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

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Abstract

We explore how the trend towards socially responsible investing affects the informational efficiency of stock prices. The return predictability of mispricing signals is much stronger among firms held by more socially responsible institutions (SR_Is). The results are driven by the divergence of trading implications from ESG performance and mispricing signals. SR_Is are less likely to buy underpriced stocks with bad ESG performance or sell overpriced stocks with good ESG performance. We rule out alternatives, such as known limits to arbitrage. The inefficiency only emerges in recent years with the rise of ESG investing, and is not fully offset by ESG-neutral arbitrageurs due to funding liquidity constraints.

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Abstract

We explore how the trend towards socially responsible investing affects the informational efficiency of stock prices. The return predictability of mispricing signals is much stronger among firms held by more socially responsible institutions (SR_Is). The results are driven by the divergence of trading implications from ESG performance and mispricing signals. SR_Is are less likely to buy underpriced stocks with bad ESG performance or sell overpriced stocks with good ESG performance. We rule out alternatives, such as known limits to arbitrage. The inefficiency only emerges in recent years with the rise of ESG investing, and is not fully offset by ESG-neutral arbitrageurs due to funding liquidity constraints.

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

JEL Classification: G14; G23; G41; M14

1. Introduction

The strategies and tastes of institutional investors have changed in a number of ways in the past 20 years. On one hand, perhaps because of the influence of academic research, institutions tend to take a more quantitative approach to investing. On the other hand, a number of institutions have broadened their perspectives, and consider the social implications of their investment choices.[1] Specifically, these institutions incorporate a firm's ESG (Environmental, Social, and Governance) performance into investment decision making process. According to a 2016 report by the 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.

In this paper we examine how these trends may have influenced stock return patterns. Our research builds on growing literatures that examine the investment performance of both quantitative and socially responsible investment strategies. The evidence on quantitative investing suggests that the increased popularity of this approach may have led to a decline in the performance of these strategies in recent years.[2] In this sense, the market has become more efficient. The literature on the performance of socially responsible investing is somewhat mixed,[3] and to our knowledge, nobody has directly examined how the trend towards socially responsible investing influenced the efficiency of market prices. This paper explores this issue by examining potential links between the choices of socially responsible investors and the efficacy of the signals used by quantitative investors.

Our analysis of quantitative signals focuses on the composite mispricing signal described in Stambaugh, Yu, and Yuan (2015), which combines 11 different anomalies from the academic literature. As we show, [4] a value-weighted long-short strategy that exploits the composite mispricing signal generates an abnormal return of 1.54% per month and an annualized Sharpe ratio of 1.03 in the 1996-2003, pre-SRI sample period. Since value-weighted portfolios are dominated

[1] See, for example, Starks, Venkat, and Zhu (2018) and Hartzmark and Sussman (2018).
[2] See for example, Chordia, Subrahmanyam, and Tong (2014) and McLean and Pontiff (2016).
[3] On one hand, stocks in "sin" industries earn significantly higher abnormal return compared with firms in other industries (Hong and Kacperczyk (2009)). On the other hand, firms that are listed as "100 Best Companies to Work for in America" demonstrate higher alpha in the future, as the market undervalues the intangible assets (Edmans (2011)). Using the release of Morningstar sustainability rating, Hartzmark and Sussman (2018) shows there is likely a reverse relation between fund performance and sustainability rating.
[4]Appendix Table A1 shows the monthly return results for the full CRSP sample with mispricing scores as defined in Stambaugh et al. (2015).

by the most efficiently priced large cap stocks we perform the same tests on a sample that excludes the 500 largest stocks – the smaller stocks generate a much stronger abnormal return of 1.97% per month, and an annualized Sharpe ratio of 1.39. Consistent with Chordia, Subrahmanyam, and Tong (2014) and McLean and Pontiff (2016), we find that the Sharpe ratios have declined in the more recent 2004-2014 period – the value-weighted portfolio that includes all stocks exhibits an annualized Sharpe ratio of 0.47. Interestingly, the annualized Sharpe ratio of the long-short portfolio that excludes the largest 500 stocks is only 0.37 in the more recent sample period. Indeed, in the recent period, the mispricing signals seem to work as well for large cap and small cap stocks.

The fact that small cap stocks are no longer the primary driver of these return premia is somewhat of a puzzle. Our conjecture is that for the larger cap stocks, the increased attention to these quant signals by some investors may have been partially offset by the growing influence of socially responsible investors. Because of their preference for social performance, socially responsible institutions tend to focus more on ESG performance, and may thus react less to direct signals of firm value. In other words, the portfolio choices of socially responsible investors will tend to be less sensitive to quantitative signals. Moreover, if socially responsible investors have a material influence on stock prices, the efficacy of the quantitative signals should be stronger for the stocks that are more held by these investors.

To test these conjectures, we start by following Hwang, Titman, and Wang (2018) and classify institutions into socially responsible (SRI) and not socially responsible (NSRI) investors according to their revealed preferences, i.e., the value-weighted ESG scores of their portfolio holdings. As it turns out, the stocks held by SRIs tend to be somewhat larger, more liquid and are followed by more analysts on average. As a result, one might expect these stocks to be more efficiently priced than their smaller counterparts more held by NSRIs. However, for the reason noted above, the stocks held by SRIs may be less efficient with respect to the quantitative information used in our composite mispricing signal.

Consistent with our conjecture, we find that the Stambaugh et al. (2015) composite mispricing signal is a better predictor of excess returns for those stocks with high SRI holdings. In particular, in our 2004-2014 sample period, a value-weighted long-short strategy that exploits the Stambaugh et al. (2015) mispricing signals generates a significant monthly return of 0.83% on those stock held more by socially responsible institutions and a statistically insignificant return of 0.28% per month for stocks held more by institutions that are not classified as socially responsible.

