Responsible Institutional Investing Around the World

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ABSTRACT

We explore a novel survey on responsible investing by institutional investors around the world and match it to archival data on equity portfolio holdings. We study what factors make institutions commit to responsible investing and incorporate environmental, social and governance (ESG) criteria into their investment processes. We examine if different ESG implementation strategies (e.g., screening, integration, engagement) affect portfolio-level ESG scores but find limited evidence. Finally, we document that there are potential trade-offs between sustainable investing and portfolio returns and risk.

JEL: G15, G23, G30, M14

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1. Introduction

The practice of responsible investing, where institutional investors incorporate environmental, social and governance (ESG) issues into their investment processes, is increasingly important globally and likely to grow (US SIF (2018), GSIA (2018)).[1] However, there is limited academic evidence on what are the portfolio consequences of integrating ESG factors. Prior studies use anonymized investor surveys (e.g. Krueger, Sautner and Starks 2019) or rely on archival data of portfolio holdings (e.g. Dyck, Lins, Roth and Wagner (2019), Gibson and Krueger (2018) or Starks, Venkat and Zhu (2018)) and cannot compare what investors say they do versus what they effectively do in terms of ESG integration in their portfolios and, ultimately, asses the link between ESG investing and risk-adjusted portfolio returns.

In this paper, we combine a non-anonymous survey with matched archival data on institutional investors' equity portfolios to examine which kinds of institutional investors commit to responsible investment and whether or not different ESG strategies result in better portfolio-level ESG scores and risk-return implications.[2] The survey data we use comes from the Principles for Responsible Investing (PRI), founded in 2006 by a group of the world's largest institutional investors with the support from the United Nations (UN).[3] The PRI operates as an industry-led membership network and its objective is to harness the financial weight of institutional investors to address sustainable development goals.[4] Principle #1 calls for the incorporation of ESG issues in the analysis and selection of investments. Importantly for our study, one of the obligations resulting from signing the principles is that institutions are required to provide detailed annual reports on how they implement responsible investment (e.g., screening, integration or engagement-oriented approaches). In our analysis, we then merge these investor reports with archival data on their institutional stock holdings to examine the impact of the

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[1] Survey estimates put the assets managed according to responsible investment criteria at US$ 12 trillion according to the US SIF Foundation's biennial Report in 2018 (up 38% from 2016, https://www.ussif.org/trends) and over US$ 30 trillion across the world according to The Global Sustainable Investment Review 2018 that collates the US data with other regional reports (http://www.gsi-alliance.org/trends-report-2018/).

[2] We use the terms sustainable, responsible and ESG investing interchangeably in this paper.

[3] The PRI network counts more than 2,000 different signatory institutions ranging from investment managers and asset owners to service providers and collectively, the signatories represent assets under management of more than US$ 80 trillion (https://www.unpri.org/about-the-pri). In our analysis, we focus only on institutional investors such as asset owners (ex: pension plans, endowments or sovereign wealth funds) and investment managers (ex: investment companies and advisors) and ignore service providers (ex: ESG rating or consulting firms).

[4] The 17 Global Sustainable Development Goals set out economic, social and environmental ambitions for UN member states (https://www.undp.org/content/undp/en/home/sustainable-development-goals.html).

reported responsible investing strategies on their equity portfolio-level ESG footprints and also the risk-return implications.

We start by studying which investor characteristics are related to an institution committing to responsible investing by joining the PRI. We document that institutions that are larger in AUM, European-based and asset owners (ex: pension plans that invest in stocks directly) are more likely to join the PRI network. We then examine differences in terms of portfolio-level sustainability between PRI and non-PRI investors. To do so, we match the self-reported PRI data with detailed archival data from Factset Ownership on institutional investors' equity holdings of publicly-listed companies worldwide. This data shows that institutional investors control large pools of capital, collectively owning over US$ 32 trillion in listed equities in developed and emerging markets as of end of 2017.[5] PRI investors grew from the 47 founding members to over 611 PRI signatories with data in Factset and their holdings represented over US$ 18 trillion (i.e. roughly one in every two dollars of institutionally managed equities) at the end of our sample period. We augment these data with stock-level environmental, social and governance scores from three ESG rating providers (Thomson Reuters ASSET4, MSCI IVA and Sustainalytics). We then follow Gibson and Krueger (2018) and Starks, Venkat and Zhu (2018) and calculate the value-weighted average ESG scores for each institutional investors' stock portfolio and call these "ESG footprints".

We find some evidence that institutions who are part of the PRI network exhibit better ESG footprints, with most of the effect coming from differences in the governance score. There are also interesting regional differences: European investors have better portfolio-level ESG scores, while North American investors tend to exhibit better governance, but lower environmental and social scores which could be related to the interpretation of "fiduciary duty" by US institutional money managers that prevent them from considering E&S issues as financially material. We address the issue that PRI signatory institutions could be different from Non-PRI institutions by estimating a difference-in-difference regression which shows that portfolio ESG footprints improve after institutions sign the PRI

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[5] This represents over 40% of the world market capitalization and this is similar to the level estimated by an OECD (2019) study on the ownership structure of the World's listed companies.

compared to non-signatories. To help with identification, we use the staggered adoption of investor stewardship codes in different countries stating investors' responsibilities on how they should integrate ESG factors and monitor their investments (OECD (2017)). These codes are sometimes mandated by regulators (ex: UK's Financial Reporting Council) or the result of peer-pressure initiatives by industry bodies (ex: Canadian Coalition for Good Governance). Using the introduction of an investor stewardship code in a country as an instrumental variable for the decision by institutions from that country to sign the PRI, we show that ESG portfolio footprints subsequently improve. We conclude that there is some evidence that PRI signatory institutions seem to "walk the ESG talk".

We then move on to study ESG implementation strategies in greater detail using the unique survey data from the PRI reporting framework. The practice of responsible investing in public equity markets started mostly with negative screening approaches that - based on moral, norms-based, or ethical considerations - excluded certain stocks from a portfolio (Hong and Kacperczyk, 2009). It has evolved substantially in recent years and there are now at least six different implementation strategies of responsible investment (see, for instance, CFA Institute (2015), GSIA (2016) and Amel-Zadeh and Serafeim (2018)). These can be classified into (i) negative or exclusionary screening, (ii) positive or best-in-class screening (investing in most ESG-friendly companies), (iii) norms-based screening (ex: UN Global Compact Principles), (iv) integration (ex: incorporating ESG factors into financial analysis), (v) thematic investments (ex: green investments) and (vi) engagement approaches (individual dialogue, collaborative campaigns and overall shareholder voting policies). While collaborative engagement approaches have been studied before using another dataset from the PRI collaboration platform (Dimson, Karakas and Li (2018)), there is little academic research on the prevalence of the other ESG strategies listed above and their potential impact on institutional investors' ESG footprints and also their risk-return implications.

The PRI survey indicates that signatories' most common responsible investment strategies (in order of reported frequency) are engagement, ESG integration and negative screening. These approaches are not mutually exclusive with most institutions reporting implementing multiple strategies simultaneously. The only style that remains niche is thematic investing. However, when we test if these

different implementation strategies are related to portfolio-level ESG scores the picture is less clear. Our results show that responsible investment strategies have little impact on ESG portfolio footprints. We only observe that positive/best-in-class screening strategies have a significant relation with portfolio-level ESG scores. The other responsible investing strategies are not statistically associated with ESG portfolio footprints.

In the final part of the paper, we examine whether there are trade-offs between responsible investing and portfolio performance. We compare the yearly buy-and-hold portfolio returns of both PRI and non-PRI signatories. Our results show that PRI signatories exhibit higher risk and slightly lower returns in their listed equity portfolios. We uncover also a weak underperformance by PRI signatories (versus Non-PRI investors) using monthly calendar-time portfolio return regressions and controlling for more asset pricing factors used in more recent research on the "sin stock anomaly" (Blitz and Fabozzi (2017)). This does not validate the "doing well by doing good (ESG)" mantra for the average PRI signatory and could be the result of constrained portfolio optimization. However, when we test if there is an effect of responsible investment strategies on holdings-based returns, we do not find an association between the actual implementation of strategies and portfolio performance but we document that negative screening, engagement and integration lower portfolio risk. We conclude that responsible investing is a risk management tool (not a return enhancer) and it is important to separate between investors that truly adopt responsible investing strategies versus those that pledge to it but fall short of implementing it.

Our paper contributes to the emerging literature studying responsible investment by different types of institutional investors. Dyck et al (2019), for instance, show that international institutional investors that are domiciled in high social-norms countries influence firms to adopt better ESG policies. In addition, Starks, Venkat and Zhu (2018) document that long-term investors care more about ESG issues while Gibson and Krueger (2018) find that environmental issues matter more for investment performance when institutions are long-term oriented. This line of work uses archival data on investor characteristics (country of origin or investment horizon) rather than their actual ESG implementation practices due to lack of data. Alternatively, Amel-Zadeh and Serafeim (2018) conduct a survey on how

investment managers use ESG data and Krueger, Sautner, Starks (2019) survey institutional investors on their climate-related policies but both studies cannot observe their actual investments. Our paper addresses some of the shortcomings of the previously cited studies which either use anonymized surveys (Amel-Zadeh and Serafeim, 2018; Krueger, Sautner and Starks 2019) or exclusively on archival data (Dyck et al. 2019, Starks et al (2019), Gibson and Krueger 2018). Our survey-portfolio matched data allows us to make inferences about institutional investors' sustainability choices and compare what investors' say they do in terms of overall responsible investment (the PRI survey data) versus what they actually do (ESG scores in the FactSet portfolio holdings). One exception is the study by Dimson, Karakas and Li (2018) which examines in detail one of the ESG sub-strategies (coordinated engagements) with direct data from the PRI Collaboration Platform matched to the activist investors' portfolio data in Factset Ownership. We take a broader view of ESG strategies that comprise screening, integration and overall engagement.

We also contribute to the literature on investor preferences for responsible investment. Due to social norms, investors historically have been shown to shun "sin stocks" (Hong and Kacperczyk (2009)). Recent work has examined the growing retail demand for products that invest responsibly. Investor flows seem to react positively to fund companies that sign PRI (Humphrey and Li (2019)), to high sustainability ratings (Hartzmark and Sussman (2019)) and to the eco-labelling of mutual funds (Ceccarelli, Ramelli and Wagner (2019)). Riedl and Smeets (2017) investigate the intrinsic social preferences of Dutch investors that correlate with holding (lower return) SRI equity funds. Our paper focuses instead on the role of delegated portfolio managers (investment managers and asset owners) who invest on behalf of individuals. Since these financial intermediaries increasingly control the largest pools of capital it is important to study how they execute on the social preferences for responsible investing.

Finally, our paper adds to the debate on the costs and benefits of ESG investing. From a standard risk-return portfolio theory perspective one should expect lower returns due to constrained optimization but Pedersen, Fitzgibbons and Pomorski (2019) argue that positive ESG factors contain relevant information about firm fundamentals which could be a predictor of returns. Alternatively, ESG factors

could negatively predict returns in case of excessive demand by responsible investors. Previous studies are either conducted at the stock-level (for example, on "E" see Bolton and Kacperczyk (2019) , on "S" see Edmans (2011) on "G" see Gompers, Ishii and Metricks (2003)) or at the fund-level (ex: SRI funds in Renneboog, Ter Horst and Zhang (2008)). Our study focuses on global institutional investors and find the effect of different ESG strategies on portfolio risk-return. We do not find return enhancement but we find that negative screening, integration and engagement mitigates portfolio risk.

2. Data and Methodology

2.1. Principles for Responsible Investment (PRI)

The PRI were launched in 2006 on the initiative of the United Nations (UN) who invited 21 institutional investors such as the California Public Employees' Retirement System (CalPERS), Hermes Pensions Management and the Norwegian Government Pension Fund to collaborate in establishing the principles for responsible investments.[6] They were joined by 47 additional founding signatories and, by 2018, the PRI network grew to be the largest investor initiatives worldwide with over 2,000 signatories that had more than US$ 80 trillion of assets under management (AUM). The six PRI principles are as follows:

- #1: We will incorporate ESG issues into investment analysis and decision-making processes.
- #2: We will be active owners and incorporate ESG issues into our ownership policies and practices.
- #3: We will seek appropriate disclosure on ESG issues by the entities in which we invest.
- #4: We will promote acceptance and implementation of the Principles within the investment industry.
- #5: We will work together to enhance our effectiveness in implementing the Principles.
- #6: We will each report on our activities and progress towards implementing the Principles.

By signing the principles, the investors publicly commit to adopt these principles as long as they are consistent with the investors' fiduciary duties. While the principles are voluntary, the signatory status comes with two mandatory requirements. First, all signatories need to pay an annual membership fee, which depends on signatory type (investment manager, asset owner or service provider) and their AUM. Second, PRI signatory investors commit to publicly report on their responsible investment

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[6] The PRI is an independent non-profit institution that is independent from, but supported by different UN agencies. Funding is assured primarily via an annual membership fee from its signatories.

considerations and decision-making on a yearly basis (principle #6 above).[7] Our research makes direct use of information derived from the PRI reporting framework.

The PRI principles can be signed by three organizational types: 1) asset owners, 2) investment managers and 3) service providers. Investors should sign the PRI at the highest level of the group.[8] Asset owners comprise pension funds, sovereign wealth funds, foundations, endowments and insurance companies and could be concerned about ESG factors that affect the ability to meet their obligations to beneficiaries. Investment managers comprise investment fund companies and advisors and could integrate ESG issues as they seek to maximize the value of their client's investments. Service providers do not manage assets by themselves so are excluded from our analysis in this paper.

2.2. PRI Survey Data

While the PRI was founded in 2006, signatory reporting data only starts in 2014 and extends to 2018. The survey is non-anonymous and we thus observe investor names and detailed responses to an extensive questionnaire for each signatory and reporting year.[9] Overall, the five years of PRI reports available to us contain 5,326 signatory-year observations by 1,549 unique PRI signatory identifiers.

Reporting takes place every year between January and March and we interpret responses to account for the previous calendar year, i.e., the 2018 report covers activities in 2017. 2014 constitutes the baseline year and, in our analysis, we adjust as subsequent reporting frameworks were subject to modifications and improvements. The PRI reporting framework comprises twelve modules. Since in our

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[7] Failure to report results in exclusion from the PRI. A list of delisted signatories is available in https://www.unpri.org/annual-report-2018/how-we-work/new-and-delisted-signatories.

