ESG Footprints in Private Equity Portfolios: Unpacking Management Instruments and Financial Performance

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ABSTRACT

Based on data covering 206 buyout funds for the time period 2010-2022, this study examines how the utilization of different ESG-management instruments is linked to such funds' ESG portfolio footprints and financial performance. Improving fund-level ESG footprints by 50% explains a statistically and economically significant net IRR increase of up to 12.4% over a fund's life cycle. The outcome is linked to specific ESG-management instruments of private equity investors, such as centralised ESG management and ESG value enhancement plans, while no significant effect is recorded for other measures, such as ESG reporting frequencies and ESG impact controlling. The findings contribute to the perspectives on financial returns and impact in the still under-explored asset class of private equity.

JEL Classification: G24; G34; L21; M14

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INTRODUCTION

ESG-focused investment products are now pivotal in the asset management industry (El Ghoul & Karoui, 2022) with studies showing they can yield positive financial returns (e.g. Cornett, Erhemjamts, & Tehranian, 2016; Flammer, 2015). However, institutional investors primarily embrace them due to regulatory requirements and client demand (Ferres & Marcet, 2021; Zolotoy, O'Sullivan, & Chen, 2019), reflecting a growing synergy between financial performance and responsible investment practices.

The same seems to apply to alternative investments and, more specifically, private equity (PE), where PE companies traditionally pursue a two-spear strategy when managing their portfolio companies, to realize performance-induced growth (Toms, Wilson, & Wright, 2015) and to improve operational efficiency (Gilligan & Wright, 2021). Yet, the increasing focus on adopting ESG practices in this sector seems to be driven more by investor demands than by the inherent modus operandi of PE firms (McCahery, Pudschedl, & Steindl, 2022).

In the context of the PE industry, operational ESG management instruments are an important cornerstone for the success of responsible investing practices (Cumming & Johan, 2007; Zaccone & Pedrini, 2020). This study builds on these findings and examines in more detail the role of ESG management instruments in the generation of financial returns by PE investors. It does so by putting the focus on the execution of portfolio transformations through specific operational ESG management instruments that PE investors apply to foster better ESG footprints among their portfolio companies.

Further, an important strand of literature explores the topic of impact, whereas the PE asset class with its often controlling stakes in portfolio companies is a particularly interesting case to study given that shareholder engagement is an important pillar in fostering sustainable development (Kölbel, Heeb, Paetzold, & Busch, 2020). Through their majority stakes, PE investors hypothetically can actively shape the ESG footprints of their portfolio companies. We therefore also explore the extent to which PE investors are harnessing their potentially significant influence to shape the ESG footprints of their portfolio companies.

Our analysis utilizes data from PitchBook covering 206 buyout funds with overall more than 2,000 portfolio companies in their entire fund lifecycle. In addition, we compute fund-level ESG portfolio footprints using the RepRisk database which allows us to capture ESG development in PE portfolios over time. Finally, we incorporate UN PRI survey data where PE

signatories provide us with detailed insights on the ESG management instruments they have put in place.

The study results show that fund-level financial returns are positively correlated with ESG portfolio footprints. Based on our analysis, a 50% improvement in the fund-level ESG footprint is associated with an increase in the fund's net IRR (internal rate of return) by up to 12.4%. We conduct various robustness checks by applying different financial performance metrics and by creating subsamples. Based on these findings, we test which operational ESG management instruments contribute to a successful ESG transformation - and which do not. We show that centralized ESG management and the adoption of ESG value enhancement plans improve ESG footprints while increasing ESG reporting frequencies and ESG impact controlling have no significant effect.

Our study addresses a critical research gap by providing empirical evidence of the financial benefits associated with ESG management in the PE sector. While prior research has explored the impact of ESG factors on corporate performance, our work takes a look specifically on the dynamics of PE investments and their ability to drive ESG footprints. Our findings underscore the relevance of ESG considerations in the PE industry, thus advancing the understanding of the interplay between finance and sustainability in this context. By identifying the specific ESG management strategies that yield positive outcomes, we equip both practitioners and scholars with valuable insights to navigate responsible investing in private equity.