In contrast, in the earlier 1996-2003 sample period that pre-dates the rise in ESG investing, the holdings of socially responsible investors were not an indicator of the efficacy of the composite mispricing signal.

In addition to sorting stocks by the holdings by socially responsible institutions, we look directly at the stocks' ESG scores. As we show, for stocks held more by socially responsible institutions, there are significant return spreads generated from quantitative trading strategies regardless of ESG scores. In particular, among stocks that are classified as underpriced by the Stambaugh et al. (2015) signal, low ESG stocks have the most positive abnormal returns. And among overpriced stocks, high ESG stocks generate the most negative abnormal returns. Such pattern is consistent with the notion that socially responsible institutions are trading off between ESG performance and future stock returns. In contrast, we find no systematic evidence of mispricing, regardless of ESG scores, for stocks primarily held by non-socially responsible investors. Our analysis of institution's holding changes further confirms that socially responsible institutions respond less to mispricing signals compared with other institutions, lending additional support to the aforementioned results.

If the return patterns we identify reflect mispricing, then we expect the patterns to be stronger when the cost of shorting and leveraging one's portfolio is higher. To explore this possibility, we follow Adrian, Etula, and Muir (2014) and proxy for the funding constraints of arbitrage activities using the aggregate broker-dealer leverage. As we show, the inefficiency caused by socially responsible investors is only observed when arbitrage capital is tight.

We also find consistent results using active mutual fund ownership. We further rule out alternative hypotheses that, for example, the results are driven by different investment horizons, known limits to arbitrage measures. 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 using this alternative mispricing signal.

To our best knowledge, the paper is the first to explore how ESG investing influences the decision making of institutional investors and stock market efficiency. However, two recent papers have helped us motivate our analysis. First, Hartzmark and Sussman (2018) provide an explanation for why mutual funds may want to expend resources identifying high ESG stocks, and thus less attention on quantitative signals. Using the release of Morningstar sustainability ratings, they find a positive flow to mutual funds with good sustainability ratings and a negative flow to mutual

funds with poor ratings. Moreover, socially responsible mutual funds are able to charge higher fees.[5] This evidence explains why some mutual funds may rationally focus more on indicators of ESG and perhaps less on quantitative mispricing signals. [6] Second, Starks et al. (2018) document that socially responsible institutional investors tend to be more patient with high ESG firms, e.g., they are less inclined to sell the stocks even after negative news or poor stock performance. This observation, which provides part of the motivation for our analysis of return patterns, is similar to our finding that socially responsible institutional investors react less to mispricing signals.

More generally, our paper is related to the literature that describes various frictions that influence the investment decisions of institutional investors, e.g., Almazan, Brown, Carlson, and Chapman (2004), Cao, Han, and Wang (2017), and Lewellen (2001). However, we may be the first to examine a constraint that has increased substantially over time. By comparing the effect of the constraint on an early period, where the constraint was much less relevant, to a more recent period where the constraint has influence, we can more accurately document an effect. We provide further evidence that supports the Fama and French (2007) argument of investors' taste for assets, and the Edelen, Ince, and Kadlec (2016) finding that institutions sometimes enhance rather than correct mispricing.

Finally, our paper is related to the literature that examines the impact of funding liquidity on asset pricing. As described by Shleifer and Vishny (1997) there are a variety of frictions that impose limits on the ability of investors to arbitrage financial markets.[7] We show that the predictable patterns we observe occur mainly in periods when borrowing is the most constrained (as described in Adrian, Etula, and Muir (2014)).

The rest of the paper is as follows. Section 2 describes our sample and measures. We present our baseline results 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.

[5] Based on the report of Morningstar Direct, the asset-weighted average expenses ratios are higher for ESG funds comparing to Non-ESG funds for six out of seven Morningstar categories. Please refer to Appendix Table A2 for details.

[6] According to Ridel and Smeets (2017), socially responsible investors are willing to forgo financial performance because of their preference for positive social impacts.

[7] 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, 2016)).

2. Data and Measures

2.1. Data sources and sample coverage

To measure mispricing magnitude, we use the monthly updated mispricing score (MISP) in Stambaugh et al. (2015). Stock returns, price and trading volumes, and mutual fund data are obtained 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 stock lending fee data are from Markit for the period from 2006 to 2014.

We collect data on firms' Environmental, Social and Corporate Governance (ESG) performance from MSCI ESG KLD 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, including community relations, product characteristics, environmental impact, employee relations, workforce diversity and corporate governance.[8] The database covers both the social benefits and harms of a firm, and therefore reflects both negative and positive screening process of socially responsible investing.[9] Our empirical tests focus on the period from 2003 to 2013, during which the dataset covers the top 3,000 U.S. firms.[10] Appendix Figure A1-(a) shows the stock coverage of ESG database over years. For robustness, we also incorporate an alternative data source for ESG score: *Sustainalytics ESG Research and Ratings*, and the results are consistent.[11]

The ESG data are published close to the end of each calendar year and we apply it to calculate the socially responsible institutional ownership (SR_IO) and the monthly returns of the next calendar year. For our stock return test sample, we only include observations of common

[8] MSCI ESG KLD STATS 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 (2019)).

[9] 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.

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

[11] This data source (Sustainalytics) 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 of stcoks is much smaller. Therefore, we compute, whenever possible, a combined ESG score using the information from both datasets.

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 A3 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 the full CRSP sample 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.

2.1. Key measures

2.1.1. Socially responsible institutional ownership measure (SR_IO)

We follow Hwang et al. (2018) and use 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 socially responsible (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

Following the literature, using ESG score as a proxy of firm's social performance, we measure the investment preference / style for 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[12] to calculate $ISRS_{i,q}$ does not change the results as well.

[12] We adopt two methods to adjust for size effects. In first method, we follow Hwang, Titman, and Wang (2018) 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

As aforementioned, ESG score includes a firm's performance along several dimensions, and scores are updated on annual basis (at the yearend), covering both strengths and concerns. Following the relevant literature, we consider five dimensions, including environment, community, diversity, employee relationship, and corporate governance.[13] 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, 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.