[8] This provision aims to prevent financial groups from signing up subsidiaries or funds with particularly strong ESG performance. We subsequently refer to the highest level of the group as a parent and to a subsidiary as an entity. Only entities that are autonomous (e.g., separate legal entities to the parent) can sign the principles independent of whether or not the parent signed them too. It follows that if an entity signs and the parent does not, the PRI signatory status cannot be inherited by the wider group. Conversely, when the parent signs on behalf of the wider group, generally all assets of the entities should be included in the reporting and entities can, therefore, represent themselves as a signatory. In addition, entities can sign up apart from the parent, even if the latter already signed itself; both then need to report separately.

[9] PRI has put processes into place to ensure the verifiability of the reports. A central element of this is to make a vast majority of the responses accessible to the public. For example, the publicly available reports allow asset owners to search and screen for potential investment managers providing a strong incentive to report truthfully. In addition, the PRI compares the reports within their peer groups and analyzes responses of recurring themes over time. Lastly, the PRI runs validation checks to detect inconsistencies. Third-party audit and/or assurance of the PRI reports are encouraged but voluntary.

paper we focus on direct equity investments by the signatories, we use the 'organizational overview', 'strategy and governance', 'listed equity incorporation' and 'listed equity active ownership' modules to draw the necessary information for our analysis. These modules include information on responsible investment strategies, such as the screening, integration, thematic strategies, as well as engagement. We only work with answers to questions that are *mandatory to report and to disclose* which are made publicly available via the reporting database.[10] The Internet Appendix provides examples of the PRI survey questions used in our analysis.

2.3. Institutional Investor Equity Holdings

We retrieve institutional holdings data from Factset Ownership (previously LionShares), which is the leading source for global institutional equity ownership data. The sample period starts in 2003 (3 years prior to the PRI being formed) till 2017 and covers the set of institutions domiciled in countries that are part of the MSCI All Country World Index. More details on this data can be found in Ferreira and Matos (2008). We use portfolio data at the end of each calendar year. In line with the PRI definitions, we group institutions by their type: asset owners (pension funds, foundation and endowment managers, sovereign wealth managers, insurance companies and governmental agencies) versus investment managers (bank investment divisions, investment companies, investment advisers and hedge funds).

We are able to match 611 PRI signatories with the Factset institutional investors using a name matching algorithm and manual verifications.[11] All of our analysis is conducted at the Factset entity level.[12] Of the 1,549 unique PRI identifiers only 874 need to complete the PRI modules relating to listed

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[10] The reason is that mandatory indicators are completed by all eligible investors, while the response rates to voluntary indicators can vary widely and are imperfect due to missing information. In addition, we only work with binary, categorical, or multiple choice responses in order to avoid the challenges arising from interpreting descriptive responses.

[11] In a first stage we run a name matching algorithm on the two lists of names cleaned for punctuation, accents, non-alphanumeric and special characters using the Jaro-Winkler measure to determine the smallest distance between two given names in the lists. In a second step, we perform manual checks and improvements to the initial output of the name matching algorithm by controlling for the country location of the signatory's headquarter, the asset class composition of its holdings as reported to PRI and the website URL reported to PRI and Factset.

[12] Our matching of the PRI with the Factset investor universe occasionally leads to a double-matching. This can happen when both the parent and the entity sign the PRI independently. In such cases, we give priority to entity over parent matches. In rare cases, even though both parent and entity signed, a valid report might not be available for the entity while it is available for the parent. Should this occur, we then prioritize the parent match. Whenever a parent signed but the entities did not, we assume that the entities inherit the PRI status, but not vice versa.

equity (while the other 675 either do not hold publicly-listed equities, do not incorporate responsible investment in their equities, or hold less than 10% of their AUM in public equities).[13] We thus conclude that our PRI-Factset match is reasonably complete. The 611 PRI signatories in our final sample had over US$ 18 trillion in equity holdings as of 2017 and this represents more than half of the total institutional holdings in FactSet.

2.4. ESG Scores

We retrieve stock-level sustainability scores from three ESG rating providers: 1) Thomson Reuters' ASSET4 ; 2) MSCI IVA; and 3) Sustainalytics. The ESG scores from each of these data providers are also broken down into environmental, social and governance dimensions. We obtain these scores on a yearly basis between 2003 and 2017 by keeping the last available ESG scores in each firm-calendar year combination, assuming that it reflects the most accurate and up-to-date information on the company for that year. We then calculate an equal-weighted average of the normalized scores from the three ESG data providers. We use three ESG ratings as we do not want our results to overly depend just on a single ESG rating, given the level of disagreement among data providers (Gibson, Krueger, Riand and Schmidt (2019)). Due to the increasing data coverage over our sample period, we take the average from the ESG scores that are available if these is no coverage for one of the ratings providers for a given stock. Given the different ratings scales of each data provider, we normalize each score to have a mean of zero and a standard deviation of one – we denote these as *z(Score)*.

$$Score_{it} = \frac{1_{A4,it} \times z_t(Score\_A4_{it}) + 1_{MSCI,it} \times z_t(Score\_MSCI_{it}) + 1_{SUST4,it} \times z_t(Score\_SUST_{it})}{1_{A4,it} + 1_{MSCI,it} + 1_{SUST,it}}$$

As a second step, we follow Gibson and Krueger (2018) and compute the portfolio-level sustainability "footprints" using the size of the individual stock holdings in the investors' portfolio. To

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[13] In addition, a large proportion of the 263 signatories that do report on their listed equities often do not have sufficient direct equity holdings to show up in Factset. Many do hold a substantial proportion of their equity AUM under fund-of-funds, or simply do not have enough AUM. For example, the SEC Form 13-F filing of portfolio holdings of equity-like securities is only required for institutional investment managers that exercise discretion over US$ 100 million or more.

do so we compute the value-weighted average of the portfolio using the market value of each stock position as a fraction of the sum of all reported equity positions.

$$Portfolio\ Score_{j,t} = \sum_{i=1}^{N_{j,t}} w_{i,j,t} \times Score_{i,t}$$

where *Portfolio Score* denotes one of the four sustainability scores: *Total ESG Score*, *Environmental Score*, *Social Score*, or *Governance Score*. w_{ijt} denotes the value-weight of stock *i* in investor *j's* portfolio at the end of year *t*. $Score_{it}$ is the sustainability score of stock *i* at the end of year *t*. N_{jt} is the total number of stocks investor *j* holds at the end of year *t* for which the stock-level scores are available. The *Portfolio Score* variable quantifies the portfolio-level sustainability footprint of institutional investor *j* at the end of year *t* as the value-weighted average of the sustainability score of the stocks that make up the institution's portfolio.

After merging all three sources (PRI survey, FactSet holdings and ESG scores) and applying the filters as described above, we are left with 83,768 institution-year observations at the investor portfolio-level ranging from 2003 to 2017. For the more detailed analysis that requires time-varying information from the PRI annual surveys, we are left with a sample of 2,778 institution-year observations from 2013 to 2017.

3. Committing to Responsible Investing

3.1. Which Institutional Investors Sign up for PRI?

In Figure 1, we provide some graphical evidence about the composition of our sample. Panel A shows that the number of PRI signatory institutions has increased over time. Panel B shows the increasing importance of PRI signatories in global stock markets. While global equity holdings of PRI institutions represented about US$ 0.7 trillion in 2006, the value of total holdings by PRI signatories grew to US$ 18 trillion by 2017 (see also Table 1). Relating the total value of holdings by PRI institutions to the total institutional investor equity holdings of about US$ 32 trillion, shows that PRI signatories now represent more than half of institutionally owned equity.

In Panel C of Figure 1, we contrast the sample of PRI signatories with the overall population of institutional investors in terms of their geographical locations. We restrict our sample to institutions that are located in countries that are part of the MSCI All Country World Index and group them into three regions: Europe, North America and Asia-Pacific plus the rest of the world (Africa, Middle East, South America). Compared to North American institutional investors, investors from Europe and Asia Pacific plus the rest of the world are more likely to sign the PRI. In terms of types of institutions (Panel D of Figure 1), that is asset owners or investment managers, we do not find large differences between the PRI signatories and overall population of institutional investors in FactSet. If anything, there is a slight over-representation of asset owners among PRI signatories compared to the overall population. Note that for an asset owner to be included in the sample, the institution would need to have considerable direct equity holdings because otherwise it would not show up in FactSet. In other words, asset owners who outsource the management of their equity investments do not show up in our sample. In terms of the size distribution (see Panel E of Figure 1), the small institutions are under-represented among PRI signatories (<US$ 1 billion in AUM) and there is an over-representation of medium (US$ 1-10 billion), large (US$ 10-100 billion) and very large (>US$ 100 billion) institutions.

Table 1 shows further sample splits using the cross-section and time-series jointly. While the early signatories tended to be more European, the percentage of North American signatories has gradually risen over time from only 19 percent when PRI was founded in 2006 to 31 percent in 2017. The fraction of PRI signatories from Asia Pacific and the rest of the world remains smaller and more stable over time. Analyzing changes in the size distribution over time allows for some interesting observations: while in 2006, PRI was dominated by larger institutions, the number of small signatories has increased steadily over time. The increase might reflect the fact that being part of PRI is now an important requirement for investment managers to obtain investment mandates from asset owners. Also the percentage of investment managers has increased over time, while asset owners accounted for a larger proportion of the early signatories.

In the Internet Appendix, we complement the univariate evidence on the characteristics of PRI vs non-PRI signatories by estimating Probit regressions in Table IA1 and confirm that the probability

of joining is higher when the institution is not based in North America, when the institution is an asset owner and when it is more long-term oriented, more index-like and larger in terms of total equity holdings. Table IA2 of the Internet Appendix also provides the list of the largest institutional investors by portfolio AUM for each region and their PRI signing date. By the end of 2017, all top 10 institutions in North America, Europe and in the rest of the world had joined the PRI (e.g. Vanguard, BlackRock, Norges Bank, UBS or Nomura).

3.2. Do PRI Signatories Exhibit Better ESG Portfolio Footprints?

We now turn to analyze portfolio-level outcomes conditional on PRI membership. To do so, we calculate an average portfolio-level *Total ESG Score* as well as individual *Environmental Score*, *Social Score* or *Governance Score* component scores for each institutional investor (see section 2.4 for more details). [14] In Table 2 we estimate OLS regressions where we use the portfolio-level ESG scores as a dependent variable. The main variable of interest is the *PRI dummy*, which takes the value of 1 if an investor is a PRI signatory in a given year. We also control for region, institution-type (investment manager versus asset owner) and time fixed effects. Standard errors are clustered at the institution- and year-level.

In columns (1), (3), (5) and (7) of Table 2, we find that PRI signatories have significantly better *Total ESG Score*, *Social Score* and *Governance Score* but no better *Environmental score* at the portfolio-level.[15] However, PRI signatories could differ in terms of their investment horizon or other portfolio style. When we add these portfolio characteristics as controls, the coefficient estimate for the *PRI dummy* decreases for the *Total ESG score* (column [2]) and it becomes insignificant for the *Social score* (column [6]). These findings imply that the observed differences between PRI and non-PRI signatories in terms of the portfolio-level ESG scores are partly driven by portfolio characteristics, such as the

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[14] In Figure IA1 of the Internet Appendix, we plot the distribution of portfolio-level ESG scores between PRI and non-PRI institutions. The univariate graphs show two interesting patterns. First, from the density graph it seems as if PRI institutions have slightly higher mean and median portfolio-level ESG scores. Secondly, the distribution of portfolio-level scores of non-PRI institutions has a fatter left tail, suggesting that in the non-PRI population there are more institutions that have low portfolio-level ESG scores.

[15] While we choose to concentrate our analysis on mean portfolio-level scores, in Table IA3 of the Internet Appendix, we analyze the extent to which investors allocate capital to firms with extremely low or extremely high firm-level ESG scores. To do so, we calculate the fraction of the portfolio that is allocated to the stocks with the highest overall ESG scores (fourth quartile [Q4] of the overall ESG score distribution at the firm-level) versus the fraction of the portfolio that is allocated to the stocks with lowest firm-level ESG scores (first quartile [Q1]). We find that PRI signatories invest more in stocks with the highest ESG scores than non-PRI signatories.

number of stocks, industry concentration, portfolio turnover, or portfolio activeness. We further find that European investors have better portfolio-level ESG scores, while North American investors tend to exhibit better *Governance score*, but lower *Environmental score* and *Social score*. These could be related to a generalized interpretation of US fiduciary standards that prevent social or environmental concerns to affect investment decisions.[16] We also see that portfolio turnover is negatively associated with ESG scores, which is consistent with previous results for US institutions in Starks, Venkat and Zhu (2018).

PRI signatory institutions could be systematically different from non-PRI institutions and address this issue using two additional tests. First, we examine whether PRI signatories increase their portfolio-level ESG scores after becoming a PRI signatory. Table 3 runs difference-in-difference regressions, in which we match each PRI signatory to one non-PRI institution based on the logarithm of AUM, region and institution type (using a nearest-neighbor algorithm without replacement) and estimate the PRI signing-effect on portfolio-level ESG scores measured in the years [-3;+3] around the signature dates. These regressions include year, region and type fixed effects as well as controls for portfolio characteristics. We find that PRI signatories significantly increase their *Total ESG score*, *Social score* and *Governance score* in the years after joining the PRI (compared to the non-PRI control institution).

