpriced stocks with High ESG score	0.05	-0.99***	-0.38	-0.92**
	(0.13)	(-2.89)	(-0.87)	(-2.56)
Churn Ratio (%)	24.4	22.6	23.6	23.4

Table A9. Size Controlled Triple Dependent Sort

This table reports the value weighted Fama-French (1993) three factor-alpha in Panel A and average size ranking in Panel B for the triple sorted portfolio. At the end of each month, all available stocks are sorted into five mispricing quintiles based on the mispricing score. The stocks then independently sorted into Low, Medium, and High groups, based on their ESG scores and annual breakpoints. For each independently double sorted portfolio, we further divide stocks into two sub-portfolios based on Socially Responsible Institutional Ownership (SR_IO). Also, for each independently double sorted portfolio, we first divide stocks into quintiles based on its size, and then within each size quintile, we further divide them based on SR_IO, and combine stocks across size quintiles. We report value-weighted Fama-French (1993) three factor-alpha of the next month for underpriced stocks with Low ESG score and overpriced stocks with High ESG score. The size percentile ranking is defined using the full CRSP sample each month. The sample period is from January 2004 to December 2014. To adjust for serial correlation, robust Newey-West (1987) t-statistics are reported in brackets.

VW FF-3 Alpha (%)	Dependent Sort		Size-Adjusted Dependent Sort	
	Low SR_IO	High SR_IO	Low SR_IO	High SR_IO
Most underpriced stocks with Low ESG score	0.26	0.49*	0.24	0.57**
	(0.76)	(1.93)	(0.80)	(2.01)
Size ranking (%)	80.29	97.12	77.19	79.66
Most overpriced stocks with High ESG score	0.05	-0.99***	-0.63	-0.97**
	(0.13)	(-2.89)	(-1.62)	(-2.55)
Size ranking (%)	69.11	89.67	77.08	78.84

Table A10. Monthly Returns for Portfolios Sorted on Mispricing, ESG Score, and Socially Responsible Institutional Ownership

This table presents the average monthly abnormal returns (in percentage) of triple-sorted portfolios by mispricing score (MISP), ESG score and Socially Responsible Institutional Ownership (SR_IO) from January 2004 to December 2014. Six different measures of SR_IO are adopted: (1) Share-weighted SR_IO: use value-weighted raw ESG score to calculate socially responsible score for institutions in the first step of constructing the SR_IO, then define SR_IO as the number of shares held by SR institutions divided by the total number of shares held by all institutions; (2) SR_IO_ESG: number of SR institutions divided by the total number of institutions; (3) SR_IO_ADESG: use size-adjusted ESG score instead of raw ESG; (4) SR_IO_ewESG: use equal-weighted ESG scores to calculate socially responsible score for institutions; (5) NSR_IO_ESG is the number of non-SR institutions divided by the total number institutions; (6) Share-weighted SR_IO*IO is the percentage of shares held by SR institutions divided by total shares outstanding. In panel A, at the end of each month, we first independently sort stocks into 5 by 3 portfolios based on Mispricing score and ESG score. Then, within each portfolio, we further dependently sort stocks into two subgroups based on different SR_IO measures. In panel B, we do independent triple sort based on mispricing score, ESG score, and SR_IO. Only portfolio of most underpriced stocks with low ESG score and portfolio of most overpriced stocks with high ESG score are reported because of limited space. Value-weighted Fama-French (1993) three-factor alpha for the next month is reported. The sample period is from January 2004 to December 2014. To adjust for serial correlation, robust Newey-West (1987) t-statistics are reported in brackets.