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

Each quarter, we sort all institutions into three groups based on their portfolios' 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

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.

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

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'

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.

[13] 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.

impact equally, we also calculate the SR_IO using an 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.

2.1.2. 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. The 11 anomalies 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 anomalies. According to this measure, stocks with the highest MISP 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).[14]

2.2. Sample summary

Table 1 reports the descriptive statistics of two main measures in this paper (Socially Responsible Institutional Ownership and MISP) and other firm characteristics, from January 2004 to December 2014. 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%. On average, the mean of mispricing score is 49.56. There is, however, a reasonable cross-sectional variation. The standard deviation of MISP in our sample firm is 12.53, large enough to identify

[14] 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.

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. 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]

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 reasonable, given the construction procedure of SR_IO. SR_IO has a relatively low Spearman correlation with MISP (-0.13) 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, Socially Responsible Institutional Ownership, and stock return

In this section, we formally test whether socially responsible institutional ownership (SR_IO) affects stocks' future return. ESG preference influences SR institutions' decision of correcting mispricing because of their "double bottom lines". If a stock is more held by socially responsible institutions, we expect to observe stronger return predictability among most mispriced stocks, since they are less responsive to the mispricing signals. Specifically, we hypothesize that the risk-adjusted high-minus-low spread sorted by mispricing signal will be more prominent among stocks with higher socially responsible institutional ownership (SR_IO).

To test these hypotheses, we perform independent double sorting (2×5) based on SR_IO and MISP. At the end of each month, all sample stocks are divided into two groups based on SR_IO. The stocks are then independently 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". P2, P3 and P4 are those relatively fairly priced stocks.

Table 2 reports the value-weighted CAPM alpha, Fama-French 3-factor alpha, and 4-factor alpha of next month for all stocks and for each SR_IO-MISP portfolio. First, in our sample period, MISP predicts portfolio risk-adjusted returns well. Value weighted CAPM alpha decreases from quintile 1 to quintile 5, generating a spread of -0.72%, significant at 1% level. The spread is driven by stocks with high SR_IO, for which the Fama-French 3-factor alpha is -0.83%, statistically significant. The results are insignificant among low SR_IO stocks (-0.28%, t-stat -1.55), showing SR institutions are less responsive to mispricing signals on average, leading to future return predictability. The difference in return spread between high SR_IO and low SR_IO portfolios is -0.54%, significant at 5% level. The higher spread of high SR_IO portfolios is driven by overpriced stocks, as it is more difficult to correct the short-leg mispricing. However, we still see a slightly larger positive abnormal return for underpriced stocks with high SR_IO (0.15%), compared with underpriced stocks with low SR_IO (0.05%). The results are robust across different asset pricing models and provide the first evidence that socially responsible institutions are less responsive to mispricing signals.

[Insert Table 2 about here]

3.2. Alternative measures of Socially responsible institutional ownership (SR_IO)

For our aforementioned baseline results, we first calculate a Social Responsibility Score (ISRS) for all institutions each quarter, according to value-weighted size-adjusted ESG score of stocks in their portfolio. 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. In this section, we show that our results are robust to another five different measures of SR_IO. The other five alternative measures differ from each other in terms of 1) the way of weighting ESG to institution 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.[15]

We repeat the test in Table 2 and focus on the high-minus-low return spread based on MISP for low SR_IO stock, high SR_IO stock and their differences. As reported in Appendix Table A5, the results are highly robust across different measures. For example, an 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, 3-factor alpha of high-minus-low return spread is -0.80 for high SR_IO stocks, significant at 1% level. Difference between low SR_IO group and high SR_IO group shrinks a little bit while the pattern remains.

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. [16] We apply the same rule to define socially responsible mutual fund ownership (SR_MO).[17] Then we re-do analysis using SR_MO and the results are tabulated in Appendix Table A6. Consistent with our previous finding, there is a more negative abnormal return for overpriced stocks held by more socially responsible active mutual fund. And the high-minus-low return spread is much more significant for high SR_IO stocks, with a value weighted FF 3-factor alpha of 56 basis points per month. We again redefine SR_MO using alternative ways and repeat the tests. The results are again robust across other measures.

3.3. The role of firm's social performance (ESG Score)

Thus far, we have documented that stocks with higher socially responsible institutional ownership demonstrate a more significant and stronger high-minus-low return spread based on MISP. The evidence is consistent with our hypothesis that social preference of the socially responsible institutions may under-react to the mispricing signals because of their social preference. If an

[15] 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.

[16] 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.

[17] 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.

underpriced stock has bad social performance, socially responsible institutions will shy away from them, buying "good citizens" instead. Similarly, they are reluctant to sell a good stock even it is overpriced. In this section, we formally test the preference mechanism.

Specifically, we investigate whether the socially responsible institutions will trade the mispriced stocks with different social performance differently. We classify the stocks into three social performance categories based on their ESG scores. 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.[18] 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 A7. On average, during 2003 to 2013, 257 stocks are classified as Low ESG firms and 301 stocks as High ESG firms, representing 11.39% and 13.27% of the sample firm.

We perform an independent triple sort (2×5×3) based on SR_IO, MISP, and ESG score.[19] At the end of each month, we divide stocks into low SR_IO group and high SR_IO group. They 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 3 reports the value-weighted Fama-French 3-factor alpha among high SR_IO stocks. Within the most underpriced stocks (MISP P1), the abnormal portfolio returns decrease with ESG score. Low ESG, Medium ESG, and High ESG portfolios have a monthly average 3-factor alpha of 0.50%, 0.17%, and 0.04 %, respectively. The return pattern across the ESG score is consistent with our hypothesis. SR institutions on average do not hesitate to buy good stocks and underpricing is corrected quickly. Underpriced firms with good ESG performance therefore have an insignificant alpha. On the contrary, SR institutions are reluctant to buy stocks

[18] 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.

