NBER WORKING PAPER SERIES

# ESG PREFERENCE, INSTITUTIONAL TRADING, AND STOCK RETURN PATTERNS

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Working Paper 28156
http://www.nber.org/papers/w28156

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
November 2020

We thank Vikas Agrawal, Hendrik Bessembinder, Jennifer Carpenter, Tarun Chordia, Zhi Da, Amit Goyal, Charlie Hadlock, Bing Han, Samuel Hartzmark, Kewei Hou, Ozgur Ince (discussant), Hao Jiang, Kose John, Lars Kaiser, Ralph Koijen, Jeffrey Pontiff, Adam Reed (discussant), Luke Taylor (discussant), Patrick Verwijmeren, Neng Wang, Robert Whitelaw, David Yermack, and seminar participants at Erasmus University Rotterdam, Hong Kong Polytechnic University, Korea University, NYU Stern, Michigan State University, Northeastern University, Schroders Systematic Investments, and Tsinghua University for helpful discussions and useful suggestions. We have benefited from the comments of participants at Western Finance Association Annual Meeting, Northern Finance Association Annual Conference, China International Conference in Finance, Finance Down Under Conference, Fixed Income and Financial Institutions (FIFI) Conference, Luxembourg Asset Management Summit, FMA Consortium on Asset Management, CQAsia-BoAML Conference, Deutsche Bank Global Quantitative Strategy Conference, INQUIRE Europe Autumn Seminar, and Geneva Summit on Sustainable Finance. We acknowledge the best paper award at 2020 FMA Consortium on Asset Management, and the 2019 AAM-CAMRI Prize in Asset Management. The work described in this paper was supported by a grant from the Research Grant Council of the Hong Kong Special Administrative Region, China (Project No. CUHK 24501519), the 2019 Alternative Risk Premia Research Grant of the Paris-Dauphine House of Finance and Unigestion, and a grant from Geneva Institute for Wealth Management. A previous version was circulated under the title “ESG Preference and Market Efficiency: Evidence from Mispricing and Institutional Trading”. All errors are our own. Sheridan Titman acknowledges that he has had consulting arrangements with institutions that use some of the strategies described in this paper.

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NBER Working Paper No. 28156
November 2020
JEL No. G12,G4


## ABSTRACT

Socially responsible (SR) institutions tend to focus more on the ESG performance and less on quantitative signals of value. Consistent with this difference in focus, we find that SR institutions react less to quantitative mispricing signals. Our evidence suggests that the increased focus on ESG may have influenced stock return patterns. Specifically, abnormal returns associated with these mispricing signals are greater for stocks held more by SR institutions. The link between SR ownership and the efficacy of mispricing signals only emerges in recent years with the rise of ESG investing, and is significant only when there are arbitrage-related funding constraints.



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## 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 incorporated a firm's ESG (Environmental, Social, and Governance) performance into the investment decision making process.[1] According to a 2016 report by the U.S. SIF Foundation, 20% of the professionally managed assets in the U.S. —$8.72 trillion or more in aggregate, are influenced by socially responsible investment principles.

This paper 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 link between ESG performance and investment performance is somewhat mixed and to our knowledge, there is no clear evidence on the investment performance of socially responsible (SR) institutions.[3]

We contribute to both literatures by studying how the interaction of these two investment styles may have influenced stock return patterns. Specifically, we test the hypothesis that because of limited attention, investors that focus on the social performance of firms pay relatively less attention to quantitative measures of value.[4] According to this hypothesis, the portfolio holdings of socially responsible institutions respond less to quantitative mispricing signals, and because of this, the returns of those stocks held more by these institutions may be more predictable.

As we show in Figure 1, the assets devoted to socially responsible investing accelerated sometime around 2004. Our conjecture, which we empirically explore, is that in the years prior to

[1] See, for example, Starks, Venkat, and Zhu (2018) and Hartzmark and Sussman (2019).
[2] See, for example, Chordia, Subrahmanyam, and Tong (2014) and McLean and Pontiff (2016).
[3] Hong and Kacperczyk (2009) find stocks in "sin" industries earn significantly higher abnormal returns than firms in other industries. Conversely, firms that are listed as the "100 Best Companies to Work for in America" demonstrate generate higher alphas in the future, as the market undervalues the intangible assets (Edmans (2011)). Using the release of Morningstar sustainability rating, Hartzmark and Sussman (2019) shows that there is a reverse relation between fund performance and sustainability rating. Pedersen, Fitzgibbons, and Pomorski (2020) model investor's portfolio choice under the ESG efficient frontier. Pastor, Stambaugh, and Taylor (2020) propose an equilibrium model of sustainable investing and its implication to the return of green assets.
[4] Our conversations with a quantitative asset management group that has added social performance to their asset selection model support our hypothesis. Specifically, by adding social performance to their asset selection model, the managers put less weight on traditional quantitative signals.

2004, socially responsible investors had very little influence on return patterns. However, in the post 2004 period, the introduction of a growing group of socially responsible investors with interests that go beyond risk and return may have at least temporarily influenced these return patterns.

We start our analysis by following Hwang, Titman, and Wang (2018) and classify institutions into those that are and are not socially responsible institutions, according to the value-weighted ESG scores (from the MSCI KLD database) of their portfolio holdings.[5] Our analysis indicates that in addition to having higher ESG scores, the stocks held by SR institutions tend to be somewhat larger, more liquid, and are followed by more analysts on average. Given these characteristics, we would expect that all else equal, these stocks should be more efficiently priced than their smaller counterparts that tend to be held more by other institutions.

Based on this classification, we examine how the holdings of SR institutions respond to quantitative signals that are associated with future stock returns. Specifically, we consider the standardized unexpected earnings signal (SUE) explored in the accounting literature,[6] as well as a composite score measure of 11 quantitative mispricing signals, which we refer to as the SYY signal since it is based on the analysis of Stambaugh, Yu, and Yuan (2015). The SUE signal has the advantage that its timing is very clear, while SYY has the advantage that it is a more comprehensive signal. The evidence indicates that SR institutions do in fact pay less attention to quantitative signals. Specifically, we find that during the 2004-2014 sample period, relative to other institutions, SR institutions are less likely to sell (buy) stocks with unfavorable (favorable) quantitative signals.

We then examine the extent to which the SUE and SYY signal predict stock returns. Our conjecture is that if SR institutions pay less attention to these signals, the returns of the stocks they follow will under react to this information, suggesting that the signals will better predict future returns for these stocks. We find that this is indeed the case. The efficacy of both the SUE and SYY score is significantly stronger for the stocks that are held more by SR institutions. Specifically, in our 2004-2014 sample period, a value-weighted long-short strategy that exploits the SUE mispricing signal generates a significant monthly return of 0.59% on stocks that are held more by socially responsible institutions. In contrast, we find a statistically insignificant return of -0.21%

[5] This approach is also quite similar to how Morningstar is currently assessing the sustainability rating of mutual funds.
[6] For example, Foster, Olsen, and Shevlin (1984); Bernard and Thomas (1989).

per month for stocks that are held more by institutions that are not classified as socially responsible. Our results using the composite SYY signal are very similar. The signal generates significantly stronger abnormal returns for those stocks held more by SR institutions, despite the fact that those stocks tend to be larger and more liquid.

As a placebo test, we repeat the analysis in the earlier 1996-2003 sample period that pre-dates the rise in ESG investing. The tests, which fail to find a significant relationship between the holdings of SR institutions and return patterns in the earlier period, support our conjecture that the significant results in the 2004-2014 period are related to the limited attention of the SR institutions. We also consider the return patterns in subperiods within our 2004-2014 sample period. If the return patterns we identify reflect mispricing, then we expect the patterns to be stronger when the cost of shorting and other capital constraints are higher. To explore this possibility, we follow Adrian, Etula, and Muir (2014) and proxy for changes in capital constraints using shocks to the broker-dealer leverage. As we show, the inefficiency caused by socially responsible institutions is only observed when capital constraints are likely to be tight.

As a further test of the relationship between SR institutional ownership and stock return patterns we consider the relationship between SR institutional ownership and the Hou and Moskowitz (2005) Price Delay measure, which measures the extent to which individual stock returns respond to market returns with a lag. Our panel regressions demonstrate that higher SR institutional ownership is in fact associated with a larger Price Delay in the 2004-2014 sample period, and this effect is stronger in the period with greater funding constraints. We again find no such relationship in the placebo 1996-2003 period.

It is natural to ask whether the KLD ESG scores directly influence stock return patterns. To evaluate this possibility, we do a triple sort on ESG scores, SR institutional ownership, and the SYY mispricing scores. We find that when we control for the ESG scores, there is still a significant relation between SR institutional ownership and return patterns, but after controlling for SR institutional ownership, ESG scores do not seem to influence returns. To better understand why this might be the case we examine alternative ESG scores provided by Thomson Reuter ASSET4, which is a Swiss private firm that provides ESG ratings for stocks in major indexes around the world, including FTSE 250, MSCI Europe, MSCI World Index, S&P 500, and Russell 1000. We find that the correlation between the Thomson Reuter ASSET4 scores and the KLD scores is relatively low, suggesting that the scores provided by individual providers are relatively noisy

indicators of the market's sentiment about the attractiveness of stocks to SR investors. However, we find a substantially higher correlation between the SR institutional ownership measures constructed with the alternative ESG scores, suggesting that our holdings measure may provide a more robust indicator of the extent to which a stock is part of the SR institutions' investment universe.

We also consider the extent to which our results are influenced by the fact that SR institutions tend to be less active. Indeed, as shown by Starks, Venkat, and Zhu (2018), socially responsible institutions tend to have longer investment horizons, suggesting that many of them may be closet indexers. We address this possibility in two ways. First, we examine whether we get similar results when we sort stocks by the holdings of long horizon institutions rather than SR institutions. We find that the returns of the SYY strategy do not appear to be related to the holdings of long horizon institutions. Second, we define SR active ownership from the holdings of active mutual funds, which tend to trade more actively and have shorter horizons than the average SR institutions. We find that when we repeat our analysis defining the SR institutions' investment universe with the holdings of active mutual funds, we get similar results.

Finally, we highlight a puzzling size-related return pattern that might be partly due to the growing importance of socially responsible investors. Specifically, we find that the returns of the SYY strategy, which historically have been much stronger for small market capitalization stocks, are actually stronger for the larger capitalization stocks in the recent period. One possible explanation is that the relative efficiency of large capitalization stocks has declined because they are increasingly being held in passive investing vehicles, like index funds. A second possible explanation is that their decline is due to large capitalization stocks being held by SR institutions.

Our results suggest that the behavior of SR institutions provides the more plausible of the two explanations. Specifically, we find that for subsamples segmented by either high or low SR institutional ownership, there is no relation between market capitalization and the returns of the SYY strategy. We do, however, find a significant relation between the profitability of the SYY strategy and the holdings of SR institutions for both the small capitalization and the large capitalization subsamples.

Although we believe that this is the first paper to explore the interaction between the ESG preferences of institutional investors and stock return patterns, two recent papers motivate our analysis. The first, Hartzmark and Sussman (2019), provide an explanation for why mutual funds

may want to allocate more attention to identifying high ESG stocks, and perhaps as a result, devote less attention to 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.[7] There is also evidence that socially responsible mutual funds are able to charge higher fees.[8] The second paper, Starks, Venkat, and Zhu (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 is consistent with our finding that socially responsible institutions react less to mispricing signals.

We also contribute to the literature that explores how limited investor attention can influence investor behavior and stock return patterns. Our analysis is particularly close to Hirshleifer, Lim and Teoh (2009), who also examine how constraints on attention affect stock returns around earnings announcements.[9] However, we are not aware of other studies that explore how broadening investor objectives influences their attention in ways that influence return patterns as well as portfolio choices.