In the second test, we address endogeneity concerns more directly by instrumenting the *PRI dummy* with the staggered adoption of investor stewardship codes in different countries. A stewardship code indicates investors' responsibilities on how they should integrate ESG factors and monitor their investments. The first code was introduced in the UK in 2012 and, among other principles, required institutional investors to monitor their investee companies, having a clear policy on voting and publicly disclosing their stewardship and voting activities.[17] Some codes are initiated by regulators (e.g. UK's Financial Reporting Council), while others were introduced by industry bodies (e.g. Canadian Coalition

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[16] For example, in 2015 the US Department of Labor (IB 2015-01) had to clarify that ESG criteria could be used in fiduciaries' investment framework. The previous interpretation of the Employee Retirement Income Security Act of 1974 (ERISA) was that fiduciaries were not permitted to sacrifice the economic interests of pension plan participants to promote collateral goals such as social, environment or other public policy causes.
[17] The UK Stewardship code 2020 revises the original 2012 version and is scheduled to take effect from 1 January 2020 (https://www.frc.org.uk/investors/uk-stewardship-code).

for Good Governance). The instrumental variable *Stewardship Code* takes the value of 1 for country-year observations that are covered by a stewardship code.[18] The first-stage regression in column (1) of Table 4 shows that when stewardship codes are present in a country, institutions are significantly more likely to be PRI signatories. The remaining columns ((2)-(5)) show the second-stage regressions. These confirm the findings of previous analyses: PRI institutions have significantly higher *Total ESG score*, *Social score* and *Governance score* but no better *Environmental score* than non-PRI institutions.[19]

We conclude that there is some evidence that PRI signatory institutions have better portfolio-level ESG footprints, especially with respect to *Governance score*. This evidence is consistent with PRI signatory institutions "walking (some of) the ESG talk".

4. Implementing Responsible Investing

4.1. What do PRI Signatories Report as Responsible Investment Strategies?

One empirical challenge in responsible investing is that it can mean different things to different investors. While there is no official classification of the various ESG investment styles pursued by institutional investors, the academic and professional literature (see, in particular, Amel-Zadeh and Serafeim, 2018; CFA Institute, 2015; and GSIA, 2016) identifies at least six different ESG strategies. Adjusting these to our context of public equities investing, we adopt the following classification:

1. **[Neg] Negative/exclusionary screening:** the exclusion from a fund or portfolio of certain sectors, companies or practices based on specific ESG criteria;

2. **[Pos] Positive/best-in-class screening:** investment in sectors or companies selected for positive ESG performance relative to industry peers;

3. **[N-b] Norms-based screening:** screening of investments against minimum standards of business practice based on international norms;

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[18] We obtain the years of introduction of the stewardship code in each country from the OECD (2017, Table 3) report. Japan, for example, the Financial Services Agency introduced the stewardship code "Principles for Responsible Institutional Investors" in 2014.

[19] The estimated coefficients on the *PRI dummy* in the instrumental variable approach are larger than those in the corresponding OLS models (Table 2). The reason for this could be that the instrumental variable approach estimates the Local Average Treatment Effect (LATE), which is the effect of signing the PRI for the subset of institutions that are affected by an investor stewardship code. The OLS model, by contrast, estimates the effect of signing the PRI for the average sample firm.

4. **[Int] Integration:** the systematic and explicit inclusion by investment managers of environmental, social and governance factors into financial analysis;

5. **[The] Thematic:** investment in themes or assets specifically related to sustainability (for example clean energy, green technology or sustainable agriculture);

6. **[Eng] Engagement:** individual corporate engagement and shareholder action, collaborative corporate engagement and shareholder action and internal voting;

   a. **[Indiv eng] Individual corporate engagement and shareholder action:** the use of shareholder power to influence corporate behavior, including through direct corporate engagement (i.e., communicating with senior management and/or boards of companies) and filing or co-filing shareholder proposals. In this case, the engagement is to be carried out solely by the investor's internal staff without involvement from other investors;

   b. **[Colla eng] Collaborative corporate engagement and shareholder action:** the conduct of corporate engagement, as defined above, however it is undertaken jointly with other investors;

   c. **[Int vot] Internal voting:** the use of proxy voting that is guided by comprehensive ESG guidelines where the voting decisions are undertaken internally and not outsourced to an external service provider.

In Panel A of Table 5, we provide descriptive statistics on the percentage of signatories' AUM that is covered by a screening, thematic, or integration strategy (obtained from LEI 01.1 question of the PRI survey – see Figure IA.5 in the Internet Appendix). The statistics are based on the overall sample period, a yearly breakdown from 2013 until 2017, geographic regions, investors types and investor size (as proxied by their equity AUM) of the PRI signatories. The same information is illustrated graphically in Figure IA2 of the Internet Appendix. We observe that 66% of the signatories' AUM is covered by integration strategies, followed by screening strategies (50% of AUM) and thematic strategies (only 11% of AUM). These strategies are not mutually exclusive with most AUM being covered by multiple strategies (e.g. integration plus screening).

In Panel B of Table 5, we provide descriptive statistics for the frequency by which PRI signatories report the use of responsible investment strategies (LEI 04.1 of the PRI survey – see question in Figure IA.6 and univariate plots in Figure IA3 of the Internet Appendix). We observe that the dominant strategies pursued by PRI signatories are engagement (especially individual and internal voting), ESG integration and negative screening. Over time, PRI signatories have placed increasing emphasis on norms-based, positive screening and thematic strategies which is in line with the GSIA (2016) report noticing material growth rates in these strategies. Second, we see that, there is wide heterogeneity in terms of how the adoption of certain strategies differs across geographies, investors' types and investors' size. PRI signatories from Europe show a higher frequency of negative, positive and norm-based screening strategies, while signatories from Asia-Pacific place more emphasis on integration and engagement strategies. We also observe that investment managers more often pursue negative, positive and thematic screening than asset owners. Larger institutions tend to prefer negative, thematic, integration and engagement strategies relative to smaller institutions.

4.2. Are Reported Responsible Investing Strategies Related to Actual ESG Portfolio Footprints?

Table 6 analyzes which responsible investment strategies most effectively influence the ESG score of the PRI signatories. We use six different variables (obtained from LEI 01.1 and LEI 04.1 of the PRI survey) to capture the signatories' responsible investment strategies: *%-Screening:Negative*, *%-Screening:Positive*, *%-Screening:Norms*, *%-Thematic*, *%-Integration* and an *Engagement* dummy. The percentage variables measure the percentage of AUM that is covered by a responsible investment strategy. Definitions of these variables are provided in Appendix A1. For example, *%-Screening:Negative* is calculated by multiplying the percentage of equities to which screening is applied (LEI 01.1) and multiply it by *Neg* dummy on whether an investor any form of negative/exclusionary screening (LEI 04.1 of the PRI survey). The regressions include year, region and type fixed effects.

The main results of Table 6 can be summarized as follows. First, we observe that positive screening/best-in-class strategies have a positive association with *Total ESG score*, *Environmental score*, *Social scor*e and *Governance score*. Second, we observe that the other responsible investment strategies do not significantly affect the ESG scores either because these are ineffective, or may be still

in early stages of adoption or just the fact that there is no agreement on how these strategies are defined among the PRI survey participants.

In Table IA4 of the Internet Appendix, we further estimate the effect of employee involvement on ESG portfolio footprints. The main variables of interest are dummies that take the value of 1 if different corporate roles are involved in the implementation and/or oversight of responsible investment strategies. While most corporate roles (e.g. executives, investment staff, ESG staff, or external managers) are significantly affect ESG scores, we find that investor relation is negatively associated with portfolio-level ESG scores which could be an indication of some "greenwashing".

5. Risk-Return Implication of Responsible Investing

5.1. Holdings-Based Returns of Institutional Investors

Following Gibson and Krueger (2018), we calculate the monthly returns of an institutional investor as the buy-and-hold returns based on an institution's disclosed equity holdings (for which ESG scores are available). This variable measures an hypothetical gross return of the long equity portion of the institutional investor's portfolio. We calculate the holdings-based returns by assuming that investors trade their positions only when the new equity holdings are observed (usually at quarter-ends). This implies no interim trading between reported quarter-ends. We start by constructing standard mean-variance investment performance measures (*mean(return)*, *std(return)* and *Sharpe*) the decomposition of risk (*systematic*, *idiosyncratic*) as well as downside risk measure *semivar* as in Hoepner, Oikonomou, Sautner, Starks and Zhou (2018). We calculate the performance measures over 12 months and use AQR's global equity market factor as the benchmark to compute risk-adjusted performance *alpha1F*. Worldwide stock returns are obtained from Datastream. Detailed variable definitions are provided in Appendix A1. Table IA5 of the Internet Appendix provides descriptive statistics for investors' holdings-based returns. Institutional investors have a mean monthly return of 0.95%, a standard deviation of 4.92% and a 1-factor alpha of 0.09% between 2003 and 2017. Given that the holdings-based returns are gross returns (i.e. they do not include transaction costs or management fees), the average institution likely underperforms its benchmark after fees.

5.2. Do PRI Signatories Exhibit Different Portfolio Performance?

To analyze the risk-return implications, we estimate OLS regressions in Table 7 where we use the holdings-based returns as a dependent variable. The main variable of interest is the *PRI dummy*. We also control for region, type and year fixed effects as well as for portfolio characteristics. Standard errors are clustered at the institution level and year level. The sample period is again from 2003 to 2017.

In Table 7, we observe that PRI signatories have significantly lower returns, higher portfolio risks (as indicated by a negative standard deviation and a positive semi-variance) and lower 1-factor alphas. The 1-factor alpha indicates that institutional investors significantly underperform the global equity market benchmark by 0.1% per month (or 1.2% per annum). The underperformance could be the result of constrained portfolio optimization. To investigate whether PRI signatories underperform because of different social preferences, we control for portfolio-level ESG scores. We observe no change in the coefficient estimates of the *PRI dummy*, suggesting that differences in portfolio-level ESG scores do not explain the underperformance of PRI signatories. [20]

Alternatively, we estimate monthly calendar-time portfolio regressions, which allow us to control for systematic risk differences between PRI and non-PRI signatories. In Panel A of Table 8, we observe that PRI signatories have a monthly 4-factor alpha of 0.02% (equal-weighted) and 0.08% (value-weighted), while non-PRI signatories have an alpha of 0.12% (equal-weighted) and 0.11% (value-weighted). This suggests that PRI signatories underperform non-PRI signatories by 0.04% to 0.10% per month. The difference is statistically significant with the equal-weighted but not with the value-weighted portfolio. However, we find significant underperformance in both equal- and value-weighted portfolios when we employ a 7-factor model used in more recent research on the "sin stock anomaly" of companies in the alcohol, tobacco and gambling industries (Blitz and Fabozzi (2017)).

In Panel B of Table 8, we double-sort the portfolios on PRI signatory status and on the median portfolio-level ESG score and estimate the 4-factor alphas. We find that PRI signatories with above-

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[20] Table IA6 of the Internet Appendix splits the *Total ESG score* control variable into *Environmental score*, *Social score* and *Governance score* control variables. The coefficient estimates of the *PRI dummy* are qualitatively similar to the ones in Panel B of Table 7.

median ESG scores do not have a significantly different performance than non-PRI with above-median ESG scores. However, we observe a significant underperformance of PRI signatories with below-median ESG scores versus non-PRI with below-median ESG scores, with alphas ranging between 0.11% (value-weighted) and 0.15% (equal-weighted) per month.

We conclude that there is some evidence that PRI signatories have a lower investment performance than non-PRI signatories, suggesting that "doing well by doing good" might not hold. However, we cannot relate the underperformance to differences in the portfolio-level ESG scores.

5.3. Are Reported Responsible Investing Strategies Related to Portfolio Performance?

We now turn to analyze the effects of the different responsible investment strategies on the institutions' holdings-based returns in Table 9. As in Table 6, we use six variables from the PRI survey (LEI 01.1 and LEI 04.1) to capture the responsible investment strategies: *%-Screening:Negative*, *%-Screening:Positive*, *%-Screening:Norms*, *%-Thematic*, *%-Integration* and an *Engagement* dummy. Definitions of these variables are provided by Appendix A1. Since this analysis requires the PRI reporting data, the sample period is from 2013 to 2017.

In columns (1), (3) and (4), we observe an insignificant relation between responsible investment strategies and mean returns, Sharpe ratios or the 1-factor alphas. However, in columns (2) and (7), we find that three responsible investment strategies (negative screening, ESG integration and engagement) have a significant *negative* effect on portfolio risks measured by the standard deviation and semi-variance of returns. In columns (5) and (6), we differentiate between idiosyncratic and systematic portfolio risks and observe that responsible investment strategies primarily lower idiosyncratic risks. Interestingly, there is one exception to the risk-reduction effect of responsible investment strategies: norms-based screening has a significant *positive* effect on portfolio risks, especially on idiosyncratic risks.

Taken together, the evidence from Tables 8 and 9 suggest that there are important differences among PRI signatories. Some PRI signatories truly adopt responsible investing strategies and seem to

have higher ESG footprints and lower idiosyncratic portfolio risks, while others pledge to it but fall short of implementing it. We conclude that it is important to separate between these investors.

6. Conclusions

We analyze the largest global network focused on responsible investment (PRI) and combine it with institutional investor equity portfolio holdings around the world. We document the considerable growth in the number and assets under management of PRI signatory institutions but also find considerable investor heterogeneity with larger and European-based investors more likely to commit to responsible investing. Our results show that institutional investors who join the PRI exhibit better portfolio-level ESG performance, particularly on the governance scores, but differences are not overwhelmingly large.

We then explore unique survey data which shows that PRI signatories predominantly implement responsible investment through engagement, ESG integration and negative/exclusionary screening. Thematic investments is still niche. However, when we test for the impact of these responsible investment strategies, we do not find strong evidence that portfolio-level ESG performance is related to the reported implementation strategies (except for positive/best-in-class screening).

Finally we ask if there are costs associated with responsible investing? We uncover mild evidence of lower portfolio returns when we compare buy-and-hold equity portfolio returns for PRI signatories compared to non-PRI signatories. When we analyze PRI signatory strategies, we find some evidence that negative screening, integration and engagement lower portfolio risk.

This paper leaves open many questions for future research. In particular, what are the real effects of initiatives such as the PRI in achieving change in ESG practices in the investee companies and how much do these contribute to fulfill the UN sustainable development goals. Our sample period is relatively short given how recent is the PRI initiative and our analysis was also limited to publicly-listed equities. The impact of responsible investing could take time to be realized or be higher when firms are seeking financing in private equity markets, fixed income or directly in infrastructure or real estate investments. The empirical challenge is that there is much less portfolio-level information on those asset classes as there is for the institutional investor equity holdings that we examined in this paper.