[19] To validate our analysis, we first confirm that ESG score itself does not predict the stock return cross-sectionally in our sample. In unreported table, 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 or weighting methods.

that have a poor ESG performance, even when they are underpriced, leaving a significant positive alpha.

[Insert Table 3 about here]

Within the most overpriced stocks (MISP P5), the abnormal portfolio returns also decrease with ESG score. Low ESG score, Medium ESG score, and High ESG score portfolios on average earn -0.31%, -0.47%, and -0.88% 3-factor alpha next month. Newey-West *t*-statistic for most overpriced stocks with High ESG score is -2.55. 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.

Panel B of Table 3 presents the value-weighted Fama-French 3-factor alpha for stocks with low SR_IO, where the social preference is not strong. For those institutions without strong social preference, they will react instantaneously to the mispricing signals. As a consequence, for stocks held less by SR institutions, we do not observe any significant abnormal returns.

3.4. Evidence from institutions' trading behaviors

In this session, we further investigate how institutions trade stocks across different ESG scores, conditional on mispricing signals. 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 corroborate 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 their holding between the end of quarter t and the end of quarter *t+1*.[20] 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

[20] 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.

responsible scores at the end of quarter *t* [21]. Then, for each stock, we calculate the percentage of (categorical) institutions that increase (decrease) their holding the end of quarter t+1. [22]

The results are tabulated in Table 4. 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 counterparts. 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.[23]

[Insert Table 4 about here]

3.5. Further discussions

In this session, we show that our documented return predictability is not due to known limits to arbitrage, or possible confounding effects of SR_IO, such as investment horizons.

[21] 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.

[22] 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.

[23] 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.

3.5.1. Limits to arbitrage

As shown in Table 2, negative alpha and high-minus-low spread is significant only among stocks with high SR_IO. 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)).[24] We show the mispricing score and other firm characteristics of our long- and short-portfolios in the Table 5. For both underpriced stocks and overpriced stocks, there is no material difference in mispricing score between low SR_IO group and high SR_IO group. (Spearman correlation between MISP and SR_IO is as low as -0.13). 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 [25] 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 low SR_IO and high SR_IO have similar arbitrage cost measure, except that stock with high SR_IO is generally larger and followed by more analysts. This may partially address such concern and confirm that the socially responsible institutional ownership is unlikely to be overlapped with known limits-to-arbitrage measures.

[Insert Table 5 about here]

3.5.2. Socially responsible institutional ownership vs. investment horizon

As we use portfolio ESG score to define socially responsible institutions, it is possible 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. (2018)). These institutions may forego short-term profits and focus on long-term value, leading to under-reaction to short-term mispricing signals. To address such concern, we

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

[25] Nagel (2005) argue that short-sale constraints are most likely to bind among stocks with low institutional ownership. Evans, Ferreira, and Prado (2017) argue that fund managers, even if not allowed to sell, tend to lend shares to earn lending fees.

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.

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. Specifically, 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 of socially responsible institutions, not by longer investment horizon.

4. ESG Preference, Funding Liquidity, and Market Efficiency

In this session, we further explore the documented return predictability based on mispricing and SR_IO. 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 social preference 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 2×5 independent double sort based on SR_IO and MISP again from 1996 to 2003 and the results are tabulated in Table 6. In the early period, abnormal return of high-minus-low spread is -1.09% and -1.05% for stocks with low SR_IO and high SR_IO, both statistically significant. It shows that the MISP has stronger prediction power in the early period, when the market is not as efficient as today. Nevertheless, the difference of high-minus-low spread between low SR_IO stocks and high SR_IO stocks is nearly zero with *t*-statistics of 0.09, indicating that high SR_IO has little impact on the risk adjusted returns in an earlier period. [26] During the late period, the difference of high-minus-low spread between low SR_IO and high SR_IO is -0.54%, significant at 5% level, suggesting that the under-reaction driven by ESG preference has become a major force for return predictability after 2004.

[Insert Table 6 about here]

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)). The sharp contrast in return predictability caused by socially responsible institutions before and after 2004 demonstrates the change in institutions' tastes for assets, which 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 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

[26] 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.

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, 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. [27] 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.[28] Table 7 reports the results for the whole period, high funding liquidity period and low funding liquidity period. We focus on the high-minus-low return spread generated by mispricing signals (MISP) of high SR_IO stocks and low SR_IO stocks, and the difference between two groups.

[Insert Table 7 about here]

We focus on 2004-2014 period, when SR_IO starts affecting market efficiency, and further examine the results conditional on the funding liquidity. Consistent with our aforementioned results, mispricing signals only generate significant return predictability for high SR_IO group. However, such abnormal return for high SR_IO group only exists during the low funding liquidity period when arbitrage capital is limited (-1.38%, *t-stat* -3.50), while disappears during the high funding liquidity period (-0.10%, *t-stat* -0.34). The difference of high-minus-low spread between high SR_IO group and low SR_IO group is statistically significant (-0.97%, *t-stat* -2.92) during

[27] 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.

[28] 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

low funding liquidity period. The difference is close to zero when there are no capital constraints for the institutions. Such evidence suggests that the phenomenal return predictability we have documented is an equilibrium between socially aware (socially responsible institutions) and unaware (ESG-neutral) investors. SRIs' 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 relationship between SR_IO 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 SR institutions' and other institutions' reaction to such change in a firm's fundamental, conditional on the firm's previous social performance. We expect the under-reaction is stronger among stocks with higher socially responsible institutional ownership.

Specifically, 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 by longing the stocks in quintile 5 and shorting the stocks in quintile 1.