More generally, our paper is related to the literature that describes various frictions, taste considerations, and other distractions that influence the investment decisions of institutional investors, e.g., Almazan, Brown, Carlson, and Chapman (2004), Fama and French (2007), Cao, Han, and Wang (2017), Lewellen (2011). Our analysis is particular close to Edelen, Ince, and Kadlec (2016), which also examines the extent to which institutional trades are consistent with the quantitative signals that have been proposed in the academic literature. We contribute to this literature by considering a setting where tastes clearly changed, and by doing so, we provide clearer evidence on the link between tastes, portfolio choices, and return patterns.

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

[7] See also, Ridel and Smeets (2017), who find that socially responsible investors are willing to forgo financial performance because of their preference for positive social impacts.

[8] 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 A1 for details.

[9] One might think that limited attention affects only retail investors, but recent studies by Ben-Rephael, Da, and Israelsen (2017) and Schmidt (2019) show that institutional investors are also subject to inattention, and examine the link between limited attention and returns around earnings announcements.

impose limits on the ability of investors to arbitrage financial markets.[10] We show that the predictable patterns we observe occur mainly in periods when borrowing is the most constrained.

The rest of the paper is as follows. Section 2 describes our data and measures. We present our baseline results in Section 3. Section 4 discusses alternative explanations and robustness tests. Section 5 concludes the paper.

## 2. Data and Measures

### *2.1. Data sources and sample coverage*

Stock returns, price, and trading volumes are obtained from the Center for Research on Security Prices (CRSP). We take the Fama-French common risk factors and the risk-free rate from Kenneth French's website. The accounting data are collected from Compustat. The analyst coverage and forecast data are from I/B/E/S. We obtain quarterly institutional holdings (13F) and mutual fund holdings (s12) data from Thomson Reuters. The stock lending fee data are from Markit for the period from 2006 to 2014. The Stambaugh, Yu, and Yuan (2015) mispricing score measure for individual stocks are obtained from Robert Stambaugh's website.

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.[11] The database covers both the social benefits and harms of a firm, and thus influences both the negative and positive screening processes of socially responsible investing.[12] Our empirical tests focus on the period from 2004 to 2014, during which the dataset covers the top 3,000 U.S. firms. Figure 2 shows the stock coverage of the MSCI ESG KLD database over each of these years.

[10] There are a number of related theories that include Garleanu and Pedersen (2011), Gromb and Vayanos (2002, 2018), and Brunnermeier and Pedersen (2009). In addition, there is a growing empirical literature that examines how capital flows to hedge funds influence mispricing, e.g., Akbas, Armstrong, Sorescu, and Subrahmanyam (2015, 2016).

[11] 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)).

[12] 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.

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 stocks (CRSP share code 10 and 11) traded on NYSE, AMEX, and NASDAQ. Stocks with prices below five dollars on the last trading day of the previous month are excluded. Our sample covers 277,573 stock-month observations from January 2004 to December 2014, with 4,324 unique stocks.[13] 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 relatively 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, indicating that our results are not driven by small, illiquid stocks, or stocks in certain industries.

### *2.2. Key measures*

#### *2.2.1. Socially responsible institutional ownership measure (SR_IO)*

We follow Hwang, Titman, and Wang (2018) and use four steps to calculate the socially responsible institutional ownership (SR_IO) for each stock each quarter.

First, we calculate an ESG score for each firm in each year. ESG scores include a firm's performance along several dimensions, and are updated on an annual basis. Following the related literature, we include five dimensions, environment, community, diversity, employee relationship, and corporate governance,[14] and 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 the number of strengths and the number of concerns in each category. Then we sum up the net score for each

[13] Appendix Table A2 tabulates the details of our sample coverage.

[14] 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.

dimension and obtain the raw firm-level ESG score. A higher raw ESG score indicates a better social performance.

Because larger firms tend to have higher raw ESG scores, we size-adjust the scores by sorting the stocks into 10 deciles based on size, calculating the average ESG score for each size decile, and subtracting the average ESG score of corresponding decile from the raw ESG score of the stock. Our results hold if we instead use raw ESG scores.

Second, we measure an institution's social preference by examining its holdings in each period. Following the literature, we measure the investment preference / style of institutional investors, $ISRS_{i,q}$, by taking a value-weighted average of the size-adjusted ESG scores of all stocks in their portfolios at the end of each quarter, using the following equation:

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

where $ESG_j$ is the size-adjusted ESG score of stock $j$ in the previous year, $w_{j,q}$ is the weight of stock $j$ in institution $i$'s portfolio at the end of quarter $q$ and $ISRS_{i,q}$ is the social responsibility score for institution $i$ at the end of quarter $q$.

Third, we define socially responsible (SR) institutions according to certain cutoffs for all institutions. Each quarter, we sort all institutions into three groups based on the calculated $ISRS_{i,q}$, i.e., the value-weighted size-adjusted ESG score of their holding portfolios. Institutions in the top group are defined as socially responsible (SR) institutions.[15]

Finally, socially responsible institutional ownership (SR_IO) at the stock level is calculated as the percentage of shares held by SR institutions, divided by shares held by all institutions.

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

*2.2.2. Mispricing signals*

Our hypothesis is that because of the limited attention of SR institutions, the stocks held by these institutions will tend to under react to quantitative measures of mispricing. To illustrate this, we

[15] We also sort all the institutions into two (four) groups based on *ISRS*. Then we define SR institutions in the first half (quartile) as socially responsible (SR) institutions. The results do not change.

start by examining the link between a stock's holdings by SR institutions and its tendency to under react to earnings announcements. This analysis is similar to Hirshleifer, Lim, and Teoh (2009), who also examine how constraints on attention affect stock returns around earnings announcements. Specifically, we follow Foster, Olsen, and Shevlin (1984) and Bernard and Thomas (1989) and examine responses to firms' standardized unexpected earnings (SUE), computed as the difference between their current quarter's earnings and the earnings four quarters ago, scaled by the standard deviation of unexpected earnings over the last eight quarters.

We also follow Stambaugh, Yu, and Yuan (2015), and consider a monthly updated composite quantitative signal, constructed by combining each stock's rankings on 11 anomaly variables. The 11 anomalies are *Net Stock Issues*, *Composite Equity Issues*, *Accruals*, *Net Operating Assets*, *Asset Growth*, *Investment-to-Assets*, *Distress*, *O-score*, *Momentum*, *Gross Profitability Premium*, and *Return on Assets*. For each anomaly, the stocks are ranked and sorted into 100 groups and assigned a rank from 1 to 100; the highest rank is assigned to the stocks associated with the lowest average abnormal future return, as documented in the literature. The composite quantitative signal of a stock is the arithmetic average of its rankings on the 11 anomalies, ranging between 1 and 100. For the convenience of analysis in our paper, we define SYY score, ranging between -100 and -1, as the opposite of the composite signal in Stambaugh, Yu, and Yuan (2015). According to this measure, stocks with the highest SYY score are the most underpriced and the future expected returns are the most positive. Those with the lowest values are the most overpriced and are expected to have the lowest expected future returns. Our results are also robust to an alternative composite mispricing score measure covering 12 anomalies used in Chordia, Subrahmanyam, and Tong (2014).[16]

### *2.3. Sample summary*

Table 1 Panel A reports the descriptive statistics of the most important variables we consider (socially responsible institutional ownership, SUE score, and SYY score) and other firm characteristics, during our January 2004 to December 2014 sample period. Socially responsible institutional ownership (SR_IO), defined as the percentage of shares held by SR institutions

[16] The 12 anomalies in Chordia, Subrahmanyam, and Tong (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.

divided by shares held by all institutions, has a mean of 13.93%. The average SUE score is 0.14%, which by construction should be close to 0. And the average SYY score is -49.56, which by construction should be close to -50. The ESG score has a mean of -0.17 and a small standard deviation as the distribution clusters around 0. The average market capitalization of firms in our sample is $6.23 billion.

[Insert Table 1 about here]

We report the time-series average of the cross-sectional Pearson correlations and Spearman correlations of the relevant variables in Panel B of Table 1. The Pearson correlation between the ESG scores and SR_IO is 0.27, which is significantly positive, but somewhat lower than our initial priors. The relatively low correlation probably reflects a couple of things. The first is disagreement about the appropriate ESG scores – indeed, we examine ESG scores provided by competing data providers and find that the correlation between their scores and the KLD scores are not particularly high.[17] It is also likely that some SR institutions hold some stocks in low ESG industries to diversify their portfolios and to track their benchmarks.

Table 1 Panel C reports summary statistics for different types of institutions. On average, SR institutions have $2.76 billion in assets under management, which is somewhat less than the non-SR institutions ($5.52 billion). SR institutions and non-SR institutions have a similar number of stocks in their portfolios, but SR institutions tend to have a longer investment horizon. We use the reciprocal of the churn ratio (Gaspar, Massa, and Matos (2005)) to measure the investment horizon. Specifically, socially responsible institutions on average hold 207 stocks in their portfolios and have an average investment horizon of 4.35 quarters, while non-SR institutions hold 260 stocks and have an average investment horizon of 2.63 quarters.[18] We also report the equal-weighted and value-weighted portfolio ESG score, SUE score, and SYY score for the portfolios held by institutions. Socially responsible institutions have a much higher portfolio ESG score, no matter which weighting method we use. Compared with non-SR institutions, SR institutions tend to hold stocks with slightly lower SUE and a little bit higher composite SYY score.

[17] Similar evidence that the correlations among MSCI ESG score and other ESG scores are low is documented in Gibson, Krüger, and Schmidt (2020). In our sample, correlations between MSCI KLD ESG scores and Thomson Reuter ASSET4 ESG scores is 0.34.

[18] We define the investment horizon explicitly in equation (6) in Section 4.3.

## 3. Empirical Results

### *3.1. ESG preference and institutions' trading behaviors*

In this subsection, we explore whether socially responsible (SR) institutions and non-SR institutions respond differently to quantitative signals. Specifically, we relate the change in the quarterly holdings of the institutions at the end of a given quarter to both the SUE score calculated during the quarter and the average of a stock's SYY score in the last month of the previous quarter and the first two months of the current quarter. We calculate these relations for the sample of SR institutions as well as for the sample of non-SR institutions.[19]

The change in holdings is calculated in two different ways. We calculate the change in the percentage of shares held by each institutional type as well as the change in the number of institutions of each type that holds the shares. We are interested in changes in the number of institutions holding shares, since previous research suggests that the number of institutions holding a stock, rather than the amount that they hold, predicts future stock returns (Sias, Starks, and Titman (2006), Khan, Kogan, and Serafeim (2012), Edelen, Ince, and Kadlec (2016)).

The results reported in Table 2 indicate that SR institutions react less to the mispricing signals. Panel A.1. reports the relationship between SUE score and the percentage change in ownership by different institutions. As the table reveals, changes in the aggregate holdings of SR institutions are positively related to the SUE score during the quarter, but the relationship is only marginally significant. In contrast, we observe a much more significant relationship between the SUE scores and changes in the holdings of non-SR institutions. Most notably, for stocks in SUE quintile 1 (the overpriced stocks) non-SR institutions decrease their holdings by 0.75%. In contrast, for stocks in SUE quintile 5 (the underpriced stocks) non-SR institutions increase their holdings by 0.43%. The difference between these flows, 1.19%, is highly significant. SR institutions only increase their holdings by 0.08% for high SUE stocks and decrease their holdings by 0.08% for low SUE stocks.