Our research offers a unique perspective on the impact potential of PE investors within the broader landscape of responsible investments (RI) (Geczy, Jeffers, Musto, & Tucker, 2021). By exploring the dynamics of PE investments, we provide first-ever insights on the intersection of financial and sustainability objectives. A number of authors have highlighted the importance of impact investing in PE. Barber, Morse, and Yasuda (2021) underscore the potential to drive social and environmental impact alongside financial returns. Furthermore, Indahl and Jacobsen (2019) emphasize the possibility for PE portfolio companies with strong ESG performance to outperform their peers. These findings emphasize the potential for impact investing in PE to not only contribute to positive societal and environmental change but also generate competitive financial returns, making it an attractive strategy for investors seeking to align their capital with their values and impact objectives.

The remainder of this article is structured as follows: The next section takes a comprehensive look at the literature on the role of ESG for institutional investors as well as specifically for PE

investors. Next, we explain the construction of the data set as well as the estimation methodology, followed by the presentation and discussion of results. The last section concludes.

LITERATURE REVIEW

Over the last decade, responsible investing by institutions has attracted significant research interest, but mainly with a focus on public markets investors (Dai, 2022). In contrast, the literature on PE is sparse to non-existing. This section presents a review of the RI literature in general as well as specific findings for the PE industry. In the following, we give an overview of institutional investors' motives for RI, the relationship between RI and financial performance, as well as ESG portfolio performance.

RI is known as the practice of incorporating sustainability criteria in investment decision-making which follows both ethical as well as financial paradigms (Widyawati, 2020). Yet, there is still vagueness in the exact definition of RI and what investment strategies can be associated with it (Berry & Junkus, 2013; Friede, 2019). Several works try to add clarity and structure to the RI research landscape (e.g. Fan, Omura, & Roca, 2022; Koeningsmarck & Geissdoerfer, 2021), yet the ESG-themed literature is still marked by a certain fuzziness (Edmans, 2023).

Responsible Investment Motives

Many institutional investors have adopted an RI approach that is driven by both long-term returns as well as risk mitigation considerations (Benson & Humphrey, 2008; Galema, Plantinga, & Scholtens, 2008; Jansson & Biel, 2011). In a later study, Amel-Zadeh and Serafeim (2017) confirm that the majority of institutional investors conduct RI because it is material to the financial performance of their investments.

Additionally, Renneboog, Horst, and Zhang (2011) report that non-financial considerations play a tangible role in investors' decision-making. RI reflects the objective to create impact on society, the environment and support sustainable development (Rizzi, Pellegrini, & Battaglia, 2018). To achieve these goals, institutional investors are under certain circumstances also willing to accept suboptimal returns (Renneboog, Horst, & Zhang, 2008b). This is backed by Hong and Kacperczyk (2009) who argue that investors following an RI approach have a different preference structure than the ones lacking such a focus.

According to Amel-Zadeh and Serafeim (2017), institutional investors also show an active ownership motivation for RI, whereas Dimson, Karakas, and Li (2015) present evidence of how this turns into an activist role in shaping companies' ESG performance. RI can also be seen as the institutional investors' response to the growing demand for corporate social responsibility (CSR) in the financial sector (Barigozzi & Tedeschi, 2015).

The regulatory environment nudges institutional investors towards RI as well (Himick & Adousset-Coulier, 2016; Renneboog, Horst, & Zhang, 2008a; Sievänen, 2014). In particular in Europe, the Sustainable Finance Disclosure Regulation (SFDR) which became effective in early 2021, put non-financial topics more firmly on the development agenda of the financial services industry (Bengo, Boni, & Sancino, 2022). New regulations thereby have a direct effect on the practices of RI players as Hamed, Al-Shattarat, Al-Shattarat, and Hussainey (2022) show that firms' reporting quality is positively impacted by newly introduced CSR legislations. Institutional investors generally tend to improve their ESG performance after a policy intervention (Becker, Martin, & Walter, 2022).