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Fig. 1. Descriptive statistics on PRI signatory institutional investors

PRI denotes those institutional investors in the FactSet Ownership data that signed the UN Principles for Responsible Investment (PRI). *Non-PRI* denotes all institutional investors in the FactSet data that did not sign the PRI. Panel A plots the number of PRI signatories and non-PRI signatories. Panel B shows the coverage in terms of assets under management (AUM in USD billion is computed as the sum of the market value of equity holdings for which we have portfolio-level ESG scores). Panel C compares the percentage of investors by geographic region of domicile. Panel D compares the percentage of investors by type (investment managers or asset owners). Panel E compares the percentage of investors by size. The sample period is from 2003 to 2017.
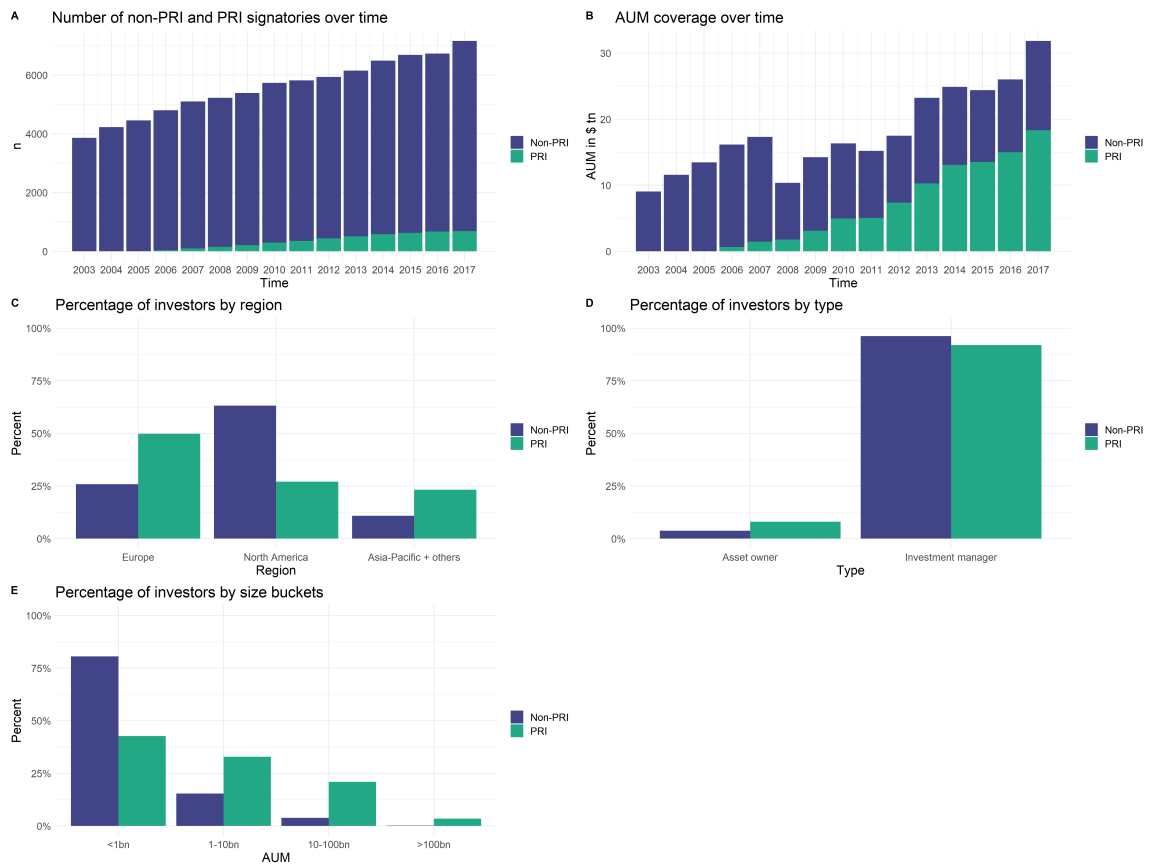
Table 1. Summary statistics on PRI signatories vs. non-PRI institutional investors

This table compares the characteristics of PRI signatory institutional investors to non-PRI investors in the FactSet Ownership data in 2006, 2012, and 2017. PRI signatories are institutional investors that reported in the PRI listed equity module that could be matched to FactSet Ownership data on portfolio holdings, Datastream stock returns, and to ESG company ratings. *Number of investors* counts the number of institutional investors in each group. *AUM coverage* corresponds to the sum of the market value of equity holdings for which ESG scores are available. Variable definition for portfolio characteristics are provided in Appendix A1.

	PRI			Non-PRI			All
	2006	2012	2017	2006	2012	2017	All
Number of investors	36	439	684	4762	5498	6481	10689
AUM coverage (USD, trillion)	0.65	7.37	18.35	15.52	10.13	13.52	271.61
by Region							
Europe	61.11%	51.25%	47.81%	29.40%	25.17%	19.90%	27.23%
North America	19.44%	23.01%	31.43%	63.06%	61.15%	68.34%	61.19%
Asia-Pacific + others	19.44%	25.74%	20.76%	7.54%	13.68%	11.76%	11.58%
by Type							
Asset owner	30.56%	8.66%	5.41%	5.29%	3.15%	2.04%	4.01%
Investment manager	69.44%	91.34%	94.59%	94.71%	96.85%	97.96%	95.99%
by AUM (USD)							
<1bn	27.78%	41.91%	42.11%	77.78%	81.99%	80.50%	78.46%
1-10bn	25.00%	35.08%	33.19%	16.82%	14.62%	15.75%	16.39%
10-100bn	47.22%	19.59%	19.88%	5.08%	3.27%	3.47%	4.76%
>100bn	0.00%	3.42%	4.82%	0.31%	0.11%	0.28%	0.40%
Portfolio characteristics							
Total ESG score	0.36	0.18	0.22	0.12	0.01	0.01	0.05
Number of Stocks	1187	805	819	276	211	207	269
Industry Concentration	0.00	0.01	0.02	0.01	0.02	0.04	0.02
Portfolio Turnover	0.28	0.27	0.28	0.40	0.37	0.33	0.37
Portfolio Activeness	0.69	0.82	0.82	0.89	0.90	0.88	0.88

Table 2. What is the ESG portfolio footprint of PRI signatory institutional investors?

This table regresses portfolio-level ESG scores on a *PRI dummy* (whether an investor is a PRI signatory or not) and on institutional investors' characteristics. The dependent variables are the four value-weighted ESG scores of institutional investors' equity portfolios: *Total ESG score*, *Environmental score*, *Social score*, and *Governance score*. Appendix A1 provides definitions of the independent variables. Robust standard errors clustered at the investor-level and year-level are reported in parentheses. The sample period is from 2003 to 2017. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels.

	Dependent variable:							
	Total ESG score		Environmental score		Social score		Governance score	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
PRI dummy	0.1***	0.03**	0.02	−0.02	0.05***	0.01	0.1***	0.1***
	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)
Europe	0.5***	0.4***	0.4***	0.3***	0.3***	0.3***	0.5***	0.4***
	(0.03)	(0.03)	(0.02)	(0.02)	(0.03)	(0.03)	(0.04)	(0.04)
North America	0.2***	0.04	0.02	−0.1***	−0.04**	−0.1***	0.6***	0.6***
	(0.03)	(0.03)	(0.03)	(0.03)	(0.02)	(0.02)	(0.05)	(0.04)
Investment manager	−0.1***	−0.02	−0.1***	−0.01	−0.1***	−0.03	−0.04**	0.01
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Number of Stocks		−0.1***		−0.1***		−0.04***		−0.1***
		(0.01)		(0.01)		(0.01)		(0.01)
Industry Concentration		−0.5***		−0.5***		−0.4***		−0.2***
		(0.04)		(0.04)		(0.03)		(0.02)
Portfolio Turnover		−0.2***		−0.2***		−0.2***		−0.1***
		(0.01)		(0.01)		(0.01)		(0.01)
Portfolio Activeness		−1.8***		−2.0***		−1.5***		−1.0***
		(0.1)		(0.1)		(0.2)		(0.1)
AUM	0.02***	−0.01***	0.02***	−0.01***	0.02***	−0.01***	0.01***	−0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	83,768	76,356	83,768	76,356	83,768	76,356	83,768	76,356
Adjusted R^2	0.1	0.3	0.1	0.3	0.1	0.3	0.2	0.3

Table 3. Is there a PRI-signing effect on an investors' ESG portfolio footprint? Difference-in-difference regressions

This table regresses portfolio-level ESG scores on a *PRI dummy*, a *Post-signature dummy*, and institutional investors' characteristics. The dependent variables are the four value-weighted portfolio-level ESG scores. *Post-signature dummy* takes the value 1 for country-year observations from the signature year onwards (also for matched non-signatories), and 0 otherwise. *PRI dummy* takes the value 1 for PRI signatories, and 0 for matched non-signatories *Post-signature x PRI* interacts the previous two dummies. Definitions for the other independent variables are provided in Appendix A1. Robust standard errors clustered at the investor-level and year-level are reported in parentheses. The sample period is from 2003 to 2017, but trimmed to [-3;+3] years around the signature dates. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels.

	Dependent variable:			
	Total ESG score	Environmental score	Social score	Governance score
	(1)	(2)	(3)	(4)
Post-signature x PRI	0.04**	0.01	0.04***	0.03**
	(0.02)	(0.01)	(0.01)	(0.02)
Post-signature dummy	−0.03*	−0.02*	−0.03**	−0.01
	(0.01)	(0.01)	(0.01)	(0.01)
PRI dummy	0.05**	0.06***	0.03	0.02
	(0.02)	(0.02)	(0.02)	(0.02)
Number of Stocks	−0.04***	−0.03**	−0.00	−0.09***
	(0.01)	(0.01)	(0.01)	(0.01)
Industry Concentration	−0.73***	−0.63***	−0.63***	−0.47***
	(0.09)	(0.08)	(0.09)	(0.10)
Portfolio Turnover	−0.24***	−0.21***	−0.25***	−0.07**
	(0.03)	(0.03)	(0.03)	(0.03)
Portfolio Activeness	−0.94***	−0.93***	−0.56***	−1.07***
	(0.10)	(0.10)	(0.09)	(0.10)
AUM	−0.00	−0.00	−0.01**	0.01
	(0.01)	(0.01)	(0.01)	(0.01)
Year fixed effects	Yes	Yes	Yes	Yes
Region fixed effects	Yes	Yes	Yes	Yes
Type fixed effects	Yes	Yes	Yes	Yes
Observations	8,610	8,610	8,610	8,610
Adjusted R^2	0.26	0.28	0.26	0.26

Table 4. Is there a PRI-signing effect on investors' ESG portfolio footprint? Instrumental variables using stewardship codes

This table regresses portfolio-level ESG scores on an *instrumented PRI dummy* and institutional investors' characteristics (using a two-stage least squares estimation). The dependent variable of the first stage is the *PRI dummy* that takes the value of 1 for investors that are PRI signatories from the signature year onwards. The dependent variables for the second stage are the value-weighted portfolio-level ESG scores. The instrumental variable, *Stewardship code*, takes the value of 1 for country-year observations that are covered by a stewardship code obtained from the "Investment governance and the integration of environmental, social and governance factors" report by the OECD (2017, Table 3), and 0 otherwise. *Instrumented PRI Dummy* is the predicted value obtained from the first-stage regression. The definitions for the independent variables are provided in Appendix A1. Robust standard errors clustered at the investor-level and year-level are reported in parentheses. The sample period is from 2003 to 2017. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels.

	Dependent variable:				
	PRI dummy First stage	Total ESG score	Environmental score Second stage	Social score	Governance score
	(1)	(2)	(3)	(4)	(5)
Stewardship code	0.06*** (0.02)				
Instrumented PRI Dummy		1.99*** (0.38)	0.39 (0.25)	1.57*** (0.39)	2.47*** (0.74)
Europe	−0.03** (0.01)	0.39*** (0.03)	0.29*** (0.02)	0.27*** (0.03)	0.46*** (0.04)
North America	−0.11*** (0.02)	0.25*** (0.06)	−0.06 (0.05)	0.04 (0.06)	0.83*** (0.08)
Investment manager	−0.04** (0.01)	0.05 (0.04)	−0.00 (0.03)	0.02 (0.04)	0.09* (0.05)
Number of Stocks	0.01** (0.00)	−0.08*** (0.01)	−0.07*** (0.01)	−0.05*** (0.01)	−0.07*** (0.01)
Industry Concentration	0.04*** (0.01)	−0.56*** (0.05)	−0.49*** (0.05)	−0.47*** (0.04)	−0.35*** (0.05)
Portfolio Turnover	0.00 (0.00)	−0.21*** (0.02)	−0.20*** (0.01)	−0.20*** (0.01)	−0.08*** (0.02)
Portfolio Activeness	−0.09** (0.04)	−1.68*** (0.16)	−1.93*** (0.11)	−1.32*** (0.19)	−0.83*** (0.15)
AUM	0.02*** (0.00)	−0.05*** (0.01)	−0.02** (0.01)	−0.04*** (0.01)	−0.05*** (0.01)
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Observations	76,356	76,356	76,356	76,356	76,356

Table 5. Summary statistics: Responsible investment strategies

This table compares the responsible investment strategies of PRI signatories as reported in the PRI surveys from 2013 to 2017. Panel A shows the percentage of signatories' AUM that is covered by a responsible investment strategy (*%-Screening, %-Thematic, %-Integration*). Panel B provides the frequency by which PRI signatories report using negative screening (*Neg*), positive screening (*Pos*), norms-based screening (*N-b*), thematic investment (*The*), integration of ESG factors (*Int*), and engagement (*Eng*). Overall engagement (*Eng*) is further broken down into individual engagement (*Indiv eng*), collaborative engagement (*Colla eng*), and internal voting (*Int vot*). Detailed definitions of these variables are available in Appendix A1.

Panel A: PRI strategies: Percentage of AUM

| | PRI | | | |
	Total	%-Screening	%-Thematic	%-Integration
Overall	2,796	50%	11%	66%
by Year				
2013	442	46%	8%	62%
2014	497	49%	10%	61%
2015	556	51%	11%	65%
2016	625	50%	12%	68%
2017	676	51%	13%	69%
by Region				
Europe	1,379	60%	12%	62%
North America	777	37%	11%	62%
Asia-Pacific + others	640	42%	10%	77%
by Type				
Asset owner	184	57%	8%	67%
Investment manager	2,612	49%	11%	65%
by AUM (USD)				
<1bn	1,202	47%	12%	58%
1-10bn	919	55%	10%	68%
10-100bn	560	49%	10%	75%
>100bn	115	43%	12%	79%

Table 5. Summary statistics: Responsible investment strategies (contd.)