Panel A.2. report the relationship between SUE scores and changes in the number of institutions. For stocks that experience the most negative earnings surprise, the number of SR institutions holding the stock decreases by 0.14% in the following quarter. For stocks that

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

experience the most positive earnings surprise, the number of SR institutions remains virtually unchanged. In contrast, non-SR institutions react much stronger towards SUE scores. The number of these institutions holding stocks with the most negative unexpected earnings decreases by 2.30% and the number of institutions holding stocks with the most positive earnings surprises increase by 0.49%, yielding a significant difference of 2.78%. In summary, the results in Panel A are consistent with our conjecture that SR institutions respond less to SUE than non-SR institutions.

[Insert Table 2 about here]

We repeat the analysis for our second mispricing signals, SYY score, and report the results in Panel B of Table 2. The results are consistent. Panel B.1. shows that SR institutions increase (decrease) the holdings less than non-SR institutions, when the stocks are underpriced (overpriced). We find a similar pattern for changes in the number of institutions in Panel B.2. Taken together, our analysis of institutional reaction to mispricing signals reveals that SR institutions are less responsive to these signals compared with non-SR institutions.

*3.2. Mispricing signals, socially responsible institutional ownership, and stock return patterns*

In this subsection, we investigate the relationship between socially responsible institutional ownership (SR_IO) and future return patterns. As we have shown in Table 2, SR institutions tend to be less responsive to mispricing signals, which suggests that if a stock is held more by SR institutions, the signals may more strongly predict future returns.

To test this hypothesis, we perform independent double sorts (2×5) based on SR_IO and our two quantitative signals (SUE score and the SYY score). Each month, we independently divide all sample stocks into two groups based on their previous quarter's SR_IO, and into five groups based on the most recent SUE score within previous three months or the SYY score of last month. P1 contains the stocks that are most "overpriced" and P5 contains stocks that are most "underpriced". Our hypothesis is that the return difference between the P1 and P5 portfolios is higher for the sample of stocks that have higher SR_IO.

Panel A of Table 3 reports the value-weighted CAPM alphas, Fama-French 3-factor alphas, and Carhart 4-factor alphas of portfolios that are formed based on SUE score. We report these portfolio returns for three samples of firms – the entire sample, a low SR_IO sample, and a high

SR_IO sample. The first thing to note is that for portfolios formed on stocks from the entire sample of firms, the predictability of SUE score is only marginally significant. The FF-3 alpha for the long-short P5-P1 portfolio is 0.45%, which is only significant at 10% level and the CAPM and Carhart 4-factor alphas are insignificant. A comparison of the samples of high and low SR_IO stocks reveals that the return spread is in fact significant for the high SR_IO stocks but not for the low SR_IO stocks. The differences in these spreads range from 0.76% to 0.80% per month and are statistically significant for each of the factor models. These differences come mainly from the low SUE score stocks, which may reflect potential short selling constraints.

Panel B of Table 3 presents our evidence on the predictability of SYY score. As we show in the first row, which includes all of our sample stocks, SYY score does predict risk-adjusted returns in our sample period. Value-weighted CAPM alpha increases from P1 to P5, generating a long-short P5-P1 CAPM alpha of 0.73%, which is significant at the 1% level. The spread is similar for multi-factor models. A comparison of the samples of high and low SR_IO stocks reveals that this spread is only significant for the high SR_IO stocks. The difference in these spreads is about 0.5% per month, and is statistically significant for each of the benchmarks. These differences again come mainly from the overpriced stocks measured by SYY score, which can again reflect short selling constraints.

[Insert Table 3 about here]

Taken together, the results are consistent with our conjecture that the efficacy of the mispricing signals is greater for stocks held more by SR institutions.

*3.3. The emergence of ESG investing and stock return patterns: 1996-2003 vs. 2004-2014*

The concept of ESG investing emerged as a response to the corporate scandals in the early 2000s and prior to 2004 influenced a relatively small part of the investment industry. After that, ESG investing gradually increased and in recent years experienced rapid growth. In this subsection we replicate our return evidence during the 1996 to 2003 sample period as a placebo test. Panel A and Panel B of Table 4 tabulate the results for SUE score and SYY score as mispricing signals, respectively. In this specific and relatively short period, SUE does not predict future returns regardless of institution type. As shown in Panel A.1., before 2004, the abnormal return of the

long-short P5-P1 portfolio sorted on SUE score is 0.48% for stocks with low SR_IO and 0.29% for stocks with high SR_IO. These return spreads are not statistically different from zero, and the difference in the spreads are not significant either.

[Insert Table 4 about here]

As we show in Panel B of Table 4, the SYY score is an especially strong predictor of returns in the early period - the abnormal return of the long-short P5-P1 portfolio spread is 1.09% for stocks with low SR_IO and 1.05% for stocks with high SR_IO. These return spreads are statistically different from zero, but in contrast to our findings for the post-2004 period, they are not significantly different from each other. In other words, the holdings of socially responsible institutions in the earlier period do not have a material influence on the returns of SYY score sorted portfolios.

### *3.4. Socially responsible institutional ownership, limits to arbitrage measures, and funding liquidity*

As shown in Table 3, the return spread between the underpriced and overpriced stocks is only significant for high SR_IO stocks, and the significant performance comes mainly from the short side of these arbitrage portfolios. In this subsection, we examine the extent to which this evidence is influenced by the financing and short-selling frictions that may limit the ability of market participants to arbitrage away the mispricing (Shleifer and Vishny (1997)).[20]

To start with, we examine whether there is any systematic difference of characteristics between low and high SR_IO stocks that may influence the extent to which mispricing can be arbitraged away. Panel A of Table 5 compares stocks with high SR_IO and low SR_IO in both underpriced and overpriced quintiles, across a number of dimensions that are associated with limits to arbitrage – these include size, idiosyncratic risk, illiquidity proxied by stock turnover, analyst coverage, institutional ownership,[21] and stock borrowing costs proxied by indicative lending fees (the Markit data on lending fee is available from 2006). In most cases, the stocks with low SR_IO

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

[21] Nagel (2005) argues 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.

and high SR_IO look similar along these dimensions. The exception is that stocks with high SR_IO are generally larger and followed by more analysts, which makes our evidence of mispricing especially surprising.

[Insert Table 5 about here]

We also examine the extent to which the "apparent" profits of the long-short portfolios are related to the cost of shorting and other borrowing constraints. To examine the importance of these capital constraints, we use the aggregate funding liquidity factor of Adrian, Etula, and Muir (2014), calculated as shocks to the book leverage of security broker-dealers to measure the availability of arbitrage capital.[22] A negative shock to broker-dealer leverage indicates the funding conditions deteriorate and the available arbitrage capital decreases. We split our sample of 2004-2014 into two subperiods based on the leverage shock of the previous quarter.[23] We then re-do our analysis in Table 3 using the two subsamples.

Panel B reports the results for the whole period and two subperiods, the high availability of funding period and the low availability of funding period. We focus on the long-short P5-P1 return spread generated by SUE score (Panel B.1.) and the SYY score (Panel B.2.) among high SR_IO stocks and low SR_IO stocks, and the difference between the two groups. As we showed earlier in Table 3, the first two rows of the two sub-panels show that over the entire sample period, the mispricing signals generate significant return predictability for the high SR_IO group. The second two rows repeat this analysis, but only for the time period when the availability of funding is high. During this period, there is no reliable evidence of abnormal performance for either the high or low SR_IO group. Finally, in the last two rows, we repeat the tests during the period of low funding availability. In this period, the arbitrage portfolio, formed using high SR_IO stocks, generates very significant alphas (0.97%, *t-stat* 2.21 when using SUE score; 1.37%, *t-stat* 3.94 when using SYY score). The difference in the long-short P5-P1spreads between the high SR_IO group and the low SR_IO group is statistically significant (1.07%, *t-stat* 2.64 in Panel B.1.; 0.93%,

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

[23] Our results hold if we use the level of broker-dealer leverage to define funding liquidity, i.e., both funding liquidity and the availability of arbitrage capital is lower when the level of broker-dealer leverage is high.

*t-stat* 2.77 in Panel B.2.) during the low funding liquidity period and is close to zero when the capital constraints are loose.[24]

*3.5. Socially responsible institutional ownership and stock price efficiency*

In this subsection we consider an additional test of our hypothesis that the presence of SR institutions slows down the speed that stock prices respond to information. We consider the Price Delay measure, proposed by Hou and Moskowitz (2005), which captures the extent that stocks underreact to market information. Specifically, following Hou and Moskowitz (2005), we run a regression of each stock's weekly returns on contemporaneous and four weeks of lagged returns of the market portfolio.

$$r_{j,t} = \alpha_j + \beta_j R_{m,t} + \sum_{n=1}^{4} \delta_j^{(-n)} R_{m,t-n} + \varepsilon_{j,t} \quad (3)$$

Where $r_{j,t}$is the return on stock *j* and $R_{m,t}$ is the return on the CRSP value-weighted market index in week *t*.[25] Then, using the estimated coefficients from this regression, we compute the Hou and Moskowitz (2005) measure of Price Delay for each firm, which is the fraction of the variation of contemporaneous individual stock returns explained by lagged market returns. Specifically, the measure is one minus the $R^2$ from above regression restricting $\delta_j^{(-n)} = 0, \forall\, n \in [1,4]$, over the $R^2$ with no restrictions.

$$Price\ Delay = 1 - \frac{R^2_{\delta_j^{(-n)}=0, \forall\, n\in[1,4]}}{R^2} \quad (4)$$

The larger the Price Delay measure, the more a stock's return variation is captured by lagged market returns, and hence the stronger is the delay in response to return innovations.

We estimate this Price Delay measure for each stock using weekly returns over each calendar year. We then regress the measure on a variety of control variables of previous year (e.g., size, turnover, institutional holdings, and year fixed effects) along with SR institutional ownership.

[24] In unreported tests, we show that excluding financial crisis period from our sample does not change our baseline results or the findings about funding liquidity qualitatively.

[25] We also use two factor model including market and industry to run the regression, the results are similar.

The estimates from this regression, both in the 2004-2014 period of interest as well as the earlier placebo period, are shown in Table 6.

[Insert Table 6 about here]

Consistent with our earlier results, the holdings of socially responsible institutions are associated with a slow response to market information in the later period of interest but not in the placebo period. In column (2), a one-standard-deviation increase in SR_IO is associated with a 2.6% increase in Price Delay relative to its unconditional mean.[26] If we further split the 2004-2014 sample into two subperiods based on the funding liquidity proxied by shock to the broker-dealer leverage, the effect of SR_IO on Price Delay is much stronger during the period when the funding liquidity is low.

## 4. Robustness and Discussion

In this section, we discuss various alternative explanations for our documented results and conduct robustness tests. Specifically, we show that the results hold if we define SR_IO using ESG measures from an alternative database. Moreover, our empirical evidence shows that SR_IO is more important than ESG score in influencing the stock return patterns. We further provide evidence that suggests that the results are not driven by investment horizon or the increase in passive investing over this sample period. Finally, we investigate the effect of firm size on our baseline results.

### *4.1. Alternative methods of defining socially responsible institutions and SR_IO*

For our baseline results, we identify socially responsible institutions and measure SR_IO using MSCI KLD database. Although ESG scores from the MSCI KLD database are widely used in the literature,[27] the measures are the subjective views of individual analysts. Moreover, the ESG scores assign the same weight to different dimensions of social performance and are not continuous. We therefore examine alternative ESG ratings to check that robustness of our results.

[26] Hou and Moskowitz (2005) Price Delay measure has an unconditional mean of 0.34 and the variable SR_IO has a standard deviation of 0.29. Therefore, 2.6% = (0.03 x 0.29)/0.34. The magnitude is economically large and about half of the magnitude of short selling risk. (Engelberg, Reed, and Ringgenberg (2018)).