Only three studies have so far examined the RI motives of PE investors. Crifo and Forget (2013) provide evidence that PE firms' move to RI is driven by the search for new value-creation possibilities and risk management. PE firms may also use RI to differentiate themselves from competitors which may help to ease fundraising constraints. Zaccone and Pedrini (2020) confirm the importance of value-creation and risk management for PE investors' RI practices. In addition, they also report that PE investors' motivation is driven by regulatory pressure as well as the fear of being marked as "ESG non-compliant" by media or society. Cumming and Johan (2007) argue that RI among PE investors is much more likely when investment teams have a centralised organizational structure for their ESG management and the investment focus is rather international. Prior scholars call for further explorations around the levers of successful ESG management as well as the interplay between RI and access to capital. In the context of financial value creation, previous studies pose the question how the integration of ESG factors impacts different deal phases.

Responsible Investments & Financial Returns

A growing body of literature is exploring the relationship between ESG and financial returns but, according to Gillan, Koch, and Starks (2021), presence, magnitude and causality of the association remain ambiguous. While some studies point to a positive impact of ESG considerations on financial returns (e.g. Cornett et al., 2016; Flammer, 2015; Lins, Servaes, &

Tamayo, 2017), others argue that ESG is value-destructive (e.g. Buchanan, Cao, & Chen, 2018; Masulis & Walid Reza, 2015) or show mixed findings (Bauer, Koedijk, & Otten, 2005).

With regards to RI strategies, there are two schools of thought re. their impact on financial returns. On one side, Diaz, Ibrushi, and Zhao (2021), Maiti (2021) and Becchetti, Ciciretti, and Dalo (2018) assess the consideration of ESG factors for RI approaches as a risk premium which are being priced into return expectations. The integration of ESG in the investment process thereby accounts as an additional risk not captured by other risk factors. Among others, Edmans (2011) takes an alternative perspective and conjectures that ESG information allows for better return forecasting. Several studies present corroborating evidence that ESG ratings serve as predictors for corporate returns, e.g. Avramov, Cheng, Lioui, and Tarelli (2022) and Bolton and Kacperczyk (2021). Hence, by adopting an RI approach, investors can systematically benefit from market reactions to ESG news (Serafeim & Yoon, 2022).

The literature has suggested that the magnitude of RI outperformance depends on the economic cycle where outperformance tends to be much higher during bearish market periods (Henke, 2016). Earlier work by Kempf and Osthoff (2007) suggested that the financial returns of RI strategies are exceptionally high when investors focus on companies that are already behaving very socially responsible. Several studies also state that RI returns are diverging by sector (Kumar et al., 2016; X. Zhang, Zhao, & He, 2022). Additionally, scholars explain the inconclusive results in effect magnitude and direction by the heterogeneity in RI approaches (Revelli & Viviani, 2015) as, for instance, the intensity of non-financial screens moderates systematic- and overall risk of investments (Lee, Humphrey, Benson, & Ahn, 2010).

With a median investment duration of 4 years for private equity investments in developed countries (Lopez-de-Silanes, Phalippou, & Gottschalg, 2015) as well as the long-term visibility of value enhancing ESG transformation effects (Malik, Mamun, & Amin, 2019), it is however difficult to conclusively determine the relationship between RI and financial returns at PE firms (Cappucci, 2018). As the first-ever study with a distinct PE focus, Crifo, Forget, and Teyssier (2015) analyse how the consideration of ESG information impacts PE professionals' financial valuations of target companies. They present evidence that PE investors lower firm valuations for companies that act socially irresponsibly. The lack of comprehensive PE return data (Harris, Jenkinson, & Stucke, 2012) may explain why these studies have not been followed by further work.

ESG Portfolio Performance

Several scholars analyse how investors can promote sustainability at their portfolio companies. Kölbel et al. (2020) identify avenues with the option to directly drive change at portfolio firms as promising to foster ESG development in portfolio companies, namely shareholder engagement in public markets, and impact investing, which mostly refers to private equity. Barko, Cremers, and Renneboog (2022) and Dyck , Lins, Roth, and Wagner (2019) both present evidence that companies' ESG ratings improve following shareholder engagements which delivers support for an activist ownership approach.