VW FF-3 α	**Share-weighted SR_IO**		SR_IO_ESG		SR_IO_ADESG		SR_IO_ewESG		NSR_IO_ESG		Share-weighted SR_IO*IO	
	Low SR_IO	High SR_IO	Low SR_IO	High SR_IO	Low SR_IO	High SR_IO	Low NSR_IO	High NSR_IO	Low SR_IO	High SR_IO	Low SR_IO	High SR_IO
Most underpriced stocks with Low ESG score	0.26	0.49*	-0.12	0.57**	0.14	0.50**	0.10	0.51**	0.57**	0.08	-0.03	0.61**
	(0.74)	(1.93)	(-0.43)	(2.29)	(0.43)	(2.01)	(0.33)	(2.00)	(2.31)	(0.24)	(-0.11)	(2.40)
Most overpriced stocks with High ESG score	0.05	-0.99***	-0.31	-0.96***	0.32	-1.06***	0.07	-0.99***	-0.86**	-0.53	-0.28	-0.91***
	(0.13)	(-2.89)	(-0.96)	(-2.78)	(0.89)	(-3.10)	(0.15)	(-2.94)	(-2.29)	(-1.57)	(-0.86)	(-2.64)

Table A11. Monthly Returns for Portfolios Sorted on Mispricing, ESG Score, and Socially Responsible Mutual Fund Ownership

This table presents the average monthly abnormal returns (in percentage) of triple-sorted portfolios by mispricing score (MISP), ESG score and Socially Responsible Mutual Fund Ownership (SR_MO) from January 2004 to December 2014. We focus on active mutual funds and exclude index funds. Six different measures of SR_MO are adopted: (1) Share-weighted SR_MO: use value-weighted raw ESG score to calculate socially responsible score for all mutual funds in the first step of constructing the SR_MO, then define SR_MO as the number of shares held by SR mutual funds divided by the total number of shares held by all mutual funds; (2) SR_MO_ESG: number of SR mutual funds divided by the total number of mutual funds; (3) SR_MO_ADESG: use size-adjusted ESG score instead of raw ESG; (4) SR_MO_ewESG: use equal-weighted ESG scores to calculate socially responsible score for mutual funds; (5) NSR_MO_ESG is the number of non-SR mutual funds divided by the total number of mutual funds; (6) Share-weighted SR_MO*MO is the percentage of shares held by SR mutual funds divided by total shares outstanding. At the end of each month, we first independently sort stocks into 5 by 3 portfolios based on Mispricing score and ESG score. Then, within each portfolio, we further dependently sort stocks into two subgroups based on different SR_IO measures. Only portfolio of most underpriced stocks with low ESG score and portfolio of most overpriced stocks with high ESG score are reported because of limited space. Value-weighted Fama-French (1993) three-factor alpha for the next month is reported. The sample period is from January 2004 to December 2014. To adjust for serial correlation, robust Newey-West (1987) t-statistics are reported in brackets.

VW FF-3 α	**Share-weighted SR_MO**		SR_MO_ESG		SR_MO_ADESG		SR_MO_ewESG		NSR_MO_ESG		Share-weighted SR_MO*MO	
	Low SR_MO	High SR_MO	Low SR_MO	High SR_MO	Low SR_MO	High SR_IO	Low NSR_MO	High NSR_MO	Low SR_MO	High SR_MO	Low SR_MO	High SR_MO
Most underpriced stocks with Low ESG score	-0.26	0.62**	-0.04	0.54**	0.10	0.51*	-0.10	0.53**	0.52**	0.15	-0.48	0.63**
	(-0.92)	(2.39)	(-0.12)	(2.15)	(0.29)	(1.96)	(-0.29)	(2.06)	(2.08)	(0.55)	(-1.53)	(2.57)
Most overpriced stocks with High ESG score	-0.45	-0.95***	-0.11	-1.01***	-0.08	-1.00***	-0.19	-0.98***	-0.96***	-0.23	-0.44	-0.89***
	(-1.33)	(-2.77)	(-0.31)	(-2.97)	(-0.24)	(-2.94)	(-0.46)	(-2.85)	(-2.84)	(-0.61)	(-1.19)	(-2.63)

Figure A1. Coverage and the Distribution of ESG Scores

Figure A1-(a) plots the number of CSRP stocks covered by ESG database and the number of stocks retained after filtering from 1995 to 2013. Our sample covers common stocks with last month-end price above $5 and excludes stocks with missing ESG scores or the composite mispricing measure. Figure A1-(b) plots the cross-sectional distributions (Q1, Median, and Q3) of ESG scores over time.