[27] For example, Deng, Kang and Low (2013), Krüger (2015), Lins, Servaes and Tamayo (2017), and among others.

Following the same steps in Section 2.2.1., we re-construct SR_IO measure using ESG scores from the Thomson Reuters ASSET4 ESG database. The correlation between the MSCI ESG scores and the ASSET4 ESG scores is 0.34. Such low correlation is consistent with Gibson, Krüger, and Schmidt (2020), who find that correlations of ESG scores from different vendors are low. In contrast, the correlation between SR_IO measures constructed using MSCI KLD database and ASSET4 database is 0.68, which is much higher than the correlation of the ESG scores. Given the higher correlation, one might conclude that SR_IO is a more robust measure of the attractiveness of a stock to socially responsible institutions.

[Insert Table 7 about here]

To check whether the results still hold if we use an alternative data source for ESG scores, we perform an independent double sort on alternative SR_IO measure and the SYY score. The results are tabulated in Table 7. Based on the alternative measure constructed using the ASSET4 ESG database, for the sample of high SR_IO stocks, the portfolio of the most underpriced stocks have a FF-3 alpha of 0.67% per month, and the long-short P5-P1 portfolio generates a 0.81% monthly alpha. This is quite similar to the results that use SR_IO constructed with the MSCI KLD data.[28]

*4.2. The direct effect of firm's social performance (ESG Score)*

Thus far, we have documented that the mispricing signals predict returns better for stocks with higher socially responsible institutional ownership. The question we ask in this subsection is whether it is the holdings, *per se*, that influence the return patterns, or whether there is a direct effect coming from the ESG scores of the stocks.

To explore this possibility, we classify the stocks into three ESG groups. We plot the distribution of ESG scores in our sample in Figure 3. As the figure illustrates, a large portion of the firms have ESG scores of -1, 0, and 1. We therefore apply more extreme values as cut-off points and classify our sample firms into Low, Medium, and High ESG groups. We choose the

[28] We also consider different alternative measures of SR_IO. For example, using the number of SR institutions divided by the total number of institutions instead of number of shares, using equal weighted method instead of value weighted when evaluate ESG performance on institution level, etc. The results are very similar.

15th percentile and the 85th percentile as our breakpoints, which is a balance between the variation of ESG scores and portfolio diversification. We then perform an independent triple sort (2×3×5) based on SR_IO, the ESG score, and the SYY score.[29] At the end of each month, we divide stocks into low SR_IO and high SR_IO groups as well as into low, medium, and high ESG groups. The stocks are then independently sorted into five mispricing quintiles, based on their SYY scores. P5 contains the stocks that are considered the most "underpriced" and P1 contains those considered the most "overpriced". Based on these portfolio sorts, we form value-weighted portfolios, and report the Fama-French 3-factor alphas of the various portfolios in Table 8.

Panel A reports the alphas for the various portfolios of high SR_IO stocks. The estimated alphas support the idea that for stocks with high SR_IO, the underpriced stocks outperform the overpriced stocks regardless of ESG scores. The return spread between the overpriced and underpriced stocks is strongest for the high ESG group. However, the difference between the spread for the stocks with high ESG scores and the spread for the stocks with low ESG scores is not statistically significant. Panel B reports the alphas for the various low SR_IO portfolios. The estimated alphas exhibit no significant relation between mispricing signal and returns. It should be stressed that these findings are consistent with our conclusion in the previous subsection, that SR_IO is a more robust measure of the attractiveness of a stock to SR investors than the more subjective ESG measure.

[Insert Table 8 about here]

It is worth noting that, in Panel A, among high SR_IO-underpriced stocks, the positive alpha is strongest for stocks with poor ESG performance and is absent for stocks with superior ESG performance. In addition, among high SR_IO-overpriced stocks, the negative alpha is strongest for stocks with good ESG performance and is absent for stock with poor ESG performance. This evidence suggests that when trading signals are aligned with the preference of SR institutions, these institutions indeed actively correct mispricing by selling overpriced-poor ESG stocks and buying underpriced-good ESG stocks.

[29] To validate our analysis, we first confirm that ESG score itself does not predict the stock returns 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.

*4.3. The effect of investment horizon*

One potential concern is that socially responsible institutions are long-term oriented (Starks, Venkat, and Zhu (2018)) and therefore do not respond to short-term quantitative signals. To examine this possibility, we follow Gaspar, Massa, and Matos (2005) and Starks, Venkat, and Zhu (2018) and measure the investment horizon for each institution each quarter using following equation:

$$Churn\ Ratio_{j,t} = \frac{\sum_{i \in I} |N_{j,i,t} * P_{i,t} - N_{j,i,t-1} * P_{i,t}|}{\sum_{i \in I} \frac{|N_{j,i,t} * P_{i,t} + N_{j,i,t-1} * P_{i,t-1}|}{2}} \quad (5)$$

$N_{j,i,t}$ is the number of shares of stock *i* held by institution *j*, at the end of quarter *t*. Institution-level investment horizon is proxied by the reciprocal of the churn ratio. As shown in Table 1 Panel C, socially responsible institutions indeed have longer investment horizons, which is consistent with their underreaction to short-term mispricing signals.

To rule out the possibility that our documented results are driven by the fact that SR institutions have longer horizons, we investigate how the investment horizons of the institutions that hold a firm's stock affect its return pattern. Specifically, for stock *i* in quarter *t*, we define stock-level investment horizon, by taking a weighted average of the churn ratios of the institutions that hold the shares, where the weight is the number of shares held by institution *j*. Then we take the reciprocal and obtain stock-level investment horizon:

$$Stock\ level\ investment\ horizon_{i,t} = \frac{1}{\frac{\sum_{j \in J}(Churn\ Ratio_{j,t} * N_{i,j,t})}{\sum_{j \in J} N_{i,j,t}}} \quad (6)$$

Then we perform a 2×5 independent double sort based on stock-level investment horizon and SYY score. The results, described in Table 9, reveal that the alphas of the SYY strategy do not seem to be related to the investment horizons of the institutions that hold the shares. Therefore, it is unlikely that our documented results about SR_IO and mispricing return patterns are driven by the longer investment horizons of SR institutions.

[Insert Table 9 about here]

*4.4. Socially responsible active mutual funds*

Another potential confounding effect is the growth of passive investing in our sample period. It is plausible that some socially responsible institutions are passive indexers and do not respond to quantitative mispricing signals. We therefore focus on a particular type of institutions, active mutual funds, which are assumed to trade more actively and have a shorter investment horizon compared with the average institutions. Using the holdings of mutual funds, we repeat our tests by constructing socially responsible active mutual fund ownership (SR_MO).[30]

As we show in Table 10, consistent with our previous findings, SYY score predicts future stock returns more reliably for stocks that are held more by socially responsible active mutual funds. We find that long-short SYY portfolios of stocks with high SR_MO generate a monthly value-weighted Fama-French 3-factor alpha of 0.82%. The spread is much smaller and insignificant for firms with low SR_MO. The difference in these spreads is about 0.55% per month and is statistically significant. We again confirm our baseline results using alternative asset pricing models.

Taken together, our empirical finding that socially responsible institutions react less to mispricing signals are not driven by differences in investment horizon or passive investing.

[Insert Table 10 about here]

*4.5. Socially responsible institutional ownership vs. firm size*

Socially responsible institutions tend to hold stocks that are larger on average. Indeed, as shown in Panel B of Table 1, the correlation between SR_IO and firm size is 0.42. In this subsection we more closely examine the relation between SR_IO and firm size, and explore how this relation may have influenced our findings.

[30] Specifically, 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)). Following similar steps in Section 2.2.1, we first calculate a size-adjusted value weighted ESG score for each mutual fund each quarter. Then we divide them into three groups, those with highest portfolio ESG score are defined as 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 0.79 correlation with SR_IO.

We explore the relationship between SR_IO and firm size within the context of two related issues. The first is the observation that at least historically, mispricing signals have worked much better for small firms than for large firms, which are much easier to arbitrage. The question we address is whether this relation between firm size and mispricing continues to hold following the emergence of quantitative investors, who try to exploit the mispricing, and SR investors, who focus more on larger stocks. The second is the emergence of indexers, who also tend to focus on large stocks such as those in the S&P 500. It is possible that the observed relation between the efficacy of mispricing signals and SR_IO is due the fact that high SR_IO stocks tend to be in the S&P 500, and are held more by passive investors such as index funds.

To explore these possibilities, we first examine the efficacy of the SYY signal among the largest 1,000 stocks and the rest of CSRP stock sample for 1996-2003 and 2004-2014 period, respectively. As shown in Panel A of Table 11, a value-weighted long-short strategy that exploits the SYY signal among small stocks generates a much stronger abnormal return of 2.09% (vs. 1.45% among 1,000 largest stocks) per month in the 1996-2003 period. Consistent with Chordia, Subrahmanyam, and Tong (2014) and McLean and Pontiff (2016), we find that the abnormal return of these strategies have declined in the more recent 2004-2014 period – the value-weighted portfolio that includes 1,000 largest stocks exhibits an abnormal (5-1) return spread of 0.85% per month. Interestingly, the abnormal return of the long-short portfolio that excludes the largest 1,000 stocks is only 0.49% per month in the same sample period. In other words, the relationship between firm size and price efficiency seems to have reversed in the recent period.

[Insert Table 11 about here]

To investigate whether this reversal is due to rise of ESG investing, we separately investigate the effect of size on the efficacy of mispricing signals, for high SR_IO stocks and low SR_IO stocks, respectively. Specifically, we conduct an independent triple sort on SR_IO, size, and SYY score for 2004-2014 sample period. Panel B of Table 11 shows that among high SR_IO stocks, SYY score predicts returns for both large stocks and small stocks. The long-short return spread is 0.74% for large stocks and is 0.83% for small stocks, and the difference between these two numbers is not significantly different from zero. In contrast, among low SR_IO stocks, SYY score does not predict returns for either large stocks or small stocks. In other words, once we

control for SR_IO, the efficacy of the SYY signal does not seem to depend on the capitalization of the stocks.

The triple sort results in Panel B of Table 11 also address the concern that the return patterns we observe is due to the emergence of passive investing in the more recent period. The large stocks are more likely to be indexed and held by passive investors than small stocks. However, the holdings of socially responsible investors are similarly associated with the efficacy of the SYY signal in both subsamples.

## 5. Conclusion

In addition to their preference for high ESG stocks, socially responsible investors tend to trade differently than their less socially responsible peers. They exhibit lower turnover, and their portfolio choices appear to be less sensitive to quantitative signals. Our evidence suggests that, perhaps because of their different trading behaviors, the emergence of these investors has had an important influence on the efficacy of quantitative signals. Specifically, we find that although the predictive power of SUE score and SYY score is much weaker in the post-2004 period, these quantitative mispricing signals continue to predict the returns of those stocks with high socially responsible institutional ownership.

Our analysis illustrates that investor tastes have indirect as well as direct effects on return patterns. The direct effect has received substantial attention in the literature. If investors prefer certain firm characteristics, then stocks with those characteristics may be associated with higher stock prices relative to various measures of fundamental value (such as book value). We believe that we are the first to study the indirect effect -- if investors focus on characteristics that are not directly linked to returns, this focus may crowd out the investors' attention to signals that do predict returns. We conjecture that the increased focus on ESG by socially responsible institutions may explain why the efficacy of quantitative signals is reduced substantially more for small capitalization than for large capitalization stocks in the recent period.