Brandon, Glößner, Krueger, Matos, and Steffen (2022) demonstrate that investors outside of the United States with a pro-ESG commitment also achieve better portfolio-level ESG footprints. Kim and Yoon (2022) confirm these findings for the US market. Hoepner, Oikonomou, Sautner, Starks, and Zhou (2020) furthermore show that shareholder engagement on ESG issues contribute to downside risk reductions for target companies.

The subject has not yet been studied for PE portfolios.

ESG Integration in Investment Practices

Joliet and Titova (2018) argue, not surprisingly, that actively integrating ESG factors in investment decision-making contributes to a more ESG-compliant portfolio. According to Eccles, Kastrapeli, and Potter (2017), the most prominent ESG investing strategies are value-based exclusions, best-in-class selection as well as thematic investing. Most institutional investors use ESG information in their investment processes for red-flagging and risk management (Van Duuren, Plantinga, & Scholtens, 2016) as ESG screens and filters have proven to be reliable tools for most investment strategies (Verheyden, Eccles, & Feiner, 2016). Investors also use ESG information for value-tracking and shareholder engagements (Amel-Zadeh & Serafeim, 2017). Krueger, Sautner, and Starks (2020) confirm the importance of non-financial information for valuation modeling in the context of climate risk.

Regarding PE investors, Long and Johnstone (2021) and Salerno (2021) conclude that it is important to have a holistic understanding of ESG management. The integration of ESG factors has to take place along the entire PE value chain, ranging from origination and portfolio management to exits. According to Zaccone and Pedrini (2020), the most common ESG management practices at PE firms are ESG due diligence and portfolio monitoring. Another influence lever is centralised ESG management, e.g., via delegating ESG responsibility to a

central figure such as the Chief Investment Officer (Cumming & Johan, 2007). Thus, it is important for PE firms to build up expertise in new areas (Indahl & Jacobsen, 2019).

DATA AND METHODOLOGY

Data

Our data sample comprises 103 PE firms with overall 206 buyout funds which we identified via PitchBook, a reliable source for PE data (Sharma, 2017). 74% of the sample funds are advised by US-headquartered PE investors; the remainder of 26% belong to European PE firms. US funds are included in our sample when they either had a strict investment mandate for Europe (e.g. KKR European Fund IV, Bain Capital Europe Fund IV) or a strong investment footprint overseas (e.g. One Equity Partners VII, Blackstone Capital Partners VIII). Among the funds advised by Europe-headquartered PE firms, most funds' PE backers were located in the United Kingdom (44%), France (15%) as well as the Nordics and Benelux (each 12%). The majority of the sample consists of large-cap funds: 23% had a fund size of more than €5bn, 33% between €1bn and €5bn and 44% showed fund sizes of less than €1bn. These funds had in total 2,184 portfolio companies (excl. add-on companies[1]).

This study focuses on buyout strategies which involve acquiring a controlling stake in an established company, improving its operations and eventually selling it at a premium. We exclude other PE-themed investing strategies (special situations, growth equity/venture capital) which follow different objectives and involve varying risk-return profiles. Buyout strategies are focused on acquiring and restructuring established companies to improve their performance and profitability. Growth equity/venture capital focuses on companies with high growth potential while special situations are aimed at distressed companies or those undergoing significant changes such as bankruptcy proceedings or divestiture. In contrast to growth equity/venture capital and special situations investments, buyouts involve a greater degree of control, are generally less risky but also tend to offer lower potential returns. Considering these variations in investment objectives and risk-return characteristics, employing a mixed sample would diminish the clarity of the ESG effect and introduce complexity to the outcomes.

[1] Businesses that are acquired by PE firms and then merged or integrated with another company in the PE firm's portfolio to create a larger, more diversified entity.

For the same reasons, we exclude PE firms that have no clear fund structure (e.g., family office PE firms) or conduct investments with evergreen funds that are designed to remain open indefinitely. All sample funds were either closed or fully invested by August 2022. Fund vintages were between 2006 and 2021.