[Insert Table 8 about here]

The results in Table 8 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 (0.98%, t-stat 2.86), 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 socially responsible institutional investors' under-reaction to mispricing signal leads to return predictability, while such inefficiency is not fully offset by ESG-neutral arbitrageurs due to the funding liquidity constraints.

5. Conclusion

We show that socially responsible institutions (SR_Is) affect the stock price efficiency. Quantitative mispricing signals (Stambaugh et al. (2015)) generate much stronger return predictability for stocks with a higher socially responsible institutional ownership. We document that the preference of SR_Is for socially responsible stocks is one possible driving force for such phenomenon. Overpriced high-ESG stocks and underpriced low-ESG stocks contribute the most, to the return predictability of the quantitative signals. We corroborate the return results with institutional trading evidence. The findings are absent for the period before ESG investing rises and are much stronger when it is difficult for ESG-neutral arbitrageurs to leverage with borrowing capital. The results are consistent if we use PEAD as an additional measure for mispricing.

Our paper highlights the impact of changes in investment preference on stock market efficiency. Despite that the U.S. stock market has become rather efficient in recent years and most anomalies are diminishing, we point out that the popularity of ESG investing may partially offset the effect of increased quantitative trading. We shed light on the nature of socially responsible investing and the importance of considering investors' tastes for defining stock market efficiency. The paper also has implications on evaluating the performance of socially responsible institutions.

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Table 1. Summary Statistics

This table reports the descriptive statistics of SR_IO, Mispricing score, 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. 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. 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. 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, and institutional ownership of most recent quarter-end.

Jan 2004 – Dec 2014	Mean	Std	10-Pctl	Q1	Med	Q3	90-Pctl
SR_IO (%)	13.93	10.10	4.72	6.73	10.64	18.18	81.28
Mispricing score (MISP)	49.56	12.53	33.64	40.68	49.13	57.91	66.17
ESG score	-0.17	2.30	-2.36	-1.64	-0.64	0.91	2.64
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

Table 2. Monthly Returns for Portfolios Independently Sorted on SR_IO (Socially responsible institutional ownership) and MISP (Mispricing score)

This table reports the value-weighted average monthly abnormal returns (in percentage) of portfolios double sorted by SR_IO (Socially responsible institutional ownership) and mispricing score (MISP) 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. To calculate SR_IO, we first use value-weighted size adjusted ESG score as socially responsible score for all institutions. Then we define socially responsible (SR) institutions (one third of all) based on their score. SR_IO is the number of shares held by SR institutions divided by the total number of shares held by all institutions. 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 are independently sorted into low SR_IO and high SR_IO groups. We report value-weighted CAPM alpha, Fama-French (1993) three-factor alpha, and Carhart (1997) four-factor alpha of all the portfolios for the next month. In addition, we report: 1) High minus low spread based on MISP for all stocks, low SR_IO group and high SR_IO group; 2) Difference of high minus low spread between low SR_IO group and high SR_IO group. To adjust for serial correlation, robust Newey-West (1987) t-statistics are reported in brackets.

Mispricing Score		P1 (Underpriced)	P2, P3 & P4 (Fairly priced)	P5 (Overpriced)	P5-P1 (H-L spread)
Value-Weighted Portfolio Return					
CAPM-α	All Stocks	0.14 (1.64)	-0.02 (-0.48)	-0.59*** (-3.12)	-0.73*** (-2.83)
	Low SR_IO	0.05 (0.32)	0.13 (0.92)	-0.23 (-1.33)	-0.28 (-1.55)
	High SR_IO	0.15 (1.58)	-0.05 (-0.95)	-0.68*** (-3.03)	-0.83*** (-2.84)
				Diff	-0.54** (-2.11)
FF-3 α	All Stocks	0.14 (1.61)	-0.02 (-0.48)	-0.59*** (-2.99)	-0.73*** (-2.69)
	Low SR_IO	0.06 (0.47)	0.14 (1.08)	-0.23 (-1.36)	-0.28 (-1.56)
	High SR_IO	0.14 (1.57)	-0.05 (-0.99)	-0.68*** (-2.95)	-0.83*** (-2.71)
				Diff	-0.54** (-2.03)
Carhart-4 α	All Stocks	0.11 (1.35)	-0.02 (-0.44)	-0.52*** (-3.05)	-0.63*** (-2.63)
	Low SR_IO	0.02 (0.20)	0.11 (0.93)	-0.21 (-1.21)	-0.23 (-1.25)
	High SR_IO	0.12 (1.33)	-0.04 (-0.83)	-0.60*** (-3.12)	-0.72*** (-2.72)
				Diff	-0.49** (-2.01)

Table 3 Monthly Returns for Portfolios Sorted on SR_IO, Mispricing Score and ESG Score

This table presents the value-weighted average monthly abnormal returns (in percentage) of triple-sorted portfolios by Socially Responsible Institutional Ownership (SR_IO), mispricing score (MISP) and ESG score and 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. To calculate SR_IO, we first use value-weighted size adjusted ESG score as socially responsible score for all institutions. Then we define socially responsible (SR) institutions (one third of all) based on their score. SR_IO is the number of shares held by SR institutions divided by the total number of shares held by all institutions. 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 independently sorted into 2x5x3 groups based on SR_IO, MISP, and ESG score. We report value-weighted Fama-French (1993) three-factor alpha for high SR_IO stocks and low SR_IO stocks in Panel A and Panel B respectively. To adjust for serial correlation, robust Newey-West (1987) t-statistics are reported in brackets.