While the evidence provided in this paper is consistent with mispricing, we would recommend caution to those who would want to implement these insights in quantitative strategies going forward. The period that we study is special for a couple of reasons. The first is that ESG investing took off in this time period, so the implications of these investing strategies may not have

been fully understood. The second, our results are significant only when the ability of hedge funds to offset the effect of socially responsible investors is significant curtailed.

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## Table 1. Summary Statistics

This table reports descriptive statistics of stock and institution characteristics. Panel A reports the stock-month summary statistics of socially responsible institutional ownership (SR_IO), standardized unexpected earnings (SUE) score, SYY score, ESG score, and other firm characteristics. The statistics are the time-series average of cross-sectional distributions from January 2004 to December 2014. At the end of each quarter, we calculate value-weighted size-adjusted portfolio ESG score for each institution, those ranked top tercile are defined as socially responsible (SR) institutions. 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. SUE score is computed as the difference between current quarter's earnings and the earnings four quarters ago, then divided by the standard deviation of unexpected earnings over the last eight quarters. Each month, we use the most recent SUE score within previous three months. SYY score is the opposite of a monthly updated composite mispricing score from Stambaugh, Yu, and Yuan (2015). Specifically, the composite mispricing score 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 score of last year from MSCI ESG STATS database. Other firm characteristics include market capitalization in $billion, 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. Panel B reports the time-series average of cross-sectional correlations among mispricing signals (SUE score and SYY score), socially responsible institutional ownership (SR_IO), ESG score, and other firm characteristics. The Pearson correlations are shown below the diagonal with Spearman correlations above the diagonal. Panel C reports the institution-quarter average of characteristics for different types of institutions, respectively. Institution characteristics include asset under management (AUM), the number of stocks in the portfolio, investment horizon proxied by the reciprocal of the churn ratio, equal-weighted and value-weighted ESG scores, SYY scores, and SUE scores.

Panel A. Stock Characteristics: Time-Series Average of Cross-Sectional Distributions

| 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 |
| SUE score (%) | 0.14 | 10.14 | -1.62 | -0.37 | 0.12 | 0.53 | 1.65 |
| SYY score | -49.56 | 12.53 | -66.17 | -57.91 | -49.13 | -40.68 | -33.64 |
| ESG score | -0.17 | 2.30 | -2.36 | -1.64 | -0.64 | 0.91 | 2.64 |
| Market capitalization ($billion) | 6.23 | 21.32 | 0.26 | 0.49 | 1.22 | 3.66 | 12.14 |
| Stock 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. Correlations among Stock Characteristics

| Spearman / Pearson | SUE score | SYY score | SR_IO | ESG score | Market capitalization | Analyst coverage | Institutional ownership |
|---|---|---|---|---|---|---|---|
| SUE score | 1.00 | -0.06 | -0.02 | -0.03 | 0.06 | 0.01 | 0.02 |
| SYY score | 0.13 | 1.00 | 0.13 | 0.11 | 0.24 | 0.11 | 0.07 |
| SR_IO | -0.01 | 0.14 | 1.00 | 0.38 | 0.53 | 0.42 | -0.08 |
| ESG score | -0.01 | 0.13 | 0.27 | 1.00 | 0.19 | 0.17 | -0.08 |
| Market capitalization | 0.00 | 0.15 | 0.42 | 0.31 | 1.00 | 0.69 | 0.20 |
| Analyst coverage | 0.00 | 0.14 | 0.45 | 0.25 | 0.41 | 1.00 | 0.25 |
| Institutional ownership | -0.01 | 0.08 | -0.08 | -0.06 | -0.05 | 0.21 | 1.00 |

Panel C. Institution Characteristics: Time-Series Average of Cross-Sectional Mean

| Q1.2004 – Q4.2014<br>Institution Type | AUM ($billion) | # of stocks | Investment horizon (1/churn ratio) | EW ESG score | EW SUE score (%) | EW SYY score | VW ESG score | VW SUE score (%) | VW SYY score |
|---|---|---|---|---|---|---|---|---|---|
| Socially Responsible (SR) Institutions | 2.76 | 207 | 4.35 | 2.52 | -0.03 | -43.76 | 3.53 | 0.09 | -42.01 |
| Non-SR institutions | 5.21 | 260 | 2.63 | 0.69 | 0.25 | -47.62 | 0.84 | 0.32 | -46.69 |

## Table 2. The Effect of Mispricing Signals on the Trading Behaviors of SR institutions and Non-SR institutions

This table reports the summary of quarterly trading behavior of socially responsible (SR) institutions and non-SR institutions, towards stocks with different SUE scores and SYY scores in Panel A and Panel B, respectively. In Panel A, we use SUE score in most recent quarter as the quarterly mispricing signal. In Panel B, one month before the end of each quarter, we calculate the average SYY scores of preceding three months for each stock. In Panel A.1., we report the changes in institutional ownership for SR institutions and non-SR institutions. In Panel A.2., we report the changes in the number of institutions for SR institutions and non-SR institutions, scaled by the total number of institutions at the beginning of the period. Panel B.1. and Panel B.2. report the parallel results using SYY score as mispricing signal. The sample period is from 2004 to 2014. To adjust for serial correlation, robust Newey-West (1987) t-statistics are reported in parentheses.

Panel A.1. Sorted on SUE Score: Change in Institutional Ownership (%)

| SUE Score | P1 (Overpriced) | P2 | P3 | P4 | P5 (Underpriced) | P5-P1 (H-L spread) |
|---|---|---|---|---|---|---|
| SR Institutions | -0.08 | -0.08 | 0.07 | 0.08 | 0.08 | 0.16* |
| | (-1.39) | (-1.02) | (0.78) | (0.89) | (1.04) | (1.75) |
| Non-SR institutions | -0.75** | -0.67* | -0.45 | -0.47 | 0.43 | 1.19*** |
| | (-2.37) | (-1.72) | (-1.24) | (-1.19) | (1.18) | (8.68) |
| Diff (SR – Non-SR) | 0.67** | 0.59 | 0.52 | 0.55 | -0.35 | -1.02*** |
| | (2.23) | (1.58) | (1.51) | (1.50) | (-1.05) | (-7.88) |

Panel A.2. Sorted on SUE Score: Change in the Number of Institutions (%)

| SUE Score | P1 (Overpriced) | P2 | P3 | P4 | P5 (Underpriced) | P5-P1 (H-L spread) |
|---|---|---|---|---|---|---|
| SR Institutions | -0.14** | -0.17** | -0.07 | -0.13 | -0.07 | 0.07* |
| | (-2.20) | (-2.21) | (-0.85) | (-1.54) | (-1.06) | (1.83) |
| Non-SR institutions | -2.30*** | -1.49*** | -1.33*** | -0.19 | 0.49 | 2.78*** |
| | (-6.75) | (-3.90) | (-4.00) | (-0.57) | (0.80) | (5.56) |
| Diff (SR – Non-SR) | 2.16*** | 1.32*** | 1.26*** | 0.06 | -0.55 | -2.71*** |
| | (6.69) | (3.59) | (3.86) | (0.17) | (-0.91) | (-5.34) |

Panel B.1. Sorted on SYY Score: Change in Institutional Ownership (%)

| SYY Score | P1 (Overpriced) | P2 | P3 | P4 | P5 (Underpriced) | P5-P1 (H-L spread) |
|---|---|---|---|---|---|---|
| SR Institutions | 0.11 | 0.12 | 0.13* | 0.16** | 0.03 | -0.08 |
| | (1.58) | (1.51) | (1.77) | (2.07) | (0.47) | (-1.51) |
| Non-SR institutions | -0.83 | -0.08 | 0.05 | 0.10 | 0.69* | 1.53*** |
| | (-1.47) | (-0.16) | (-0.30) | (0.22) | (1.84) | (3.86) |
| Diff (SR – Non-SR) | 0.94* | 0.20 | 0.08 | 0.06 | -0.66* | -1.60*** |
| | (1.83) | (0.43) | (0.19) | (0.16) | (-1.89) | (-4.35) |

Panel B.2. Sorted on SYY Score: Change in the Number of Institutions (%)

| SYY Score | P1 (Overpriced) | P2 | P3 | P4 | P5 (Underpriced) | P5-P1 (H-L spread) |
|---|---|---|---|---|---|---|
| SR Institutions | 0.10 | 0.39 | 0.43** | 0.51** | 0.42** | 0.32* |
| | (0.43) | (1.62) | (2.15) | (2.47) | (2.27) | （1.80） |
| Non-SR institutions | -1.75** | 0.28 | 1.24 | 1.51* | 1.66*** | 3.41*** |
| | (-2.34) | (0.36) | (1.23) | (1.82) | (3.36) | （5.91） |
| Diff (SR – Non-SR) | 1.85*** | 0.11 | -0.81 | -1.00 | -1.24*** | -3.09*** |
| | (3.15) | (0.19) | (-0.90) | (-1.28) | (-2.99) | （-5.77） |

## Table 3. Monthly Returns for Portfolios Independently Sorted on SR_IO (Socially responsible institutional ownership) and Mispricing Signals

This table reports the value-weighted average monthly abnormal returns (in percentage) of portfolios double sorted on socially responsible institutional ownership (SR_IO) and standardized unexpected earnings (SUE) score in Panel A, and SYY score in Panel B. SUE score is computed as the difference between current quarter's earnings and the earnings four quarters ago, then divided by the standard deviation of unexpected earnings over the last eight quarters. SYY score for a stock is the opposite of mispricing score in Stambaugh, Yu, and Yuan (2015). To calculate SR_IO, we first calculate value-weighted size-adjusted ESG score as socially responsible score for all the 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 the institutions. In Panel A, at the end of each month, all available stocks are sorted into five quintiles based on the most recent SUE score within previous three months. P5 refers to the stocks with the highest SUE score (most "underpriced") and stocks in P1 are those with lowest SUE score (most "overpriced"). In Panel B, at the end of each month, all available stocks are sorted into five mispricing quintiles based on the SYY score of last month. P5 refers to the most "underpriced" stocks and stocks in P1 are the most "overpriced". Then the stocks are independently sorted into low and high SR_IO groups in both panels based on the SR_IO of previous quarter. 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 mispricing signals 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. The sample period is from January 2004 to December 2014. To adjust for serial correlation, robust Newey-West (1987) t-statistics are reported in parentheses.