According to the classification scheme presented by Hebb (2013) as well as PE investors' self-declarations, none of the sample PE firms can be considered impact investors. The reason is that our study takes an exclusive look at buyout funds with their yet heterogenous ESG management systems. The inclusion of impact investors within our sample could have introduced a potential bias due to their advanced efforts in ESG management in comparison to buyout funds without a specific impact focus. Impact investors are dedicated to generating positive ESG outcomes alongside financial returns (Hebb, 2013). Consequently, they often prioritize and integrate ESG practices at a higher level and with more sophistication than traditional buyout funds solely driven by financial returns. This distinction in commitment could create misleading findings where the impact of ESG management on financial performance appears stronger due to the relatively enhanced ESG practices of impact investors.

Financial return data of sample funds was obtained from PitchBook based on reporting by limited partners or the PE investors themselves. PitchBook is also the source of structural data on PE funds (for further details see the independent variables section below).

The database RepRisk provided quantitative data for measuring the portfolio companies' ESG footprints. RepRisk scores measure ESG-related reputation risks based on past (negative) ESG incidents. RepRisk has become a widely used source for researchers, asset managers and risk departments to measure companies' exposure to ESG risks (Hummel & Schlick, 2016; Schiemann & Tietmeyer, 2022). The RepRisk scoring methodology is described in more detail in the dependent variables and independent variables sections. The methodology of aggregating the ESG footprints of all portfolio companies on a fund level is also explained in the methodology section.

We utilize the database of the United Nations Principles for Responsible Investment (UN PRI) for information on the ESG management instruments deployed by PE investors. PE investors, as signatories of UN PRI are required to provide comprehensive information about their ESG strategies and policies as part of a standardized annual surveys. Most survey questions have a quantitative format where signatories for instance rank the importance or level of integration of certain ESG management practices. Several scholars have previously incorporated the UN PRI

data in their empirical work (e.g., Brandon et al. (2022) and Majoch, Hoepner, and Hebb (2017)). Further information on the measures used is provided in the independent variable section below.

We use the 2022 Environmental Performance Index (EPI) to account for cross-country differences in ESG policies and practices. The EPI uses more than 40 performance indicators, such as air quality, water resource management and biodiversity conservation, to measure the level of sustainability in a given country by comparing sustainability policies with actual developments. The EPI is typically reported biennially and serves as a valuable tool for comparing environmental progress and identifying differences in sustainability efforts among nations. For example, Germany's stringent air quality regulations and transition to clean energy sources have contributed to relatively better air quality whereas Poland's heavy reliance on coal for energy production has led to more pronounced air pollution challenges. The EPI has been used by many scholars as a proxy for a country's progress on sustainability (see e.g., Balezentis, Li, Streimikiene, and Balezentis (2016) and Mei, Wai, and Ahamad (2016)).

[Table 1 & 2 near here]

Table 1 presents the descriptive statistics for the sample. A mean Net IRR of 0.23 suggests that funds in the dataset generated relatively stable positive returns, given the low standard deviation of 0.16, indicating consistent performance across the funds. On the other hand, the mean Investment Multiple of 1.74 implies that funds returned nearly twice the amount of capital invested. This ratio provides insight into funds' efficiency in generating returns. The moderate standard deviation of 0.56 suggests some variability in how effectively funds utilized their invested capital. The Benchmark Outperformance mean of 2.62 points to the average excess return achieved by the funds relative to their benchmarks. However, the high standard deviation of 14.71 indicates a wide dispersion in these excess returns. This suggests that while some funds significantly outperformed their benchmarks, others may have experienced substantial underperformance.

Table 2 contains the matrix of correlation coefficients for our sample. It shows that multicollinearity is not an issue as the model variables' bivariate correlations are generally below 0.6 (G. Zhang, 2008).

Methodology

Our study analyses two value-creation channels: First, we estimate the effect of fund-level ESG portfolio footprints on fund financial returns (Analysis 1). Second, we focus on the relationship between ESG management systems and fund-level ESG footprints, i.e., we determine which operational ESG management measures PE professionals can take / cannot take to foster improvements in ESG portfolio footprints (Analysis 2). With this dual-track research approach, we can establish how PE's ESG operations are related to improvements of ESG footprints at the level of their portfolio companies and to what extent this is statistically linked to superior financial performance.