Panel B: PRI strategies: Dummy variables

						PRI				
	Total	Neg	Pos	N-b	The	Int	Eng	Indiv eng	Colla eng	Int vot
Overall	2,796	68%	38%	33%	33%	77%	86%	81%	65%	72%
by Year										
2013	442	61%	26%	19%	27%	83%	73%	79%	68%	64%
2014	497	64%	32%	29%	29%	84%	72%	78%	65%	71%
2015	556	70%	38%	30%	32%	87%	76%	81%	62%	74%
2016	625	69%	42%	38%	37%	88%	78%	82%	65%	75%
2017	676	71%	47%	41%	37%	87%	82%	83%	68%	74%
by Region										
Europe	1,379	72%	42%	44%	35%	85%	76%	79%	66%	67%
North America	777	63%	32%	22%	30%	81%	72%	74%	60%	67%
Asia-Pacific + others	640	65%	36%	20%	32%	95%	85%	91%	70%	89%
by Type										
Asset owner	184	51%	18%	38%	15%	91%	72%	86%	76%	84%
Investment manager	2,612	69%	40%	32%	34%	86%	77%	80%	65%	71%
by AUM (USD)										
<1bn	1,202	60%	34%	25%	29%	78%	69%	73%	55%	65%
1-10bn	919	70%	38%	36%	28%	90%	79%	82%	69%	73%
10-100bn	560	77%	46%	40%	47%	94%	89%	92%	78%	82%
>100bn	115	91%	40%	45%	48%	100%	91%	96%	84%	98%

Table 6. Is there an effect of responsible investment strategies on ESG portfolio footprints?

This table regresses portfolio-level ESG scores on the reported implementation of responsible investment strategies by PRI signatories. The dependent variables are the value-weighted portfolio-level ESG scores. The independent variables are the percentage of AUM effected by a responsible strategy (*%-Screening, %-Thematic, %-Integration*) and a dummy taking the value of 1 for institutional investors who engage with firms on ESG issues (*Engagement*). More detailed variable definitions are available in Appendix A1. Robust standard errors clustered at the investor-level and year-level are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels. The sample period is from 2013 to 2017.

	Dependent variable:			
	Total ESG score (1)	Environmental score (2)	Social score (3)	Governance score (4)
%-Screening:Negative	−0.01 (0.03)	−0.00 (0.03)	0.01 (0.02)	−0.04 (0.03)
%-Screening:Positive	0.08*** (0.03)	0.09*** (0.03)	0.05** (0.03)	0.06* (0.03)
%-Screening:Norms	0.00 (0.03)	−0.02 (0.03)	0.01 (0.03)	−0.03 (0.03)
%-Thematic	0.04 (0.04)	0.01 (0.03)	0.01 (0.03)	0.06 (0.05)
%-Integration	−0.00 (0.02)	−0.01 (0.02)	−0.01 (0.02)	0.01 (0.03)
Engagement	0.04 (0.05)	0.04 (0.04)	0.02 (0.04)	0.02 (0.04)
Number of Stocks	0.03 (0.02)	0.03** (0.01)	0.05*** (0.02)	−0.07*** (0.02)
Industry Concentration	−0.60*** (0.14)	−0.56*** (0.16)	−0.56*** (0.10)	−0.16 (0.24)
Portfolio Turnover	−0.26*** (0.08)	−0.14** (0.07)	−0.25*** (0.07)	−0.18** (0.08)
Portfolio Activeness	−0.16 (0.11)	−0.32*** (0.10)	0.06 (0.09)	−0.58*** (0.16)
AUM	−0.01 (0.01)	−0.01 (0.01)	−0.02*** (0.01)	0.02 (0.01)
Year fixed effects	Yes	Yes	Yes	Yes
Region fixed effects	Yes	Yes	Yes	Yes
Type fixed effects	Yes	Yes	Yes	Yes
Observations	2,718	2,718	2,718	2,718
Adjusted R^2	0.27	0.29	0.26	0.17

Table 7. What are the holdings-based returns of PRI signatory institutional investors?

This table regresses institutional investors' performance measures on a *PRI dummy* and portfolio characteristics. The dependent variables are these yearly holdings-based performance measures: *mean(return)*, *std(return)*, *sharpe*, *alpha1F*, *systematic*, *idiosyncratic*, and *semivar*. Appendix A1 provides detailed definitions of the independent variables. Robust standard errors clustered at the investor-level and year-level are reported in parentheses. The coefficients are multiplied by 100. The sample period is from 2003 to 2017. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels.

	*Dependent variable:*													
	mean(return)		std(return)		sharpe		alpha1F		systematic		idiosyncratic		semivar	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
PRI dummy	−0.1*	−0.1	0.2**	0.2***	−2.0	−2.0	−0.1**	−0.1*	0.1	0.1*	0.1	0.1*	0.2*	0.2**
	(0.1)	(0.1)	(0.1)	(0.1)	(2.6)	(2.6)	(0.1)	(0.1)	(0.1)	(0.1)	(0.1)	(0.1)	(0.1)	(0.1)
ESG Score		−0.1		−1.0***		0.5		−0.2*		−0.2		−1.1***		−0.6***
		(0.1)		(0.1)		(1.7)		(0.1)		(0.1)		(0.1)		(0.1)
Europe	0.04	0.1	−0.7***	−0.3	5.3	5.1	−0.1	0.01	0.2	0.3*	−1.3***	−0.9***	−0.5*	−0.3
	(0.2)	(0.2)	(0.2)	(0.2)	(4.2)	(4.0)	(0.2)	(0.2)	(0.2)	(0.2)	(0.2)	(0.2)	(0.2)	(0.2)
North America	−0.01	−0.01	−1.4***	−1.3***	6.4	6.4	0.1	0.1	−0.6***	−0.6***	−1.3***	−1.2***	−0.9***	−0.9***
	(0.2)	(0.2)	(0.2)	(0.2)	(5.1)	(5.1)	(0.3)	(0.3)	(0.1)	(0.1)	(0.2)	(0.2)	(0.1)	(0.1)
Investment manager	−0.2	−0.2	−0.7	−0.7	0.9	0.9	−0.02	−0.02	−0.4	−0.4*	−0.6	−0.6	−0.1	−0.1
	(0.2)	(0.2)	(0.5)	(0.5)	(1.0)	(1.0)	(0.1)	(0.1)	(0.2)	(0.2)	(0.4)	(0.4)	(0.1)	(0.1)
Number of Stocks	−0.04	−0.05	−0.2***	−0.3***	0.3	0.3	−0.03	−0.05	0.05	0.03	−0.3***	−0.4***	−0.1	−0.1**
	(0.04)	(0.03)	(0.05)	(0.04)	(0.9)	(1.0)	(0.04)	(0.04)	(0.04)	(0.03)	(0.04)	(0.04)	(0.05)	(0.05)
Industry Concentration	−0.02	−0.1	3.9***	3.4***	−12.2**	−11.9**	−0.01	−0.1	0.4*	0.3	4.0***	3.5***	1.9***	1.6***
	(0.1)	(0.1)	(0.3)	(0.3)	(5.4)	(4.8)	(0.1)	(0.1)	(0.2)	(0.2)	(0.3)	(0.3)	(0.2)	(0.2)
Portfolio Turnover	0.4**	0.4**	1.1**	0.9*	1.3	1.4	0.3**	0.3*	0.4**	0.3**	1.0**	0.7	0.2**	0.1
	(0.2)	(0.2)	(0.5)	(0.5)	(1.5)	(1.4)	(0.1)	(0.1)	(0.2)	(0.2)	(0.5)	(0.5)	(0.1)	(0.1)
Portfolio Activeness	0.3	0.1	3.1***	1.3**	−17.7	−16.8	0.3	−0.04	2.0***	1.6***	2.9***	0.9*	2.1***	1.0**
	(0.5)	(0.4)	(0.6)	(0.5)	(13.0)	(10.7)	(0.5)	(0.4)	(0.6)	(0.5)	(0.6)	(0.5)	(0.6)	(0.5)
AUM	0.1***	0.05***	−0.03***	−0.04***	0.9***	0.9***	0.1***	0.1***	−0.02*	−0.02**	−0.04***	−0.1***	−0.03***	−0.03***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.3)	(0.3)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	76,356	76,356	76,356	76,356	76,356	76,356	76,356	76,356	76,356	76,356	76,355	76,355	72,289	72,289
Adjusted R^2	0.4	0.4	0.1	0.1	0.7	0.7	0.03	0.03	0.3	0.3	0.1	0.1	0.5	0.5

Table 8. Portfolio Performance of PRI and Non-PRI signatories

This table reports monthly calendar-time portfolio returns regressions of PRI and Non-PRI signatories. Panel A presents the risk-adjusted alphas of portfolios comprising PRI and Non-PRI signatories. The equity return factors are MKT (1-factor), MKT SMB HML UMD (4-factor), and MKT SMB HML UMD BAB RMW CMA (7-factor). Panel B shows the risk-adjusted alphas of double-sorted portfolios along PRI signatory status and above/below median ESG portfolio-level score. The benchmark model is the 4-factor model in Panel B. Newey-West standard errors are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels. The coefficients are multiplied by 100. The sample period is from 2003 to 2017.

Panel A: Single-sorted Portfolios (PRI signatory status)

	EQ(1factor)	EQ(4factor)	EQ(7factor)	VW(1factor)	VW(4factor)	VW(7factor)
PRI	0.00	0.02	−0.02	0.09**	0.08**	0.08*
Non-Pri	0.09**	0.12***	0.16***	0.12**	0.11*	0.19***
Long/Short	−0.09	−0.10*	−0.18***	−0.03	−0.04	−0.11***

Panel B: Double-sorted Portfolios (PRI signatory status and median portfolio-level ESG score)

	EQ(High ESG)	EQ(Low ESG)	EQ(Long/Short)	VW(High ESG)	VW(Low ESG)	VW(Long/Short)
PRI	−0.01	0.03	−0.04	0.07*	0.03	0.04
Non-PRI	0.06*	0.18***	−0.12*	0.08	0.14**	−0.06
Long/Short	−0.06	−0.15**		−0.02	−0.11**	

Table 9. Is there an effect of responsible investment strategies on holdings-based returns?

This table regresses institutional investors' performance measures on responsible investment strategies. The dependent variables are the yearly holdings-based performance measures of institutional investors. The independent variables are the percentage of AUM effected by a responsible strategy (*%-Screening, %-Thematic, %-Integration*) and a dummy taking the value 1 for institutional investors who engage with firms on ESG issues (*Engagement*). Robust standard errors clustered at the investor-level and year-level are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels. The coefficients are multiplied by 100. The sample period is from 2013 to 2017.

	Dependent variable:						
	mean(return) (1)	std(return) (2)	sharpe (3)	alpha1F (4)	systematic (5)	idiosyncratic (6)	semivar (7)
%-Screening:Negative	0.04 (0.04)	-0.19^{**} (0.08)	1.25 (1.53)	0.03 (0.06)	-0.06 (0.05)	-0.18^{**} (0.08)	-0.09^{*} (0.05)
%-Screening:Positive	0.06 (0.07)	-0.04 (0.08)	0.18 (2.12)	0.05 (0.09)	0.01 (0.05)	-0.09 (0.08)	-0.07 (0.05)
%-Screening:Norms	-0.05 (0.05)	0.27^{***} (0.09)	-1.74 (1.67)	-0.01 (0.13)	0.06 (0.08)	0.25^{***} (0.08)	0.23^{***} (0.04)
%-Thematic	-0.03 (0.03)	-0.08 (0.09)	2.19^{**} (0.92)	-0.12^{*} (0.07)	0.08 (0.06)	-0.06 (0.09)	-0.09 (0.09)
%-Integration	-0.03 (0.05)	-0.22^{**} (0.10)	2.23 (2.18)	0.06 (0.08)	-0.10 (0.07)	-0.24^{**} (0.10)	-0.11^{*} (0.06)
Engagement	-0.02 (0.05)	-0.38^{**} (0.15)	0.90 (1.20)	0.06 (0.12)	-0.07 (0.07)	-0.42^{**} (0.18)	-0.20^{**} (0.10)
Number of Stocks	-0.04 (0.04)	-0.39^{***} (0.10)	2.65 (3.64)	-0.01 (0.05)	-0.04 (0.03)	-0.42^{***} (0.08)	-0.25^{***} (0.07)
Industry Concentration	0.36^{**} (0.18)	4.33^{***} (1.35)	1.27 (5.60)	0.78^{***} (0.17)	0.56 (0.55)	4.29^{***} (1.16)	1.99^{***} (0.66)
Portfolio Turnover	0.18 (0.41)	-0.37 (0.40)	1.06 (8.77)	0.21 (0.45)	-0.40^{*} (0.22)	-0.25 (0.30)	0.07 (0.33)
Portfolio Activeness	-0.18 (0.41)	0.14 (0.48)	-30.20^{***} (10.43)	-0.24 (0.50)	0.27 (0.39)	0.84^{*} (0.44)	-0.13 (0.36)
AUM	0.07 (0.05)	-0.07^{*} (0.04)	1.20 (0.97)	0.04 (0.07)	-0.02 (0.03)	-0.07^{*} (0.04)	-0.03 (0.03)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Region fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Type fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,718	2,718	2,718	2,718	2,718	2,718	2,333
Adjusted R^2	0.41	0.48	0.73	0.04	0.60	0.46	0.38

Appendix

Table A1. Variable definitions

ESG scores

Sources: FactSet Ownership, MSCI IVA, ASSET4, Sustainalytics

Total ESG score	is the (value-weighted) equity portfolio-level total ESG score of an institutional investor. The first step is to calculate an equal-weighted ESG score for each stock in an investor's portfolio. We do so by taking an equal-weighted average of the normalized scores from three ESG data providers (MSCI IVA, ASSET4, and Sustainalytics) or from the ones that are available if these is no coverage for one of them. The second step is to take the value-weighted average of the portfolio using the market value of each stock position.
Environmental score	is the portfolio-level environmental score of an institutional investor.
Social score	is the portfolio-level social score of an institutional investor.
Governance score	is the portfolio-level governance score of an institutional investor.