Panel A. Value-Weighted Portfolio Return Sorted on SUE Score (%)

| SUE Score | | P1 (Overpriced) | P2, P3 & P4 (Fairly priced) | P5 (Underpriced) | P5-P1 (H-L spread) |
|---|---|---|---|---|---|
| CAPM-α | All Stocks | -0.37** | 0.05 | 0.07 | 0.44 |
| | | (-2.04) | (1.22) | (0.47) | (1.65) |
| | Low SR_IO | 0.15 | 0.13 | -0.06 | -0.21 |
| | | (0.67) | (1.26) | (-0.23) | (-0.59) |
| | High SR_IO | -0.47** | 0.05 | 0.12 | 0.59** |
| | | (-2.27) | (0.91) | (0.81) | (2.06) |
| | | | | Diff | 0.80** |
| | | | | | (2.04) |
| FF-3 α | All Stocks | -0.38** | 0.05 | 0.07 | 0.45* |
| | | (-2.20) | (1.20) | (0.48) | (1.77) |
| | Low SR_IO | 0.15 | 0.14* | -0.06 | -0.21 |
| | | (0.88) | (1.74) | (-0.21) | (-0.62) |
| | High SR_IO | -0.47** | 0.05 | 0.12 | 0.59** |
| | | (-2.46) | (0.93) | (0.80) | (2.18) |
| | | | | Diff | 0.80** |
| | | | | | (2.11) |
| Carhart-4 α | All Stocks | -0.29** | 0.04 | 0.02 | 0.32 |
| | | (-2.18) | (1.08) | (0.15) | (1.38) |
| | Low SR_IO | 0.20 | 0.12* | -0.10 | -0.30 |
| | | (1.27) | (1.72) | (-0.37) | (-0.94) |
| | High SR_IO | -0.39** | 0.04 | 0.07 | 0.46* |
| | | (-2.48) | (0.82) | (0.44) | (1.80) |
| | | | | Diff | 0.76** |
| | | | | | (1.98) |

Panel B. Value-Weighted Portfolio Return Sorted on SYY Score (%)

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

## Table 4. The Emergence of ESG Investing and Stock Return Patterns:

## 1996 – 2003 vs. 2004 – 2014

This table reports the comparison of main results between the period of 1996–2003 and the period of 2004–2014. In Panel A, all available stocks are sorted into five quintiles based on most recent SUE score within previous three months. P5 refers to the stocks having the highest SUE score (most "underpriced") and stocks in P1 are those with the lowest SUE score (most "overpriced"). In Panel B, at the end of each month, all available stocks are sorted into five quintiles based on the SYY score of last month. P5 refers to the stocks having the highest SYY score (most "underpriced") and stocks in P1 are those with the lowest SYY score (most "overpriced"). The stocks are then independently sorted into low SR_IO and high SR_IO groups in both panels. We report value-weighted Fama-French (1993) three-factor alpha of all the portfolios during the period of 1996-2003 (Panel A.1. & Panel B.1.) and the period of 2004-2014 (Panel A.2. & Panel B.2.). In addition, we report: 1) High-minus-low spread based on two mispricing signals 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 parentheses.

Panel A. Value-Weighted Portfolio Return Sorted on SUE Score (%)

| | | P1 | P2, P3, & P4 | P5 | P5-P1 |
|---|---|---|---|---|---|
| Panel A.1. Sample Period of 1996–2003 | | | | | |
| FF-3 α | Low SR_IO | -0.49 | 0.17 | -0.00 | 0.48 |
| | | (-1.42) | (0.91) | (-0.01) | (1.23) |
| | High SR_IO | -0.19 | 0.22 | 0.10 | 0.29 |
| | | (-0.43) | (1.22) | (0.34) | (0.60) |
| | | | | Diff | -0.19 |
| | | | | | (-0.37) |
| Panel A.2. Sample Period of 2004–2014 | | | | | |
| FF-3 α | Low SR_IO | 0.15 | 0.14* | -0.06 | -0.21 |
| | | (0.88) | (1.74) | (-0.21) | (-0.62) |
| | High SR_IO | -0.47** | 0.05 | 0.12 | 0.59** |
| | | (-2.46) | (0.93) | (0.80) | (2.18) |
| | | | | Diff | 0.80** |
| | | | | | (2.11) |

Panel B. Value-Weighted Portfolio Return Sorted on SYY Score (%)

| | | P1 | P2, P3, & P4 | P5 | P5-P1 |
|---|---|---|---|---|---|
| Panel B.1. Sample Period of 1996–2003 | | | | | |
| FF-3 α | Low SR_IO | -0.60** | 0.04 | 0.49* | 1.09** |
| | | (-2.56) | (0.24) | (1.71) | (2.59) |
| | High SR_IO | -0.44 | 0.08 | 0.62*** | 1.05** |
| | | (-1.33) | (0.38) | (2.74) | (2.63) |
| | | | | Diff | -0.04 |
| | | | | | (-0.09) |
| Panel B.2. Sample period of 2004–2014 | | | | | |
| FF-3 α | Low SR_IO | -0.23 | 0.14 | 0.06 | 0.28 |
| | | (-1.36) | (1.08) | (0.47) | (1.56) |
| | High SR_IO | -0.68*** | -0.05 | 0.14 | 0.83*** |
| | | (-2.95) | (-0.99) | (1.57) | (2.71) |
| | | | | Diff | 0.54** |
| | | | | | (2.03) |

## Table 5. Stock Characteristics and the Effect of Funding Liquidity

Panel A reports the average stock characteristics of portfolios independently double sorted on socially responsible institutional ownership (SR_IO), and two mispricing signals (SUE score and SYY score) from January 2004 to December 2014. Standardized unexpected earnings (SUE) score is computed as the difference between current quarter's earnings and the earnings four quarters ago, then divided by the standard deviation of unexpected earnings over the last eight quarters. Each month, we use the most recent SUE score within previous three months. SYY score for a stock is the opposite of mispricing score in Stambaugh, Yu, and Yuan (2015). To calculate SR_IO, we first calculate value-weighted size-adjusted ESG score as socially responsible score for all the 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 the institutions. At the end of each month, all available stocks are sorted into five SUE/SYY quintiles. The stocks are then independently sorted into low SR_IO and high SR_IO groups. Panel A.1. and Panel A.2. report the stock characteristics of portfolios sort based on SUE & SR_IO, and SYY & SR_IO, respectively. Stock characteristics include 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 the indicative lending fee (2006-2014) at the end of last month.

Panel B reports the main results for the entire sample period from 2004 to 2014, high funding liquidity period, and low funding liquidity period, respectively. We use the aggregate funding liquidity factor of Adrian, Etula, and Muir (2014) to measure the availability of arbitrage capital and split our sample into two subperiods based on the shock to broker-dealer leverage of previous quarter. Each month, stocks are sorted into two groups based on SR_IO, then we independently sort stocks into quintiles based on SUE score in Panel B.1 and SYY score in Panel B.2. H-L is the spread portfolio of buying stocks in quintile 5 and shorting stocks in quintile 1. We report value-weighted (VW) Fama-French (1993) three factor-alpha of the next month. In addition, we report differences 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 parentheses.

Panel A. Stock Characteristics of SR_IO-Mispricing Signals Portfolios

| | Panel A.1. Sorted on SUE Score | | | | Panel A.2. Sorted on SYY Score | | | |
|---|---|---|---|---|---|---|---|---|
| | P1: Lowest SUE (Overpriced Stocks) | | P5: Highest SUE (Underpriced Stocks) | | P1: Lowest SYY (Overpriced Stocks) | | P5: Highest SYY (Underpriced Stocks) | |
| | SR_IO | | SR_IO | | SR_IO | | SR_IO | |
| | Low | High | Low | High | Low | High | Low | High |
| SR_IO (%) | 6.17 | 18.57 | 6.20 | 18.01 | 5.41 | 17.09 | 5.83 | 19.06 |
| Size ranking (%) | 67.12 | 78.91 | 70.94 | 81.43 | 63.22 | 70.59 | 69.37 | 84.38 |
| Stock turnover (%) | 24.58 | 26.95 | 26.98 | 26.59 | 23.31 | 25.22 | 21.33 | 20.40 |
| IVOL (%) | 9.51 | 8.46 | 9.45 | 8.11 | 10.26 | 9.29 | 8.48 | 6.67 |
| Analyst coverage | 7.67 | 11.58 | 7.87 | 11.89 | 7.44 | 9.71 | 7.68 | 13.61 |
| Institutional ownership | 0.78 | 0.76 | 0.79 | 0.76 | 0.70 | 0.68 | 0.74 | 0.74 |
| Lending fee (%) | 0.76 | 0.71 | 0.58 | 0.65 | 1.22 | 1.28 | 0.68 | 0.56 |

Panel B. The Effect of Funding Liquidity

Panel B.1. Value-Weighted FF-3 Alpha (%) of (H-L) Return Spread Sorted on SUE Score

| H-L portfolio 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 | 0.33 | 0.22 | 0.39 | 0.17 |
| (More arbitrage capital) | (1.15) | (0.51) | (1.32) | (0.42) |
| Low funding liquidity period | 0.81** | -0.10 | 0.97** | 1.07** |
| (Less arbitrage capital) | (2.05) | (-0.44) | (2.21) | (2.64) |

Panel B.2. Value-Weighted FF-3 Alpha (%) of (H-L) Return Spread Sorted on SYY Score

| | 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 | 0.32 | 0.27 | 0.32 | 0.05 |
| (More arbitrage capital) | (0.86) | (1.48) | (0.71) | (0.12) |
| Low funding liquidity period | 1.16*** | 0.43* | 1.37*** | 0.93*** |
| (Less arbitrage capital) | (3.80) | (1.68) | (3.94) | (2.77) |

## Table 6. Socially Responsible Institutional Ownership and Stock Price Efficiency

This table presents the panel regression coefficients of stocks' price efficiency measure on socially responsible institutional ownership (SR_IO) and other control variables in the previous year. The dependent variable is Price Delay (Hou and Moskowitz (2005)), measured on an annual basis for each calendar year. Control variables include institutional ownership, stock-level investment horizon, the logarithm of market capitalization, and stock turnover. Stock-level investment horizon is defined as the weighted average of the churn ratios of the holding institutions each quarter and then take the reciprocal. SR_IO, institutional ownership, and investment horizon are the quarterly average of previous year. LnME is measured at the end of last year. Turnover is the monthly average of previous year. All regressions control for year fixed effect and firm fixed effect. Column (1) shows the results for sample period from 1996 to 2003. Column (2), (3) and (4) show the results for the entire sample period from 2004 to 2014, high funding liquidity period, and low funding liquidity period, respectively. The t statistics in the brackets are calculated from robust clustered standard errors by firm. $^{***}$, $^{**}$, and $^{*}$ denote significance at the 0.01, 0.05, and 0.10 levels, based on a two-sided test.

Price Delay (Hou and Moskowitz (2005))

| | 1996–2003 | 2004–2014 | | |
|---|---|---|---|---|
| | | Entire period | High funding liquidity period | Low funding liquidity period |
| | (1) | (2) | (3) | (4) |
| SR_IO | 0.007 | 0.030$^{*}$ | 0.003 | 0.053$^{**}$ |
| | (0.47) | (1.78) | (0.11) | (2.16) |
| Institutional ownership | -0.079$^{***}$ | -0.027$^{*}$ | -0.020 | -0.058$^{***}$ |
| | (-3.75) | (-1.81) | (-0.91) | (-2.86) |
| Stock-level investment horizon | 0.013 | -0.046 | -0.124$^{*}$ | 0.022 |
| | (0.30) | (-0.93) | (-1.66) | (0.32) |
| LnME | -0.004 | -0.041$^{***}$ | -0.048$^{***}$ | -0.035$^{***}$ |
| | (-0.92) | (-12.83) | (-10.34) | (-7.93) |
| Stock turnover | -0.168$^{***}$ | -0.032$^{***}$ | -0.044$^{***}$ | -0.020 |
| | (-8.09) | (-3.26) | (-2.61) | (-1.33) |
| Firm Fixed Effect | Yes | Yes | Yes | Yes |
| Time Fixed Effect | Yes | Yes | Yes | Yes |
| Adjusted R-squared | 0.332 | 0.452 | 0.457 | 0.450 |
| Observations | 28,755 | 36,734 | 15,959 | 19,098 |

## Table 7. Monthly Returns for Portfolios Sorted on Alternative SR_IO and SYY score

This table reports the value-weighted average monthly abnormal returns (in percentage) of portfolios double sorted on alternative socially responsible institutional ownership (SR_IO) and SYY score. SYY score for a stock is the opposite of mispricing score in Stambaugh, Yu, and Yuan (2015). To calculate the alternative SR_IO, we use the ESG score from Thomson Reuter database (formerly known as ASSET4). We first calculate value-weighted size-adjusted ESG score as socially responsible score for all the 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 the institutions. At the end of each month, all available stocks are sorted into five mispricing quintiles based on the SYY score of last month. P5 refers to the most "underpriced" stocks and stocks in P1 are the most "overpriced". Then the stocks are independently sorted into low and high SR_IO groups based on the SR_IO of previous quarter. 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 mispricing signals 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. The sample period is from January 2004 to December 2014. To adjust for serial correlation, robust Newey-West (1987) t-statistics are reported in parentheses.