For analysis 1, our dependent variable is the fund-level financial return (net IRR, benchmark outperformance, investment multiple). To calculate ESG portfolio footprints, we apply the following procedure: First, we determine in which year a given fund started investing. Second, we collect all current and historic portfolio companies of the respective fund. We then calculate for all portfolio companies their annual average RepRisk rating for each year since the fund started investing in the company. Thereafter, we calculate for each year where the fund was active (= all years after their vintage year) the average RepRisk rating across all portfolio companies in which the fund was already invested. Lastly, we average these aggregated annual RepRisk ratings across the fund lifecycle. We thereby arrive at a single measure for the state of ESG development at portfolio companies which we are referring to as "fund-level ESG portfolio footprint".

We employ several OLS regression specifications for analysis 1 to estimate the cross-sectional effect of ESG portfolio footprints on financial returns. The baseline specification takes the following form:

$$Fund\ Performance_i = \beta_0 + \beta_1\, x\, Fund\ ESG\ Footprint_i + \beta_i\, x\, X_i + \varepsilon_i \qquad (1)$$

ε_i is the error term and X represents the vector of control variables which are further described in the independent variable section below. β_i is a vector of regression coefficients for the control variables in vector X.

For analysis 2, fund-level ESG portfolio footprints now serve as the dependent variable. Independent variables comprise several operational ESG management measures: (1) pure public ESG commitment, (2) the use of ESG value enhancement plans, (3) the presence of ESG

impact controlling, as well as (4) portfolio companies' ESG reporting frequency. With these variables, we can determine the role of ESG across the entire deal lifecycle of PE investments.

We again employ several OLS regression specifications to assess the cross-sectional effect of ESG management instruments on fund-level ESG portfolio footprints. The baseline specification of analysis 2 is as follows:

$$Fund\ ESG\ Footprint_j = \alpha_0 + \alpha_1\, x\, ESG\ Considerations_i + \alpha_j\, x\, X_j + \varepsilon_j \qquad (2)$$

The terminology is the same as under equation 1. ESG considerations represent the aforementioned ESG management instruments. Equation 2 utilizes the a similar vector of control variables as equation 1.

We look at several subsamples for analysis 1. We estimate the effect by fund size, i.e., funds with assets under management (AuM) of less than €1bn, between €1bn and €5bn, and more than €5bn. We also test the effect for US-backed and Europe-backed funds separately. As not all funds provide information on their ESG management instruments, our sample size shrinks for analysis 2 which restricts us from creating subsamples that would otherwise be too small to yield meaningful results.

We follow the framework of Haans, Pieters, and He (2016) to check for the presence of u-shaped effects by regressing our dependent variable (Y) on the independent variable (X) and its squared term ($Y = \beta_0 + \beta_1 \cdot X + \beta_2 \cdot X^2$). Following the three-step procedure of Lind and Mehlum (2010), our study does not provide evidence to support the presence of any non-linear effects.

We applied the Breusch-Pagan and the White test to confirm homoscedasticity in our data. Therefore, we neither applied clustered nor robust standard errors. The presence of homoscedasticity can be attributed to several factors. First, the nature of the PE investments in our sample involve relatively homogenous populations of portfolio companies. These companies share similar industry sectors, growth stages and financial characteristics, leading to a similar response to various investment strategies. Secondly, we employed standardized measurements for several variables which enhances data reliability and contributes to the observed homoscedasticity by reducing measurement errors and variations. Additionally, our relatively small sample size can contribute to homoscedasticity as smaller samples are less likely to exhibit extreme variations in error terms, particularly when compared to larger and more diverse datasets.