Panel A: Value-Weighted FF-3 Alpha (%) among **High** SR_IO Stocks

	All	ESG Score		
Mispricing Score	Stocks	Low	Medium	High
P1	0.14	0.50*	0.17**	0.04
(Most Underpriced)	(1.57)	(1.95)	(2.10)	(0.30)
P2, P3, & P4	-0.05	-0.09	-0.00	-0.13
(Fairly priced)	(-0.99)	(-0.40)	(-0.04)	(-1.29)
P5	-0.68***	-0.31	-0.47**	-0.88**
(Most Overpriced)	(-2.95)	(-0.61)	(-2.58)	(-2.55)
(P5-P1)	-0.83***			
	(-2.71)			

Panel B: Value-Weighted FF-3 Alpha (%) among **Low** SR_IO Stocks

	All	ESG Score		
Mispricing Score	Stocks	Low	Medium	High
P1	0.06	-0.03	0.11	0.19
(Most Underpriced)	(0.47)	(-0.09)	(0.97)	(0.64)
P2, P3, & P4	0.14	0.09	0.14	0.04
(Fairly priced)	(1.08)	(0.29)	(1.27)	(0.20)
P5	-0.23	-0.25	-0.19	-0.48
(Most Overpriced)	(-1.36)	(-0.82)	(-1.07)	(-1.07)
(P5-P1)	-0.28			
	(-1.56)			

Table 4. 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. The sample period is from 2004 to 2014. 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 5. Characteristics of SR_IO-MISP Portfolios

This table reports the average of stock characteristics of portfolios independently double sorted by SR_IO (Socially responsible institutional ownership) and MISP (mispricing 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. To calculate SR_IO, we first use value-weighted size adjusted ESG score as socially responsible score for all institutions. Then we define socially responsible (SR) institutions (one third of all) based on their score. SR_IO is the number of shares held by SR institutions divided by the total number of shares held by all institutions. 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 SR_IO and high SR_IO groups. VW FF-3 α is the Fama-French (1993) three-factor alpha of next month return for each portfolio. Stock characteristics include mispricing score, SR_IO, 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.

	P1: Most Underpriced Stocks		P5: Most Overpriced Stocks	
	SR_IO		SR_IO	
	Low	High	Low	High
VW FF-3 α (%)	0.06	0.14	-0.23	-0.68***
Mispricing score	32.43	32.59	67.58	67.77
SR_IO (%)	5.83	19.06	5.41	17.09
Size ranking (%)	69.37	84.38	63.22	70.59
Turnover (%)	21.33	20.40	23.31	25.22
IVOL (%)	8.48	6.67	10.26	9.29
Analyst coverage	7.68	13.61	7.44	9.71
Institutional ownership	0.74	0.74	0.70	0.68
Lending fee (%)	0.68	0.56	1.22	1.28

Table 6. 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. 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 SR_IO and high SR_IO groups. We report value-weighted Fama-French (1993) three-factor alpha of all the portfolios during the period 1996-2003 (Panel A) and the period 2004-2014 (Panel B). In addition, we report: 1) High minus low spread based on MISP for low SR_IO group and high SR_IO group; 2) Difference of high minus low spread between low SR_IO group and high SR_IO group. To adjust for serial correlation, robust Newey-West (1987) t-statistics are reported in brackets.

Mispricing Score		P1	P2, P3, & P4	P5	P5-P1
Panel A: 1996-2003					
FF-3 α	Low SR_IO	0.49*	0.04	-0.60**	-1.09**
		(1.71)	(0.24)	(-2.56)	(-2.59)
	High SR_IO	0.62***	0.08	-0.44	-1.05**
		(2.74)	(0.38)	(-1.33)	(-2.63)
				Diff	0.04
					(0.09)
Panel B: 2004-2014					
FF-3 α	Low SR_IO	0.06	0.14	-0.23	-0.28
		(0.47)	(1.08)	(-1.36)	(-1.56)
	High SR_IO	0.14	-0.05	-0.68***	-0.83***
		(1.57)	(-0.99)	(-2.95)	(-2.71)
				Diff	-0.54**
					(-2.03)

Table 7. 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. 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 the entire period, low funding liquidity period and high funding liquidity period. In addition, we report difference of high minus low spread between low SR_IO group and high SR_IO group for the entire period, low funding liquidity period and high funding liquidity period respectively. To adjust for serial correlation, robust Newey-West (1987) t-statistics are reported in brackets.

H-L portfolio VW FF-3 α (%)	All Stocks	Low SR_IO	High SR_IO	Diff
Entire period (2004–2014)	-0.73***	-0.28	-0.83***	-0.54**
	(-2.69)	(-1.56)	(-2.71)	(-2.03)
High funding liquidity period	-0.05	-0.07	-0.10	-0.02
(More arbitrage capital)	(-0.19)	(-0.21)	(-0.34)	(-0.07)
Low funding liquidity period	-1.23***	-0.41	-1.38***	-0.97***
(Less arbitrage capital)	(-3.47)	(-1.67)	(-3.50)	(-2.92)

Table 8. 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.

Value-Weighted FF-3 Alpha (%) of (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*	-0.21	0.59**	0.80**
	(1.77)	(-0.62)	(2.18)	(2.11)
High funding liquidity period	-0.02	0.01	0.01	0.00
(More arbitrage capital)	(-0.06)	(0.03)	(0.04)	(0.00)
Low funding liquidity period	0.77**	-0.30	0.98***	1.28***
(Less arbitrage capital)	(2.38)	(-0.68)	(2.86)	(2.66)

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

Variable Definitions

Mispricing Measures	
MISP	Mispricing measure, as in Stambaugh, 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 size-adjusted ESG score to calculate value-weighted SR scores
SR_IO_rawESG	Percentage of shares held by SR institutions out of shares held by all institutions, using raw ESG score to calculate value-weighted SR scores
SR_IO_ewESG	Percentage of shares held by SR institutions out of shares held by all institutions, using size-adjusted ESG score to calculate equal-weighted SR scores
NSR_IO_ESG	Percentage of shares held by non-SR institutions out of shares held by all institutions, using size-adjusted ESG score to calculate value-weighted SR scores
Share-weighted SR_IO	Percentage of shares held by SR institutions out of shares held by all institutions, using size-adjusted ESG score to calculate value-weighted SR scores
Share-weighted SR_IO * IO	Percentage of shares held by SR institutions out of all shares outstanding, using size-adjusted ESG score to calculate 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.
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).