Value-Weighted Portfolio Return Sorted on SYY Score (%)

| SYY Score | | P1 (Overpriced) | P2, P3 & P4 (Fairly priced) | P5 (Underpriced) | P5-P1 (H-L spread) |
|---|---|---|---|---|---|
| CAPM-α | All Stocks | -0.59*** | -0.02 | 0.14 | 0.73*** |
| | | (-3.13) | (-0.47) | (1.66) | (2.84) |
| | Low SR_IO | -0.21 | 0.09 | -0.04 | 0.18 |
| | | (-1.14) | (0.65) | (-0.20) | (0.94) |
| | High SR_IO | -0.66*** | -0.04 | 0.15 | 0.81*** |
| | | (-3.03) | (-0.71) | (1.62) | (2.84) |
| | | | | Diff | 0.63** |
| | | | | | (2.38) |
| FF-3 α | All Stocks | -0.59*** | -0.02 | 0.14 | 0.73*** |
| | | (-3.00) | (-0.47) | (1.62) | (2.70) |
| | Low SR_IO | -0.21 | 0.10 | -0.03 | 0.18 |
| | | (-1.26) | (1.29) | (-0.27) | (0.91) |
| | High SR_IO | -0.67*** | -0.04 | 0.15 | 0.81*** |
| | | (-3.00) | (-0.77) | (1.61) | (2.73) |
| | | | | Diff | 0.63** |
| | | | | | (2.35) |
| Carhart-4 α | All Stocks | -0.52*** | -0.02 | 0.11 | 0.63*** |
| | | (-3.05) | (-0.43) | (1.36) | (2.64) |
| | Low SR_IO | -0.16 | 0.09 | -0.06 | 0.11 |
| | | (-0.97) | (1.23) | (-0.53) | (0.53) |
| | High SR_IO | -0.59*** | -0.04 | 0.12 | 0.71*** |
| | | (-3.15) | (-0.69) | (1.36) | (2.74) |
| | | | | Diff | 0.61** |
| | | | | | (2.38) |

## Table 8. Monthly Returns for Portfolios Sorted on SR_IO, ESG Score, and SYY Score

This table presents the value-weighted average monthly abnormal returns (in percentage) of triple-sorted portfolios based on socially responsible institutional ownership (SR_IO), SYY score, and ESG score from January 2004 to December 2014. SYY score for a stock is the opposite of mispricing score in Stambaugh, Yu, and Yuan (2015). To calculate SR_IO, we first calculate value-weighted size-adjusted ESG score as socially responsible score for all the 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 the institutions. ESG score is the net score (positive score minus negative score) of last year from MSCI ESG STATS database. At the end of each month, all available stocks are independently sorted into 2x3x5 groups based on SR_IO, ESG score, and SYY 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 parentheses.

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

| SYY Score | | P1 (Overpriced) | P2, P3 & P4 (Fairly priced) | P5 (Underpriced) | P5-P1 (H-L spread) |
|---|---|---|---|---|---|
| All High SR_IO Stocks | | -0.68*** | -0.05 | 0.14 | 0.83*** |
| | | (-2.95) | (-0.99) | (1.57) | (2.71) |
| ESG Scores | Low | -0.34 | 0.03 | 0.34* | 0.68 |
| | | (-1.09) | (0.19) | (1.67) | (1.63) |
| | Medium | -0.71*** | 0.08 | 0.15 | 0.86*** |
| | | (-3.51) | (0.60) | (1.41) | (3.51) |
| | High | -0.79*** | -0.15 | 0.07 | 0.86** |
| | | (-2.73) | (-1.62) | (0.63) | (2.44) |
| | H-L | -0.45 | -0.18 | -0.27 | |
| | | (-1.45) | (-0.75) | (-1.16) | |

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

| | | | | | |
|---|---|---|---|---|---|
| All Low SR_IO Stocks | | -0.23 | 0.14 | 0.06 | 0.28 |
| | | (-1.36) | (1.08) | (0.47) | (1.56) |
| ESG Scores | Low | -0.20 | 0.18 | 0.10 | 0.31 |
| | | (-0.81) | (0.82) | (0.55) | (0.99) |
| | Medium | -0.23 | 0.11 | 0.12 | 0.35 |
| | | (-1.23) | (0.88) | (0.75) | (1.45) |
| | High | -0.21 | 0.23 | 0.07 | 0.29 |
| | | (-0.49) | (1.53) | (0.36) | (0.77) |
| | H-L | -0.01 | 0.05 | -0.03 | |
| | | (-0.02) | (0.20) | (-0.13) | |

## Table 9. Monthly Returns for Portfolios Sorted on Investment Horizon and SYY score

This table reports the value-weighted average monthly abnormal returns (in percentage) of portfolios double sorted on investment horizon and SYY score. Stock-level investment horizon is defined as the weighted average of the churn ratios of the holding institutions in the previous quarter and then take the reciprocal. At the end of each month, all available stocks are independently sorted into 2x5 groups based on investment horizon measure and SYY score. 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 spreads based on SYY score for shorter and longer investment horizon group, respectively; 2) Difference of high-minus-low spreads between shorter investment horizon group and longer investment horizon 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 parentheses.

Value-Weighted Portfolio Return Sorted on Investment Horizon and SYY Score (%)

| | SYY Score | P1 (Overpriced) | P2, P3 & P4 (Fairly priced) | P5 (Underpriced) | P5-P1 (H-L spread) |
|---|---|---|---|---|---|
| CAPM-α | Shorter Investment Horizon | -0.48* | -0.00 | 0.26* | 0.74*** |
| | | (-1.82) | (-0.02) | (1.79) | (2.84) |
| | Longer Investment Horizon | -0.61** | -0.04 | 0.11 | 0.73*** |
| | | (-2.59) | (-0.53) | (1.06) | (2.63) |
| | | | | Diff | -0.01 |
| | | | | | (-0.05) |
| FF-3 α | Shorter Investment Horizon | -0.48* | 0.00 | 0.27** | 0.74*** |
| | | (-1.78) | (0.00) | (2.22) | (2.76) |
| | Longer Investment Horizon | -0.62*** | -0.04 | 0.11 | 0.73*** |
| | | (-3.11) | (-0.71) | (1.05) | (2.90) |
| | | | | Diff | -0.01 |
| | | | | | (-0.06) |
| Carhart-4 α | Shorter Investment Horizon | -0.43* | -0.01 | 0.25** | 0.68*** |
| | | (-1.69) | (-0.07) | (2.14) | (2.75) |
| | Longer Investment Horizon | -0.54** | -0.04 | 0.08 | 0.62** |
| | | (-2.55) | (-0.58) | (0.80) | (2.44) |
| | | | | Diff | 0.06 |
| | | | | | (0.21) |

## Table 10. Monthly Returns for Portfolios Sorted on SR_MO (Socially Responsible Active Mutual Fund Ownership) and SYY Score

This table presents the average monthly abnormal returns (in percentage) of high-minus-low spread based on socially responsible active mutual fund ownership (SR_MO) and SYY score from January 2004 to December 2014. To calculate SR_MO, we first calculate value-weighted size-adjusted ESG score as socially responsible score for all the active mutual funds. Then we define socially responsible (SR) active mutual funds (one third of all) based on their score. SR_MO is the number of shares held by SR active mutual funds divided by the total number of shares held by all the active mutual funds. At the end of each month, we independently sort stocks into 2x5 portfolios based on SR_MO measure and SYY score. 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 mispricing signals for all stocks, 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 parentheses.

Value-Weighted Portfolio Return Sorted on SR_MO and SYY Score (%)

| | SYY Score | P1 (Overpriced) | P2, P3 & P4 (Fairly priced) | P5 (Underpriced) | P5-P1 (H-L spread) |
|---|---|---|---|---|---|
| CAPM-α | Low SR_MO | -0.22 | 0.13 | 0.06 | 0.28 |
| | | (-1.27) | (0.89) | (0.34) | (1.49) |
| | High SR_MO | -0.68*** | -0.05 | 0.14 | 0.82*** |
| | | (-3.02) | (-0.96) | (1.56) | (2.83) |
| | | | | Diff | 0.55** |
| | | | | | (2.11) |
| FF-3 α | Low SR_MO | -0.21 | 0.13 | 0.06 | 0.28 |
| | | (-1.29) | (1.04) | (0.49) | (1.52) |
| | High SR_MO | -0.68*** | -0.05 | 0.14 | 0.82*** |
| | | (-2.95) | (-1.00) | (1.55) | (2.69) |
| | | | | Diff | 0.55** |
| | | | | | (2.03) |
| Carhart-4 α | Low SR_MO | -0.19 | 0.11 | 0.03 | 0.22 |
| | | (-1.14) | (0.90) | (0.22) | (1.20) |
| | High SR_MO | -0.60*** | -0.04 | 0.12 | 0.71*** |
| | | (-3.12) | (-0.84) | (1.31) | (2.71) |
| | | | | Diff | 0.49** |
| | | | | | (2.01) |

## Table 11. Monthly Returns for Portfolios Sorted on Size, SR_IO, and SYY Score

Panel A presents the average monthly returns (in percentage) of portfolios sorted by SYY score from 1996 to 2003 (Panel A.1) and 2004 to 2014 (Panel A.2), using full CRSP sample with non-missing SYY score. For each portfolio, we report value-weighted Fama-French (1993) three-factor alpha of next month, for the largest 1,000 stocks and the other stocks. Panel B presents the value-weighted average monthly abnormal returns (in percentage) of triple-sorted portfolios based on socially responsible institutional ownership (SR_IO), size, and SYY score from January 2004 to December 2014. At the end of each month, all available stocks are independently sorted into 2x2x5 groups based on SR_IO, size, and SYY score. We report value-weighted Fama-French (1993) three-factor alphas for high SR_IO stocks and low SR_IO stocks in Panel B.1 and Panel B.2, respectively. SYY score for a stock is the opposite of mispricing score in Stambaugh, Yu, and Yuan (2015). To calculate SR_IO, we first calculate value-weighted size-adjusted ESG score as socially responsible score for all the 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 the institutions. To adjust for serial correlation, robust Newey-West (1987) t-statistics are reported in parentheses.