Investment performance

Sources: FactSet Ownership, Datastream returns, AQR and Fama-French Equity Factors

mean(return)	is the mean of the portfolio holdings-based returns over 12 months. We calculate the returns of an institutional investor as the buy-and-hold returns based on an institutions' disclosed equity holdings (for which ESG scores are available). We assume no interim trading between reported quarter-ends.
std(return)	is the standard deviation of the holdings-based returns over 12 months.
sharpe	is the Sharpe ratio of the holdings-based returns over 12 months.
alpha1F	is the 1-factor alpha of the holdings-based returns over 12 months. We use AQR's global equity market factor to calculate the alpha.
systematic	is the systematic risk of the holdings-based returns over 12 months. We use AQR's global equity market factor to calculate the systematic risk.
idiosyncratic	is the idiosyncratic risk of the holdings-based returns over 12 months.
semivar	is the semi-variance of the holdings-based returns over 12 months. It is defined as the standard deviation of all negative returns. We require at least 2 negative months.

PRI signatories

Sources: PRI signatory data from 2006 to 2017 and OECD

PRI dummy	is one if the institutional investor is a PRI signatory in a given year, and zero if an investor is not a PRI signatory.
Stewardship code	takes the value of 1 for country-year observations that are covered by an investor stewardship code obtained of the "Investment governance and the integration of environmental, social and governance factors" report by the OECD (2017, Table 3), and 0 otherwise.

PRI strategies

Sources: PRI surveys from 2013 to 2017. The Internet Appendix provides descriptions of the PRI survey questions from the LEI (Listed Equity Incorporation) and LEA (Listed Equity Active Ownership) modules.

%-Screening:Negative	is the percentage of AUM covered by negative screening strategies. We take the percentage of equities to which screening is applied in LEI 01.1 and multiply it by *Negative screening (Neg)*, a dummy on whether an investor any form of negative/exclusionary screening in LEI 04.1 of the PRI survey.
%-Screening:Positive	is the percentage of AUM covered by positive screening strategies. We take the percentage of equities to which screening is applied in LEI 01.1 and multiply it by *Positive screening (Pos)*, a dummy on whether the investor uses the positive/best-in-class screening in LEI 04.1 of the PRI survey.
%-Screening:Norms	is the percentage of AUM covered by norms-based screening strategies. We take the percentage of equities to which screening is applied in LEI 01.1 and multiply it by *Norms-based screening (N-b)*, a dummy on whether the investor uses any form of norms-based screening in LEI 04.1 of the PRI survey.
%-Thematic	is the percentage of AUM covered by thematic strategies. We take the percentage of equities to which thematic investment is applied in LEI 01.1 of the PRI survey. Thematic is defined as investment in companies specifically related to sustainability (e.g. clean energy, green technology, or sustainable agriculture).
%-Integration	is the percentage of AUM covered by integration strategies. We take the percentage of equities to which thematic investment is applied in LEI 01.1 of the PRI survey. Integration is defined as the systematic and explicit inclusion by investment managers of environmental, social, and governance factors into traditional financial analysis.
Negative screening (Neg)	is one if the "Negative/exclusionary screening" type is selected in *LEI 04.1* of the PRI survey. This comprises the exclusion from a portfolio of certain sectors, companies, or practices based on specific ESG criteria.
Positive screening (Pos)	is one if the "Positive/best-in-class screening" type is selected in *LEI 04.1* of the PRI survey. This comprises the investment in companies selected for positive ESG performance relative to industry peers.
Norms-based screening (N-b)	is one if the "Norms-based screening" type is selected in *LEI 04.1* of the PRI survey. This comprises screening of investments against minimum standards of business practice based on international norms (UN Global Compact Principles, etc.).
Thematic (The)	is one if any of the options containing the word "thematic" and/or "All three strategies combined" are ticked in *LEI 01.1* of the PRI survey.
Integration (Int)	is one if any of the options containing the word "integration" and/or "All three strategies combined" are ticked in *LEI 01.1* of the PRI survey.
Engagement (Eng)	is one if any of the variables individual engagement (*Indiv eng*), collaborative engagement (*Collab eng*), or internal voting (*Int Vot*) is one.
Individual engagement (Indiv eng)	is one if the type of engagement in *LEA 02.1* of the PRI survey equals "Individual/Internal staff engagements" and the reason for interaction includes any of the following: "To influence corporate practice (or identify the need to influence) on ESG issues", "To encourage improved/increased ESG disclosure", or "Other; specify_____"

|	
Collaborative engagement (Colla eng)	is one if the type of engagement in *LEA 02.1* of the PRI survey equals "Collaborative engagements" and the reason for interaction includes any of the following: "To influence corporate practice (or identify the need to influence) on ESG issues", "To encourage improved/increased ESG disclosure", or "Other; specify_____"
Internal voting (Int vot)	is one if the approach in *LEA 16.1* of the PRI survey equals either "We use our own research or voting team and make voting decisions without the use of service providers." or "We hire service provider(s) that make voting recommendations or provide research that we use to inform our voting decisions."

Portfolio characteristics
Sources: FactSet Ownership and Datastream returns

|	
Europe	is one if the institutional investor is domiciled in Europe.
North America	is one if the institutional investor is domiciled in North America.
Investment manager	is one if the institution is an investment company or adviser and zero if it is an asset owner (pension funds, endowments, and sovereign wealth funds).
Number of stocks	is the number of unique stocks (in logs) held by an investor.
Industry concentration	is a dummy that takes the value of one if an investor holds stocks from two or less different industries.
Portfolio turnover	is the portfolio turnover of an investor. It is defined as the average portfolio churn rate of the last 4 quarters. See Gaspar, Massa, and Matos (2005) for more details.
Portfolio activeness	is the active share measure (versus the MSCI All Country World Index) of an institutional investor. We calculate active share as in Cremers and Petajisto (2009).
AUM	is the logarithm of the total market value of an investors' equity holdings for which ESG scores are available.

Internet Appendix

Fig. IA1. Densities of portfolio-level ESG scores: PRI signatories vs. non-PRI investors

PRI denotes those institutional investors in the FactSet Ownership data that signed the UN Principles for Responsible Investment (PRI). PRI Signatories are denoted *PRI* from their signature year onwards. *Non-PRI* denotes all institutional investors in the FactSet Ownership data that did not sign the PRI. The densities are computed based on value-weighted portfolio-level ESG scores for all stocks with available ESG scores. Panel A compares the *Total ESG score* for PRI and Non-PRI investors, while the other panels compare the densities of the *Environmental score* (Panel B), *Social score* (Panel C), and *Governance score* (Panel C). The sample period is from 2003 to 2017.
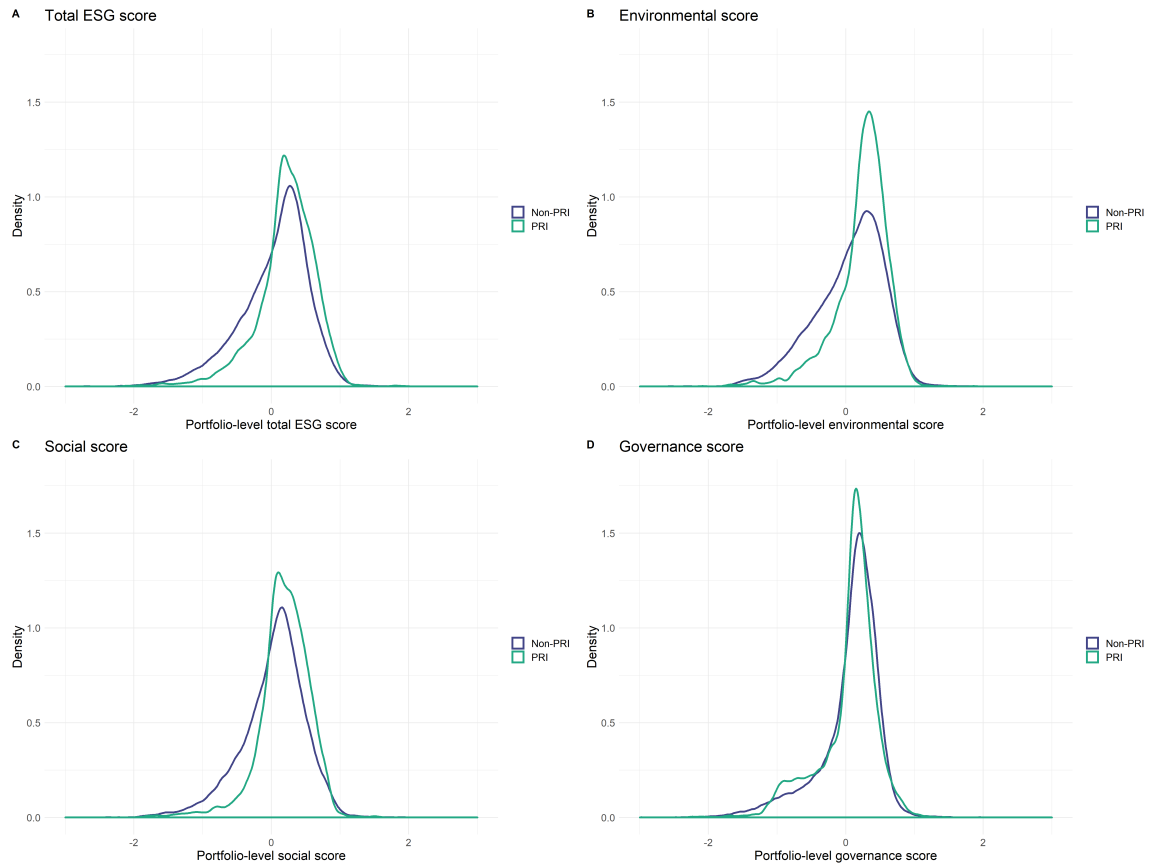
Fig. IA2. PRI signatory institutional investors: Responsible investment strategies in percentage of AUM

This figure compares the percentage of equity AUM affected by different responsible investment strategies among PRI signatories. The strategies are screening (*%-Screening*), thematic investment (*%-Thematic*), integration of ESG factors (*%-Integration*). Panel A reports the overall average percentage of AUM for the different strategies. Panel B, C, D, and E show the average percentage of AUM affected by the strategies across years, region, type, and equity portfolio size (AUM). The sample period is from 2013 to 2017.
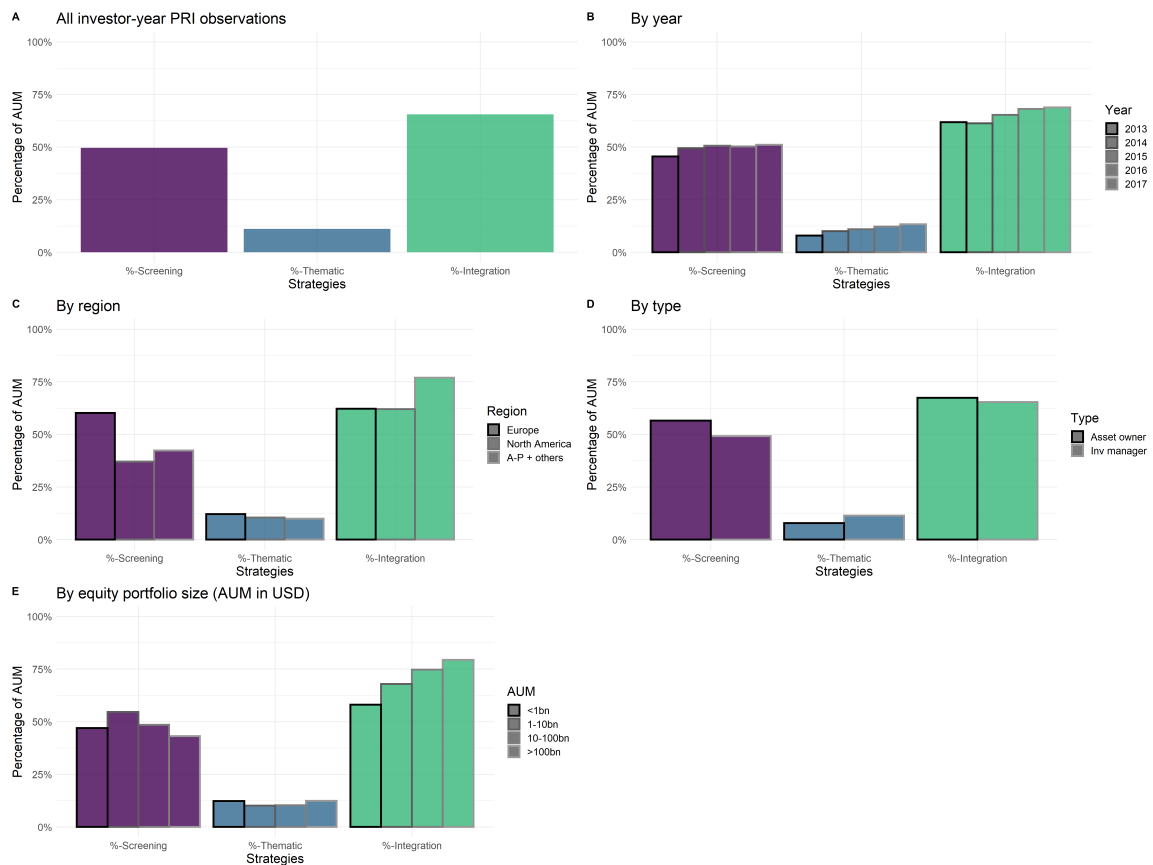
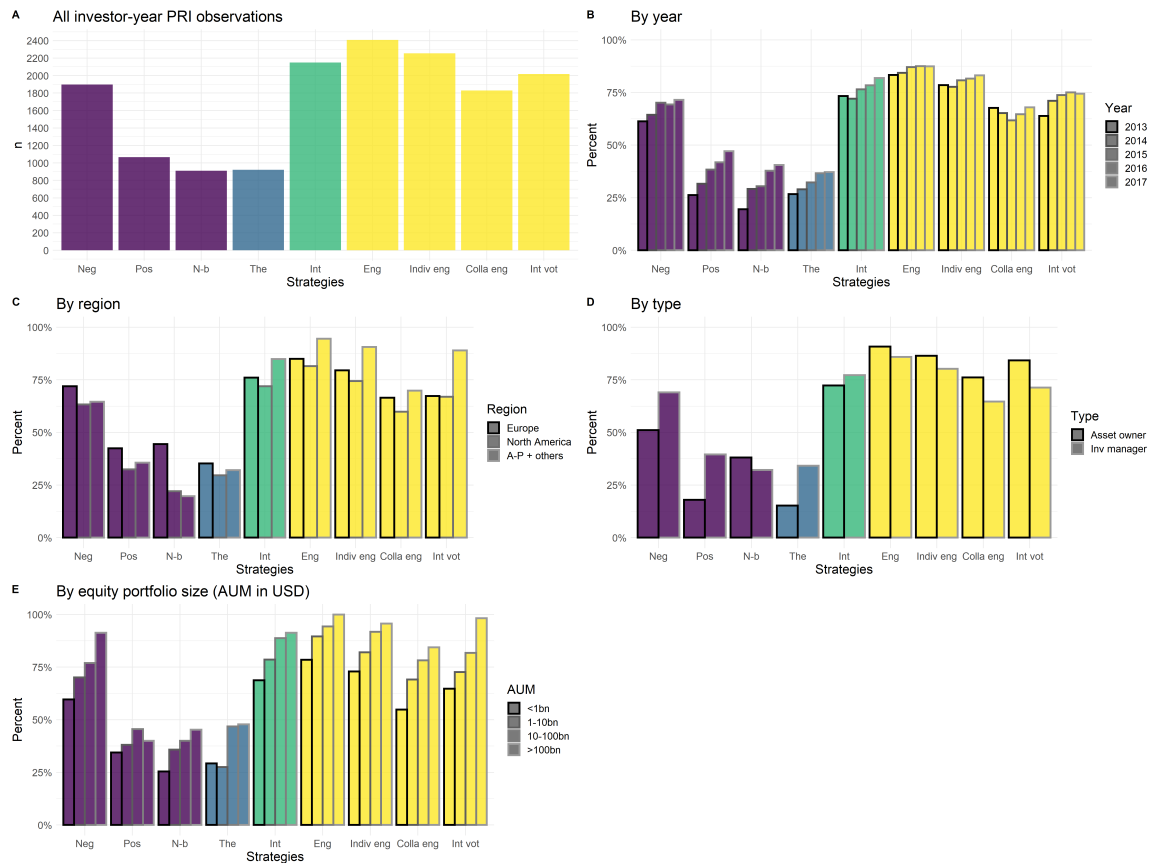**Fig. IA3.** PRI signatory institutional investors: Frequency of responsible investment strategies