Table A1. Monthly Returns of Portfolios Sorted on Mispricing Score before and after 2004

This table presents the average monthly returns (in percentage) of portfolios sorted by Mispricing score (MISP, defined in Stambaugh, Yu, and Yuan (2015)) from 1996 to 2003 (Panel A) and 2004 to 2014 (Panel B), using full CRSP sample with non-missing MISP. At the end of each month, all available stocks are evenly sorted into five quintiles based on MISP. 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 value-weighted Fama-French (1993) three-factor alpha of next month, for all stocks and all stocks excluding the largest 500 stocks. In addition, we report Fama-French (1993) three-factor alpha and the annualized sharp ratio for High-minus-low portfolios. To adjust for serial correlation, robust Newey-West (1987) t-statistics are reported in brackets.

Panel A: Value-Weighted FF-3 Alpha (%) and Sharp Ratio from 1996 to 2003

	P1 (Underpriced)	P2, P3 & P4 (Fairly priced)	P5 (Overpriced)	P5-P1 ((H-L) spread)	
	FF-3 α	FF-3 α	FF-3 α	FF-3 α	Sharp ratio
All stocks	0.43***	0.06	-1.11***	-1.54***	0.297
	(3.50)	(0.68)	(-4.39)	(-4.46)	
Exclude largest 500 stocks	0.40***	0.01	-1.57***	-1.97***	0.400
	(2.68)	(0.09)	(-5.37)	(-5.86)	

Panel B: Value-Weighted FF-3 Alpha (%) and Sharp Ratio from 2004 to 2014

	P1 (Underpriced)	P2, P3 & P4 (Fairly priced)	P5 (Overpriced)	P5-P1 ((H-L) spread)	
	FF-3 α	FF-3 α	FF-3 α	FF-3 α	Sharp ratio
All stocks	0.14*	-0.02	-0.67***	-0.81***	0.108
	(1.74)	(-0.46)	(-3.56)	(-3.16)	
Exclude largest 500 stocks	0.09	0.11**	-0.41***	-0.50***	0.135
	(1.31)	(2.16)	(-3.20)	(-3.23)	

Table A2. 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 A3. 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 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. 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, using size-adjusted ESG score to calculate value-weighted SR scores. SR_IO_ESG is the defined as the number of SR institutions divided by the total number institutions. SR_IO_rawESG uses raw ESG to calculate value-weighted SR scores for all institutions. SR_IO_rawESG uses equal-weighted SR scores for all institutions. NSR_IO_ESG is the number of shares held by non-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. The sample period is from 2004 to 2014.

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

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

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

Spearman / Pearson	SR_IO _ESG	SR_IO _rawESG	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_rawESG	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, 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 size-adjusted 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_rawESG: use raw ESG score instead of size-adjusted 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 shares held by non-SR institutions divided by the total number of shares held by all 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_rawESG	SR_IO_ewESG	NSR_IO_ESG	Share-weighted SR_IO*IO
	VW FF-3 α for high-minus-low spread					
Low SR_IO	-0.28	-0.34*	-0.32*	-0.39*	-0.38*	-0.21
	(-1.56)	(-1.67)	(-1.88)	(-1.87)	(-1.92)	(-0.93)
High SR_IO	-0.83***	-0.80***	-0.78**	-0.81	-0.77***	-0.82***
	(-2.71)	(-2.72)	(-2.61)	(-2.76)	(-2.65)	(-2.76)
Diff	-0.54**	-0.46*	-0.46*	-0.42**	-0.39*	-0.61**
	(-2.03)	(-1.79)	(-1.76)	(-1.99)	(-1.78)	(-2.29)

Table A6. Monthly Returns for Portfolios Independently Sorted on SR_MO (Socially responsible mutual fund ownership) and MISP (Mispricing score)

This table reports the average monthly abnormal returns (in percentage) of portfolios double sorted by SR_MO (Socially responsible mutual fund ownership) and mispricing score (MISP) 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. To calculate SR_MO, we first use value-weighted size adjusted ESG score as socially responsible score for all active mutual funds. Then we define socially responsible (SR) mutual funds (one third of all) based on their score. SR_MO is the number of shares held by SR mutual funds divided by the total number of shares held by all mutual funds. 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 are independently sorted into low SR_MO and high SR_MO groups. We report value-weighted CAPM alpha, Fama-French (1993) three-factor alpha and Carhart (1997) four-factor alpha of all the portfolios for the next month. In addition, we report: 1) High minus low spread based on MISP for low SR_MO group and high SR_MO group; 2) Difference of high minus low spread between low SR_MO group and high SR_MO group. To adjust for serial correlation, robust Newey-West (1987) t-statistics are reported in brackets.

Mispricing Score		P1 (Underpriced)	P2, P3 & P4 (Fairly priced)	P5 (Overpriced)	P5-P1 (H-L spread)
Value-Weighted Portfolio Return					
CAPM α	Low SR_IO	0.06	0.11	-0.17	-0.23
		(0.34)	(0.71)	(-1.00)	(-1.50)
	High SR_IO	0.14	-0.04	-0.65***	-0.79***
		(1.60)	(-0.74)	(-2.94)	(-2.76)
				Diff	-0.56**
					(-2.22)
FF-3 α	Low SR_IO	0.07	0.12	-0.16	-0.23
		(0.59)	(1.16)	(-1.29)	(-1.42)
	High SR_IO	0.14	-0.04	-0.65***	-0.79***
		(1.57)	(-0.76)	(-2.91)	(-2.66)
				Diff	-0.56**
					(-2.19)
Carhart-4 α	Low SR_IO	0.03	0.09	-0.13	-0.17
		(0.31)	(1.04)	(-1.04)	(-1.10)
	High SR_IO	0.11	-0.03	-0.58***	-0.69***
		(1.31)	(-0.65)	(-2.98)	(-2.62)
				Diff	-0.52**
					(-2.13)