Panel A.1. Value-Weighted FF-3 Alpha (%) for 1996–2003 Period

| Sorted on SYY Score | P1 (Overpriced) | P2, P3 & P4 (Fairly priced) | P5 (Underpriced) | P5-P1 ((H-L) spread) |
|---|---|---|---|---|
| Largest 1,000 stocks | -0.99*** | 0.08 | 0.42*** | 1.42*** |
| | (-3.91) | (1.01) | (3.33) | (4.05) |
| Other stocks | -1.41*** | 0.12 | 0.67*** | 2.08*** |
| | (-5.01) | (0.89) | (3.72) | (6.15) |

Panel A.2. Value-Weighted FF-3 Alpha (%) for 2004–2014 Period

| Sorted on SYY Score | P1 (Overpriced) | P2, P3 & P4 (Fairly priced) | P5 (Underpriced) | P5-P1 ((H-L) spread) |
|---|---|---|---|---|
| Largest 1,000 stocks | -0.70*** | -0.03 | 0.14* | 0.85*** |
| | (-3.30) | (-0.59) | (1.73) | (3.00) |
| Other stocks | -0.42*** | 0.11* | 0.07 | 0.49*** |
| | (-3.80) | (1.87) | (0.77) | (3.33) |

Panel B.1. Value-Weighted FF-3 Alpha (%) among **High** SR_IO Stocks for 2004–2014 Period

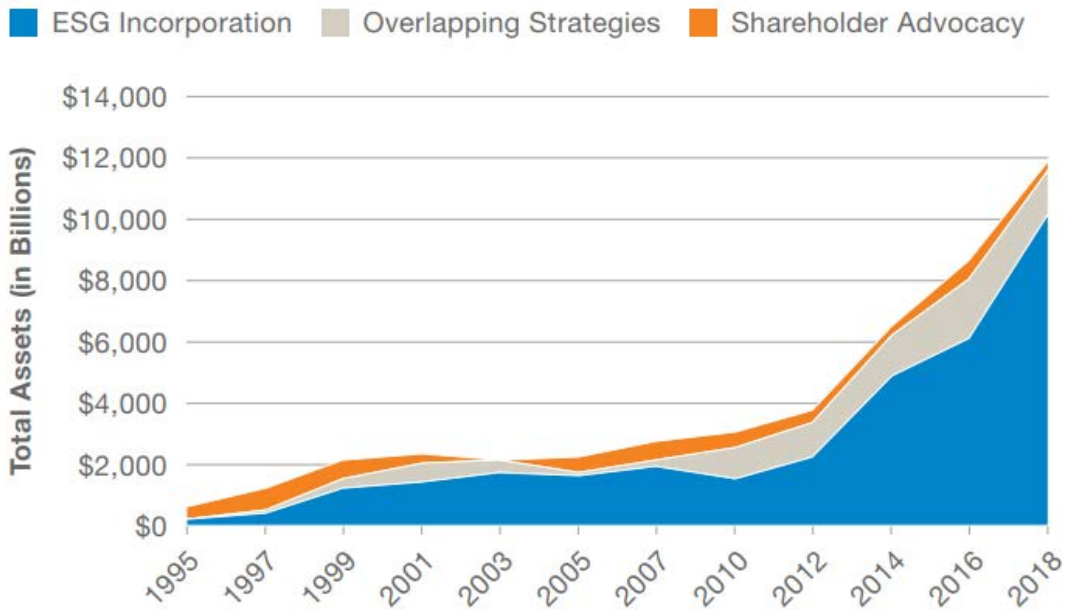
| SYY Score | | P1 (Overpriced) | P2, P3 & P4 (Fairly priced) | P5 (Underpriced) | P5-P1 (H-L spread) |
|---|---|---|---|---|---|
| All High SR_IO Stocks | | -0.68*** | -0.05 | 0.14 | 0.83*** |
| | | (-2.95) | (-0.99) | (1.57) | (2.71) |
| Firm Size | Small | -0.42** | 0.10 | 0.32** | 0.74*** |
| | | (-2.17) | (0.74) | (2.18) | (3.34) |
| | Large | -0.69*** | -0.05 | 0.14 | 0.83** |
| | | (-2.83) | (-1.05) | (1.55) | (2.61) |
| | H-L | -0.26 | -0.15 | -0.18 | 0.09 |
| | | (-1.06) | (-1.07) | (-1.07) | (0.28) |

Panel B.2. Value-Weighted FF-3 Alpha (%) among **Low** SR_IO Stocks for 2004–2014 Period

| SYY Score | | P1 (Overpriced) | P2, P3 & P4 (Fairly priced) | P5 (Underpriced) | P5-P1 (H-L spread) |
|---|---|---|---|---|---|
| All Low SR_IO Stocks | | -0.23 | 0.14 | 0.06 | 0.28 |
| | | (-1.36) | (1.08) | (0.47) | (1.56) |
| Firm Size | Small | -0.36*** | 0.07 | -0.12 | 0.24 |
| | | (-3.71) | (0.90) | (-1.05) | (1.63) |
| | Large | -0.17 | 0.18 | 0.09 | 0.26 |
| | | (-0.74) | (1.05) | (0.59) | (1.09) |
| | H-L | 0.22 | 0.11 | 0.21 | -0.01 |
| | | (0.93) | (0.54) | (1.13) | (-0.04) |

**Figures 1. Sustainable and Responsible Investing in the United States 1995-2018**

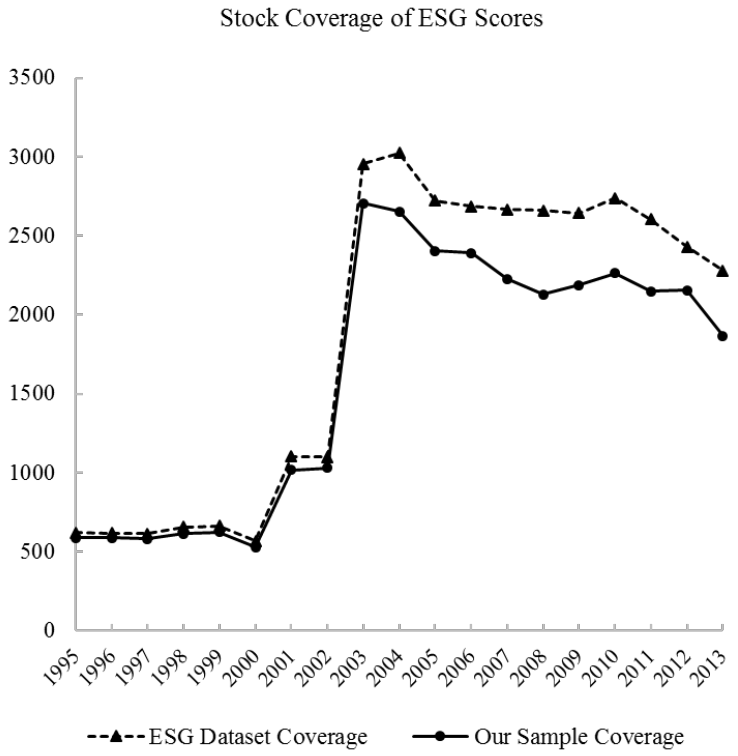
This figure plots the size ($billion) of the U.S. sustainable and responsible investment universe from 1995 to 2018. Blue area represents the assets involved in ESG incorporation strategy. Orange area represents the assets involved in shareholder advocacy. Grey area represents the assets involved in both strategies.




Source: U.S. Forum for Sustainable and Responsible Investment Foundation

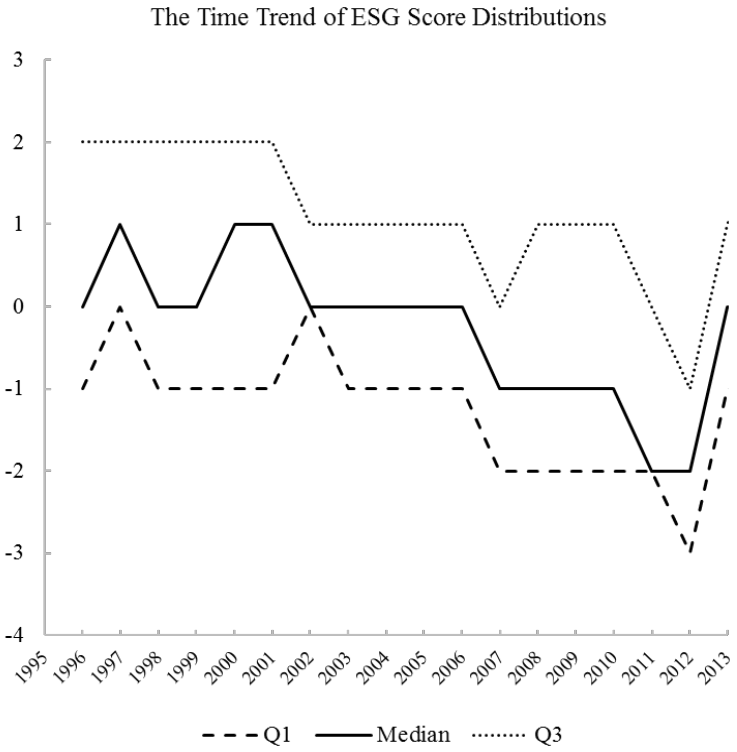
## Figures 2. Stock Coverage of ESG Scores

Figure 2 plots the number of CSRP stocks covered by MSCI ESG KLD 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.




## Figures 3. The Distribution of ESG Scores over Time

Figure 3 plots the cross-sectional distributions (Q1, Median, and Q3) of ESG scores from 1995 to 2013.



# Supplementary Appendix for

# ESG Preference, Institutional Trading, and Stock Return Patterns

## Variable Definitions

| | |
|---|---|
| *Mispricing Measures* | |
| SUE score | Standardized unexpected earnings score is computed as the difference between current quarter's earnings and the earnings four quarters ago, then divided by the standard deviation of unexpected earnings over the last eight quarters. |
| SYY score | SYY score, ranging between -100 and -1, is the opposite of composite mispricing measure in Stambaugh, Yu, and Yuan (2015). Stocks with lowest SYY values are most "overpriced" and those with the highest values are most "underpriced". Updated monthly. |
| *Corporate Social Performance (ESG) measures* | |
| ESG score | Net score provided by MSCI ESG STATS (formerly known as KLD), calculated as the sum of Strengths minus the sum of Concerns. Five dimensions are considered, including Corporate Governance, Community, Diversity, Employee Relations and Environments. Updated annually. |
| *Stock Price Efficiency* | |
| Price Delay | Price Delay, proposed by Hou and Moskowitz (2005), measures the degree of a stock's return variation captured by lagged market returns. Higher Price Delay measure indicates stronger delay in response to return innovations. We run weekly return regression over each calendar year on contemporaneous and four weeks of lagged market returns as follows, $$r_{j,t} = \alpha_j + \beta_j R_{m,t} + \sum_{n=1}^{4} \delta_j^{(-n)} R_{m,t-n} + \varepsilon_{j,t}$$ Price Delay measure is one minus the ratio of the $R^2$ from above regression restricting $\delta_j^{(-n)} = 0, \forall\, n \in [1,4]$, over the $R^2$ with no restrictions. $$Price\ Delay = 1 - \frac{R^2_{\delta_j^{(-n)}=0, \forall\, n\in[1,4]}}{R^2}$$ |
| *Socially Responsible Institutional Ownership (SR_IO) measures* | |
| SR_IO | Percentage of shares held by socially responsible institutions out of shares held by all the institutions. We use size-adjusted ESG score to calculate value-weighted ESG scores (ISRS) for all the institutions and define top tercile as socially responsible institution. Updated quarterly. |

| | |
|---|---|
| SR_MO | Percentage of shares held by socially responsible active mutual funds out of shares held by all the active mutual funds. We use size-adjusted ESG score to calculate value-weighted ESG scores for all the active mutual funds and define top tercile as socially responsible active mutual funds. Updated quarterly. |
| *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 from Markit 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. |
| Stock turnover | The total stock trading volume scaled by the average daily shares outstanding in the previous month. |
| Stock-level investment horizon | 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 and then take the reciprocal. The churn ratio for each institution each quarter is calculated using the procedure by Gaspar, Massa, and Matos (2005). |
| *Institution Characteristics* | |
| AUM ($billion) | Total market value of stocks in the institutions' portfolio in the end of each quarter. |
| Churn ratio | A higher churn ratio indicates shorter investment horizon. It is calculated for each institution each quarter, following the procedure used by Gaspar, Massa, and Matos (2005). For each institution *j* holding stock universe *I*, at the end of quarter *t*, we calculate churn ratio using: $$Churn\ Ratio_{j,t} = \frac{\sum_{i \in I} \lvert N_{j,i,t} P_{i,t} - N_{j,i,t-1} P_{i,t} \rvert}{\sum_{i \in I} \frac{\lvert N_{j,i,t} P_{i,t} + N_{j,i,t-1} P_{i,t-1} \rvert}{2}}$$ |

## 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. 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% |