This figure compares the frequency in the implementation of different responsible investment strategies among PRI signatories. The strategies are negative screening (*Neg*), positive screening (*Pos*), norms-based screening (*N-b*), thematic investment (*The*), integration of ESG factors (*Int*), engagement (*Eng*), individual engagement (*Indiv eng*), collaborative engagement (*Colla eng*), and internal voting (*Int vot*). Panel A reports the number of investor-year observations for the different strategies. Panel B, C, D, and E compare the applied strategies (in percent) by year, region, type, and equity portfolio size (AUM). The sample period is from 2013 to 2017.

Fig. IA4. Densities of holdings-based returns: PRI signatories vs. Non-PRI investors

PRI denotes those institutional investors in the FactSet Ownership data that have signed the UN Principles for Responsible Investment (PRI). *Non-PRI* denotes those investors in the FactSet Ownership data that have not signed the PRI. The densities are computed based on institutional investors' holdings-based returns. Panel A compares the mean returns (*mean(return)*). Panel B compares the standard deviation of returns (*std(return)*). Panel C compares the Sharpe ratio (*sharpe*). Panel D compares the 1-factor alpha (*alpha1F*). Panel E provides a mean-standard deviation of returns scatterplot. The sample period is from 2003 to 2017.
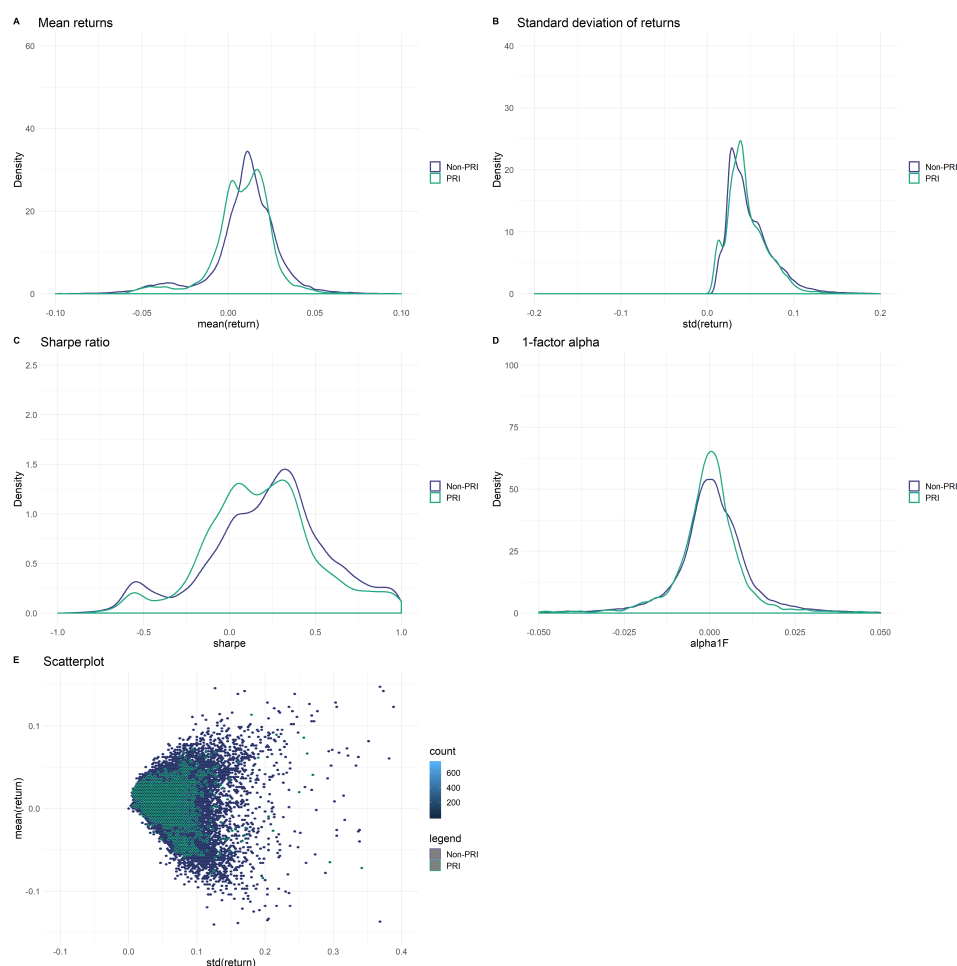
Fig. IA5. PRI Reporting Framework: Indicator LEI 01.1

Retrieved from the Listed Equity Incorporation (LEI) module of the PRI survey. Principle 1 states that PRI signatories must incorporate ESG factors into investment analysis and decision-making processes. The purpose of this indicator is to capture the proportions of the listed equity assets of the PRI signatories that are covered by different approaches in implementing this principle. For instance, if a signatory applies two strategies to the same asset, she needs to select the relevant combination options. For example, one may apply screening for only 5% of ones assets, and for the remainder a combination of screening and integration. In these cases, one would report 'Screening alone' for 5% and 'Screening and Integration strategies' for the remaining 95%. If one does not apply any incorporation approach, then the option 'We do not apply incorporation strategies' should account for 100% of your listed equity assets. *Screening* is defined as a) negative/exclusionary screening: The exclusion from a fund or portfolio of certain sectors, companies or practices based on specific ESG criteria; b) positive/best-in-class screening: Investment in sectors, companies or projects selected for positive ESG performance relative to industry peers; or c) norms-based screening: Screening of investments against minimum standards of business practice based on international norms. *Thematic* is defined as investment in themes or assets specifically related to sustainability (for example, clean energy, green technology or sustainable agriculture). *Integration* is defined as the systematic and explicit inclusion by investment managers of environmental, social and governance factors into traditional financial analysis.

	Indicator status	Purpose	Principle
LEI 01	**MANDATORY**	**CORE ASSESSED**	**PRI 1**

LEI 01	**INDICATOR**	
LEI 01.1	Indicate • which ESG incorporation strategy and/or combination of strategies you apply to your actively managed listed equities; and • the breakdown of your actively managed listed equities by strategy or combination of strategies.	
	ESG incorporation strategy (select all that apply)	**Percentage of active listed equity to which the strategy is applied — you may estimate +/- 5%**
	❑ Screening alone (i.e. not combined with any other strategies)	☐ %
	❑ Thematic alone (i.e., not combined with any other strategies)	☐ %
	❑ Integration alone (i.e., not combined with any other strategies)	☐ %
	❑ Screening and integration strategies	☐ %
	❑ Thematic and integration strategies	☐ %
	❑ Screening and thematic strategies	☐ %
	❑ All three strategies combined	☐ %
	❑ We do not apply incorporation strategies	☐ %
	Total actively managed listed equities	**100%**

Fig. IA6. PRI Reporting Framework: Indicator LEI 04.1

Retrieved from the Listed Equity Incorporation (LEI) module of the PRI survey. This indicators asks PRI signatories to describe which ESG screens are used and whether they are used in combination with other screens. Screening can be based on: a) *products*— e.g., specified weapons, tobacco; b) *activities*—e.g., specific products within a sector that is not in itself excluded such as uranium mining; c) *sectors*—e.g., oil and gas, mining; d) *countries/geographic regions*—e.g., Sudan, Iran; e) *environmental and social practices and performance*—e.g., child labor, environmental damage, sustainability reporting; or f) *corporate governance*—e.g., excessive executive remuneration, non-independent boards.

LEI 04	Indicator status	Purpose	Principle
	MANDATORY	DESCRIPTIVE	PRI 1

LEI 04	INDICATOR		
LEI 04.1	Indicate and describe the type of screening you apply to your internally managed active listed equities.		
	Type of screening	**Screened by**	**Description**
	Negative/exclusionary screening	☐ Product ☐ Activity ☐ Sector ☐ Country/geographic region ☐ Environmental and social practices and performance ☐ Corporate governance	
	Positive/best-in-class screening	☐ Product ☐ Activity ☐ Sector ☐ Country/geographic region ☐ Environmental and social practices and performance ☐ Corporate governance	
	Norms-based screening	☐ UN Global Compact Principles ☐ The UN Guiding Principles on Business and Human Rights ☐ International Labour Organization Conventions ☐ United Nations Convention Against Corruption ☐ OECD Guidelines for Multinational Enterprises ☐ Other; specify_____	

Fig. IA7. PRI Reporting Framework: Indicator LEA 02.1

Retrieved from the Listed Equity Active Ownership (LEA) module of the PRI survey. This indicators targets engagements that seek better ESG-related disclosure and transparency, and relate to Principles 2 and 3. There are many different configurations of engagement. The defining characteristics of an *individual/internal staff engagement* are: a) it is carried out by your internal staff alone; and b) it is conducted in the name of your organization. *Collaborative engagement* is engagement that an investor conducts jointly with other investors. This includes: a) groups of investors working together without the involvement of a formal investor network; b) groups of investors working together within a formal investor network, with some level of support but with individual members of the collaboration responsible for most of the engagement activity; and c) collaborative engagement coordinated and facilitated by a formal investor network (i.e. PRI coordinated investors coalitions). *Service provider engagements* include engagements conducted via: a) commercial parties that provide stand-alone engagement services without managing their clients' underlying assets; and b) investor organizations that conduct engagement on their members' behalf and that have an explicit mandate from their members to represent them. These include engagements conducted entirely on an outsourced basis as well as those facilitated by the service provider with some involvement of the investor's own staff.

LEA 02	Indicator status	Purpose	Principle
	MANDATORY	GATEWAY	PRI 1, 2, 3

LEA 02	INDICATOR
LEA 02.1	Indicate the method of engagement, giving reasons for the interaction.

	Type of engagement	Reason for interaction
	Individual/Internal staff engagements	☐ To influence corporate practice (or identify the need to influence) on ESG issues ☐ To encourage improved/increased ESG disclosure ☐ Other; specify_____ ☐ We do not engage via internal staff. 　　Please specify why your organisation does not engage via internal staff. (max. 200 words)
	Collaborative engagements	☐ To influence corporate practice (or identify the need to influence) on ESG issues ☐ To encourage improved/increased ESG disclosure ☐ Other; specify_____ ☐ We do not engage via collaborative engagements. 　　Please specify why your organisation does not engage via collaborative engagement. (max. 200 words)
	Service provider engagements	☐ To influence corporate practice (or identify the need to influence) on ESG issues ☐ To encourage improved/increased ESG disclosure ☐ Other; specify_____ ☐ We do not engage via service providers. 　　Please specify why your organisation does not engage via service providers. (max. 200 words

Fig. IA8. PRI Reporting Framework: Indicator LEA 16.1

Retrieved from the Listed Equity Active Ownership (LEA) module of the PRI survey. This indicators relates to PRI signatories' voting policies. The provided answer options are self-explanatory.

LEA 16	Indicator status MANDATORY	Purpose DESCRIPTIVE	Principle PRI 2

LEA 16	INDICATOR	
LEA 16.1	Indicate how you typically make your (proxy) voting decisions.	
	Approach	**Based on**
	○ We use our own research or voting team and make voting decisions without the use of service providers.	○ Our own voting policy ○ Our clients' requests or policy ○ Other; explain_____
	○ We hire service provider(s) that makes voting recommendations and/or provides research that we use to inform our voting decisions.	○ The service provider voting policy we sign off on ○ Our own voting policy ○ Our clients' requests or policy ○ Other; explain_____
	○ We hire service provider(s) that make voting decisions on our behalf, except for some pre-defined scenarios for which we review and make voting decisions.	○ The service provider voting policy we sign off on ○ Our own voting policy ○ Our clients' requests or policy ○ Other; explain_____
	○ We hire service provider(s) that make voting decisions on our behalf.	○ The service provider voting policy we sign off on ○ Our own voting policy ○ Our clients' requests or policy ○ Other; explain_____

Table IA1. Which institutional investors sign the PRI?