Table A7. 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 A8. Adjusting for Investment Horizon

This table reports the main result after controlling for the investment horizon. Stock churn ratios is defined as the weighted average of the churn ratios of the holding institutions in the previous quarter. We regress SR_IO on churn ratio to get the residual as the investment horizon adjusted SR_IO. 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 SR_IO and high SR_IO group based on the investment horizon adjusted SR_IO. We report value-weighted CAPM alpha, Fama-French (1993) three-factor alpha and Carhart (1997) four-factor alpha of all the portfolios for the next month. In addition, we report: 1) High minus low spread based on MISP for low and high adjusted SR_IO group, receptively; 2) Difference of high minus low spread between low adjusted SR_IO group and high adjusted SR_IO group. 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.

Mispricing Score		P1 (Underpriced)	P2, P3 & P4 (Fairly priced)	P5 (Overpriced)	P5-P1 (H-L spread)
CAPM α	Low adj. SR_IO	0.04	0.15	-0.18	-0.21
		(0.24)	(1.08)	(-1.02)	(-1.19)
	High adj. SR_IO	0.15	-0.05	-0.68***	-0.83***
		(1.58)	(-1.06)	(-3.02)	(-2.83)
				Diff	-0.61**
					(-2.34)
FF-3 α	Low adj. SR_IO	0.04	0.15	-0.17	-0.21
		(0.35)	(1.33)	(-1.11)	(-1.17)
	High adj. SR_IO	0.15	-0.05	-0.68***	-0.83***
		(1.57)	(-1.09)	(-2.97)	(-2.71)
				Diff	-0.61**
					(-2.28)
Carhart-4 α	Low adj. SR_IO	0.01	0.13	-0.14	-0.15
		(0.09)	(1.24)	(-0.92)	(-0.86)
	High adj. SR_IO	0.12	-0.05	-0.60***	-0.72***
		(1.33)	(-0.94)	(-3.12)	(-2.70)
				Diff	-0.57**
					(-2.26)

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.

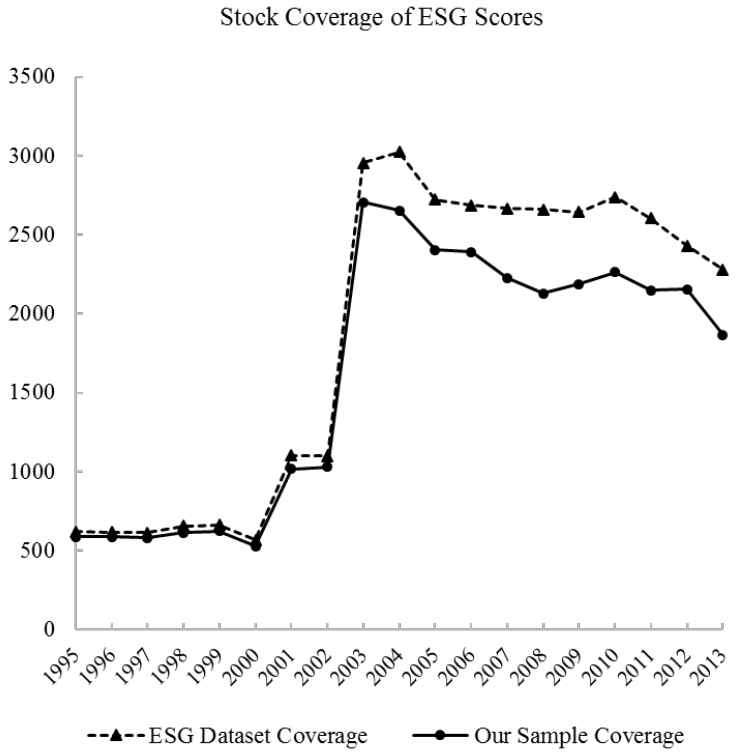

Figure A1-(a)

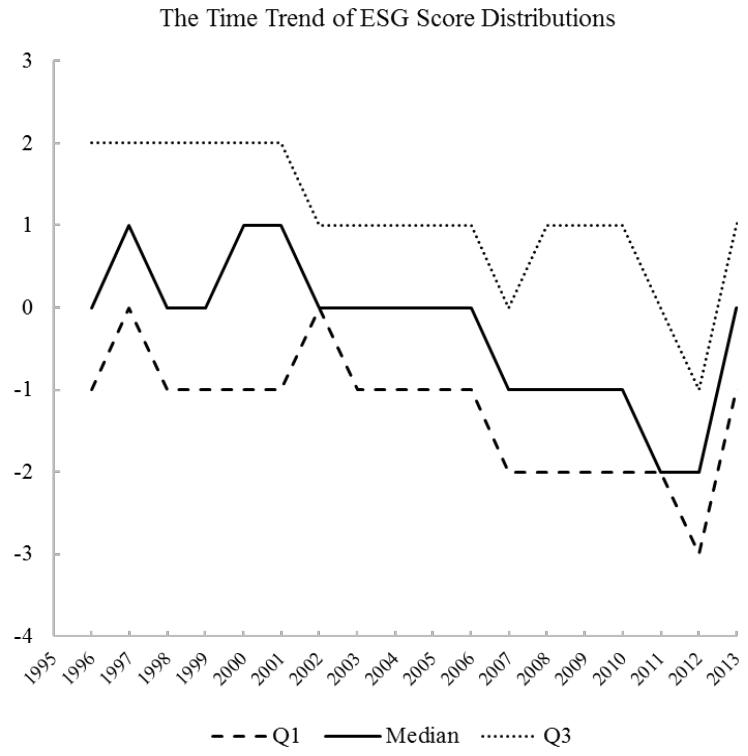

Figure A1-(b)