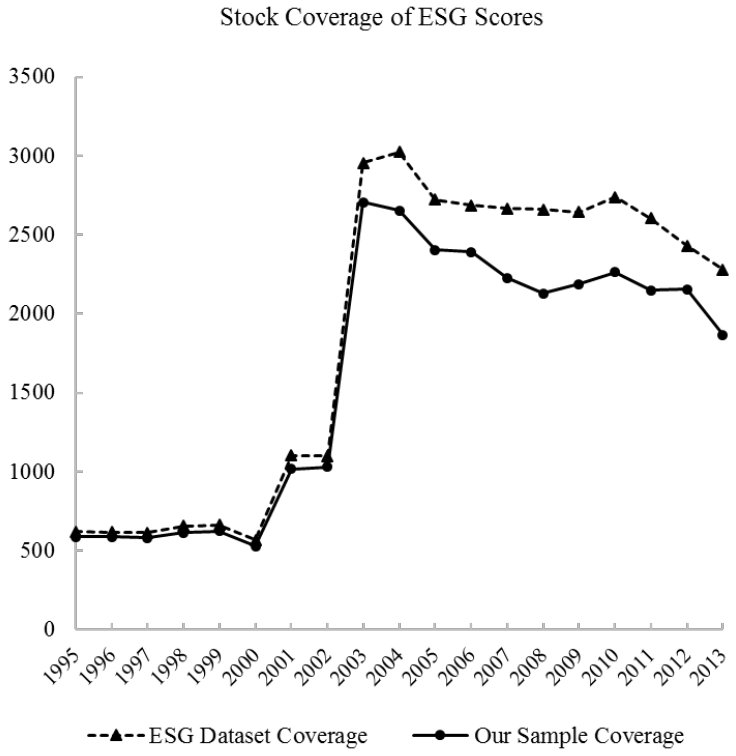

Figure A1-(a)

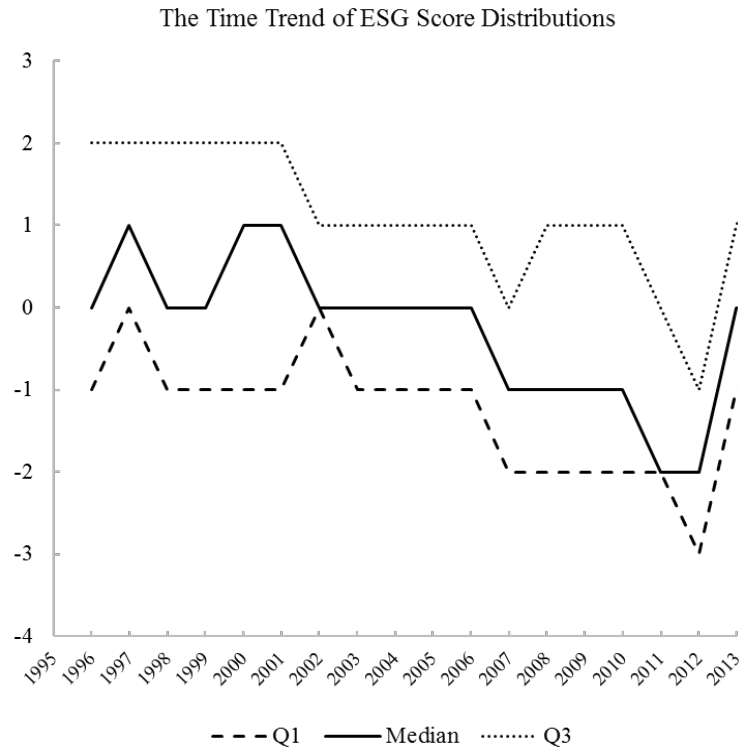

Figure A1-(b)