This table regresses a PRI signing dummy on institutional investors' characteristics. The dependent variable *PRI dummy* takes the value of 1 for PRI signatories from the signature year onwards. Definitions for the independent variables are provided in Appendix A1. Robust standard errors clustered at the investor-level are reported in parentheses. The sample period is from 2003 to 2017. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels.

	Dependent variable:
	PRI dummy
	(1)
Europe	−0.07 (0.07)
North America	−1.06*** (0.07)
Investment manager	−0.23** (0.11)
Number of Stocks	0.03 (0.02)
Industry Concentration	0.39** (0.15)
Portfolio Turnover	−0.15** (0.07)
Portfolio Activeness	−0.51** (0.22)
AUM	0.19*** (0.01)
Constant	−6.64*** (0.29)
Year fixed effects	Yes
Psuedo R2	0.27
Observations	76,356

Table IA2. Top institutional investors by region

This table shows the top 10 institutional investors by portfolio AUM at the parent level domiciled for each *Region. Signing year* denotes the earliest year where either the parent or any of its entities signed the PRI. The *Parent AUM* and *PRI AUM covg* are the assets under management at the parent level and the proportion (in percent) covered by the PRI signature, and are computed as the sum of the market value of equity holdings for which ESG scores are available.

Parent name	Country	Region	Signing year	Parent AUM	PRI AUM covg
Norges Bank Investment Management	NO	Europe	2006	664 bn	100 %
UBS Group AG	CH	Europe	2009	316 bn	34 %
AXA SA	FR	Europe	2007	239 bn	100 %
BPCE SA	FR	Europe	2008	239 bn	34 %
Deutsche Bank AG	DE	Europe	2008	223 bn	1 %
Janus Henderson Group Plc	GB	Europe	2006	221 bn	9 %
Schroders Plc	GB	Europe	2007	189 bn	100 %
Standard Life Aberdeen Plc	GB	Europe	2007	179 bn	100 %
Amundi	FR	Europe	2006	168 bn	41 %
Legal and General Group Plc	GB	Europe	2010	157 bn	98 %
The Vanguard Group, Inc.	US	North America	2014	2732 bn	100 %
BlackRock, Inc.	US	North America	2008	2619 bn	100 %
State Street Corp.	US	North America	2012	1328 bn	90 %
The Capital Group Cos., Inc.	US	North America	2010	1265 bn	100 %
FMR LLC	US	North America	2017	938 bn	100 %
T. Rowe Price Group, Inc.	US	North America	2010	665 bn	100 %
JPMorgan Chase and Co.	US	North America	2007	491 bn	51 %
Wellington Management Group LLP	US	North America	2012	482 bn	99 %
The Bank of New York Mellon Corp.	US	North America	2006	423 bn	54 %
Northern Trust Corp.	US	North America	2009	384 bn	95 %
Nomura Holdings, Inc.	JP	Asia-Pacific + others	2011	250 bn	52 %
Sumitomo Mitsui Trust Holdings, Inc.	JP	Asia-Pacific + others	2006	141 bn	89 %
FIL Ltd.	BM	Asia-Pacific + others	2012	135 bn	100 %
ORIX Corp.	JP	Asia-Pacific + others	2006	128 bn	32 %
Mitsubishi UFJ Financial Group, Inc.	JP	Asia-Pacific + others	2006	119 bn	45 %
Daiwa Securities Group Inc.	JP	Asia-Pacific + others	2006	59 bn	99 %
Macquarie Group Ltd.	AU	Asia-Pacific + others	2015	57 bn	0 %
Asset Management One Co., Ltd.	JP	Asia-Pacific + others	2013	51 bn	100 %
Commonwealth Bank of Australia	AU	Asia-Pacific + others	2007	43 bn	27 %
Korea National Pension Service	KR	Asia-Pacific + others	2009	38 bn	48 %

Table IA3. What is the portfolio allocation of PRI signatories to high and low total ESG score stocks?

This table regresses quartile-over-total AUM ratios on a *PRI dummy* and on institutional investors' characteristics. The dependent variables are the investors' allocation weights to stocks in the low, low-medium, top-medium and high quartiles in terms of their ESG performance (*Quartile-to-overall AUM ratio*). The quartiles in each column are determined based on the *Total ESG score* of the stocks in the FactSet Ownership data and range from low-ESG-score stocks (Q1) to high-ESG-score stocks (Q4). The *PRI dummy* takes the value of 1 for PRI signatories from the signature year onwards. Definitions for the independent variables are provided in Appendix A1. Robust standard errors clustered at the investor-level and year-level are reported in parentheses. The sample period is from 2003 to 2017. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels.

	Dependent variable:			
	Quartile-to-overall AUM ratio			
	(1) Total Q1	(2) Total Q2	(3) Total Q3	(4) Total Q4
PRI dummy	−0.01	−0.00	−0.01*	0.02**
	(0.01)	(0.00)	(0.00)	(0.01)
Europe	−0.11***	−0.05***	−0.02	0.17***
	(0.01)	(0.01)	(0.01)	(0.01)
North America	−0.02*	0.03***	0.00	−0.01
	(0.01)	(0.01)	(0.01)	(0.01)
Investment manager	0.01	0.00	−0.01	−0.00
	(0.01)	(0.01)	(0.01)	(0.01)
Number of Stocks	0.02***	0.01***	−0.01***	−0.02***
	(0.00)	(0.00)	(0.00)	(0.00)
Industry Concentration	0.20***	0.03***	−0.09***	−0.14***
	(0.02)	(0.01)	(0.02)	(0.01)
Portfolio Turnover	0.07***	0.03***	−0.00	−0.10***
	(0.01)	(0.01)	(0.01)	(0.01)
Portfolio Activeness	0.71***	0.24***	−0.35***	−0.60***
	(0.04)	(0.02)	(0.03)	(0.06)
AUM	0.00*	0.00***	−0.00**	−0.00***
	(0.00)	(0.00)	(0.00)	(0.00)
Year fixed effects	Yes	Yes	Yes	Yes
Observations	76,356	76,356	76,356	76,356
Adjusted R^2	0.20	0.11	0.09	0.30

Table IA4. What is the effect of employee involvement on ESG portfolio footprints?

This table regresses portfolio-level ESG scores on employee involvement variables and institutional investors' characteristics. The dependent variables are the four value-weighted portfolio-level ESG scores. The independent variables are dummies taking the value of 1 if different corporate roles are involved in the implementation and/or oversight of responsible investment, and 0 otherwise. *Executive staff* includes board members, C-suite level employees, and head of departments, *Investment staff* includes portfolio managers and investment analysts. *ESG staff* includes ESG portfolio managers and dedicated responsible investment staff. *External manager* includes external managers or service providers. *Investor relations* includes investor relation staff. *Other* includes various roles that respondents could specify. Appendix A1 provides definitions for the independent variables. Robust standard errors clustered at the investor-level and year-level are reported in parentheses. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels. The sample period is from 2013 to 2017.

	Dependent variable:			
	Total ESG score (1)	Environmental score (2)	Social score (3)	Governance score (4)
Executive staff	0.05 (0.04)	0.04 (0.03)	0.06* (0.03)	0.02 (0.04)
Investment staff	−0.01 (0.07)	−0.04 (0.06)	−0.01 (0.07)	−0.01 (0.06)
ESG staff	−0.02 (0.03)	−0.01 (0.02)	0.00 (0.02)	−0.07** (0.03)
External manager	0.02 (0.02)	0.04** (0.02)	0.01 (0.01)	−0.01 (0.02)
Investor relations	−0.15*** (0.05)	−0.11** (0.05)	−0.12*** (0.04)	−0.09* (0.06)
Other	0.01 (0.02)	0.03 (0.02)	0.02 (0.02)	−0.02 (0.02)
Number of Stocks	0.03* (0.02)	0.04** (0.01)	0.05*** (0.02)	−0.06** (0.02)
Industry Concentration	−0.60*** (0.13)	−0.57*** (0.15)	−0.56*** (0.10)	−0.15 (0.23)
Portfolio Turnover	−0.27*** (0.08)	−0.15** (0.06)	−0.25*** (0.07)	−0.18** (0.07)
Portfolio Activeness	−0.16 (0.11)	−0.31*** (0.10)	0.07 (0.09)	−0.60*** (0.15)
AUM	−0.01 (0.01)	−0.01 (0.01)	−0.02*** (0.01)	0.02 (0.01)
Year fixed effects	Yes	Yes	Yes	Yes
Region fixed effects	Yes	Yes	Yes	Yes
Type fixed effects	Yes	Yes	Yes	Yes
Observations	2,718	2,718	2,718	2,718
Adjusted R^2	0.26	0.28	0.26	0.17

Table IA5. Descriptive statistics for investors' holdings-based returns

This table presents descriptive statistics for the institutional investors' holdings-based returns. The measures are the mean return (*mean(return)*), standard deviation (*std(return)*), Sharpe ratio (*sharpe*), 1-factor alpha (*alpha1F*), systematic portfolio risk (*systematic*), idiosyncratic portfolio risk (*idiosyncratic*), and semivar (*semivar*).

Panel A: Sample with PRI dummy (2003–2017)

Variable	Mean	Median	Std	Min	P05	P95	Max	Obs
mean(return)	0.0095	0.0114	0.0281	-0.1402	-0.0343	0.0364	5.1629	76,683
std(return)	0.0492	0.0419	0.0648	0	0.0175	0.0980	15.6280	76,683
sharpe	0.2801	0.2715	0.4231	-5.7835	-0.4729	1.0234	3.7316	76,683
alpha1F	0.0009	0.0007	0.0151	-0.3482	-0.0174	0.0191	1.1602	76,683
systematic	0.0387	0.0340	0.0354	-0.2710	0.0073	0.0829	7.3305	76,683
idiosyncratic	0.0257	0.0190	0.0566	0.0014	0.0079	0.0638	13.8021	76,678
semivar	0.0293	0.0235	0.0213	0.000002	0.0055	0.0703	0.3487	72,596

Panel B: Sample with PRI strategies (2013–2017)

Variable	Mean	Median	Std	Min	P05	P95	Max	Obs
mean(return)	0.0090	0.0085	0.0136	-0.0838	-0.0107	0.0267	0.1138	2,731
std(return)	0.0377	0.0355	0.0236	0.0053	0.0113	0.0717	0.3423	2,731
sharpe	0.4170	0.2258	0.5641	-0.7822	-0.2043	1.5973	2.7088	2,731
alpha1F	-0.0009	-0.0003	0.0133	-0.1028	-0.0202	0.0142	0.2026	2,731
systematic	0.0276	0.0295	0.0160	-0.1213	0.0052	0.0485	0.1654	2,731
idiosyncratic	0.0216	0.0148	0.0223	0.0014	0.0058	0.0577	0.3201	2,731
semivar	0.0222	0.0202	0.0149	0.0001	0.0036	0.0485	0.1723	2,345

Table IA6. What are the holdings-based returns of PRI signatory institutional investors?

This table regresses portfolio-level ESG scores on a *PRI dummy* and on institutional investors' characteristics. The dependent variables are investors' holdings-based returns: *mean(return)*, *std(return)*, *sharpe*, *alpha1F*, *systematic*, *idiosyncratic*, and *semivar*. Appendix A1 provides definitions for the independent variables. Robust standard errors clustered at the investor-level and year-level are reported in parentheses. The coefficients are multiplied by 100. The sample period is from 2003 to 2017. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels.

	Dependent variable:						
	mean(return)	std(return)	sharpe	alpha1F	systematic	idiosyncratic	semivar
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
PRI dummy	−0.1	0.2***	−1.6	−0.1*	0.1*	0.1*	0.2**
	(0.1)	(0.1)	(2.6)	(0.1)	(0.1)	(0.1)	(0.1)
Environmental score	0.3**	−1.0***	12.1***	0.4***	−0.3**	−1.0***	−0.7***
	(0.2)	(0.2)	(3.2)	(0.1)	(0.1)	(0.2)	(0.1)
Social Score	−0.4**	0.3**	−12.0***	−0.5**	0.2	0.1	0.3*
	(0.2)	(0.2)	(3.3)	(0.2)	(0.2)	(0.2)	(0.2)
Governance Score	−0.1	−0.5***	−0.3	−0.1	−0.2	−0.5***	−0.3***
	(0.1)	(0.2)	(1.4)	(0.1)	(0.1)	(0.1)	(0.1)
Europe	0.1	−0.2	5.0	0.01	0.3**	−0.8***	−0.2
	(0.2)	(0.2)	(3.8)	(0.2)	(0.2)	(0.2)	(0.2)
North America	0.04	−1.1***	6.4	0.1	−0.5***	−1.1***	−0.7***
	(0.2)	(0.1)	(4.6)	(0.2)	(0.1)	(0.1)	(0.1)
Investment manager	−0.2	−0.7	0.7	−0.03	−0.4	−0.6	−0.1
	(0.2)	(0.5)	(1.0)	(0.1)	(0.2)	(0.4)	(0.1)
Number of Stocks	−0.04	−0.3***	0.6	−0.04	0.03	−0.4***	−0.1**
	(0.04)	(0.05)	(1.0)	(0.04)	(0.04)	(0.04)	(0.05)
Industry Concentration	−0.05	3.4***	−11.3**	−0.1	0.3	3.5***	1.6***
	(0.1)	(0.3)	(4.8)	(0.1)	(0.2)	(0.3)	(0.1)
Portfolio Turnover	0.4**	0.9*	1.2	0.3*	0.4**	0.8	0.1
	(0.2)	(0.5)	(1.3)	(0.1)	(0.2)	(0.5)	(0.1)
Portfolio Activeness	0.3	1.1*	−11.6	0.1	1.5***	0.7	0.9*
	(0.4)	(0.6)	(9.3)	(0.4)	(0.5)	(0.5)	(0.5)
AUM	0.05***	−0.04***	0.9***	0.1***	−0.02**	−0.05***	−0.03***
	(0.01)	(0.01)	(0.2)	(0.01)	(0.01)	(0.01)	(0.01)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	76,356	76,356	76,356	76,356	76,356	76,355	72,289
Adjusted R^2	0.4	0.1	0.7	0.03	0.3	0.1	0.5