Dependent Variables

To capture the financial value-creation effects of PE funds for analysis 1, we use three different measures: (1) Net IRR, (2) investment multiples reported in the form of total value paid-in capital (TVPI), and (3) benchmark outperformance. All three fund-level performance indicators are widely accepted by the research community as well as practitioners for comparisons. Since PitchBook does not supply cashflow data of the respective funds, we were not able to calculate the public market equivalent (PME) as an alternative and, if available, preferrable performance measure (Korteweg & Nagel, 2016; Sorensen & Jagannathan, 2015). We treat Net IRR as our main dependent variable and cross-check results with the two alternative performance metrics. Although the IRR has several limitations, it is the most common PE performance measure which is used by most prior private equity studies (e.g Acharya, Gottschalg, Hahn, & Kehoe, 2013; Franzoni, Nowak, & Phalippou, 2012; Sensoy, Wang, & Weisbach, 2014). The main benefits of employing net IRR as a performance measure are (i) the metric's ability to place substantial emphasis on cash flows, considering both the timing and scale of these flows throughout an investment's lifecycle (Borgonovo & Peccati, 2004), (ii) its consideration of reinvestments (Dudley 1972) which aligns with the dynamic nature of private equity investments, (iii) its capability to incorporate fees, expenses and other costs inherent in managing and operating private equity funds (Aigner et al., 2008), (vi) the risk adjustment embedded within Net IRR, stemming from its recognition of the time value of money (Osborne, 2010) and (v) its suitability for assessing long-term performance (Cheng, Kite, & Radtke, 1994) in the context of private equity's extended investment horizons. We use the most recent performance metrics available via PitchBook.

For analysis 2, our dependent variable is the fund-level ESG portfolio footprint which we compose of the portfolio company RepRisk ratings. The procedure for computing the aggregated ESG portfolio footprint is explained in the methodology section. RepRisk ratings are a composite measure and consist of companies' own ESG risk exposure as well as the business exposure to industries and regions where the company generates revenues (country-sector matrix). The country-sector matrix measures the average ESG risk by industry as well as country. This allows us to capture ESG footprints for companies with global sales footprints and diversified business models. RepRisk ratings are on a scale from AAA to C which we

quantify to a numeric scale from 1 (= AAA / "best possible RepRisk rating") to 9 (= C / "worst possible RepRisk rating").[2]

RepRisk ratings serve as a proxy of ESG risk exposure. They are computed using the reach and severity of ESG incident news. The reach of incidents ranges from low to high and depends on the publicity and reputation of the media which is reporting about the ESG incidents. While international newspaper articles (e.g., Financial Times, Wall Street Journal) have high reach, national media outlets have medium reach, whereas regional media channels are indicated as low reach. Severity is determined via (1) the magnitude of the negative impact, (2) the level of responsibility of the firm for the incidence, as well as (3) the magnitude of irresponsibility. Additionally, the novelty or frequency of specific ESG incidents also impacts RepRisk ratings.

Independent Variables

We use the RepRisk rating as a measure of the fund-level ESG portfolio footprint. In analysis 1, it serves as an independent variable to measure the effect on financial returns and, for analysis 2, it represents the dependent variable which we explain via a range of alternative ESG management measures. The construction of this variable has been explained in the previous section.

For analysis 2, we exploit UN PRI survey data for an inside view of PE firms' operational ESG management. The survey constructs which we consider in our analysis are the following: The ESG commitment (*PRI Signatory Dummy*) variable measures the signatory status of the backing PE firm (yes = 1, no = 0). Bauckloh, Schaltegger, Utz, Zeile, and Zwergel (2023) present evidence that signatories integrate ESG criteria more often in their business operations than non-signatories. This shows that the PRI signatory status can be assessed as a proxy for the ESG commitment of PE firms. PRI signatory statuses have thereby recently become a widely used metric to capture companies' level of ESG commitment, e.g. Kordsachia, Focke, and Velte (2022), Brandon et al. (2022) or Nofsinger and Varma (2022).

The ESG responsibility centralisation (*ESG Responsibility*) variable measures to what extent ESG responsibility is bundled at the PE firm internally, instead of delegating power to management teams at the portfolio company itself. The survey construct is indicated by the share of portfolio companies where ESG responsibility is with the portfolio company management team. The scale ranges from 0 to 4, i.e. 0 (0% of portfolio companies have ESG

[2] For further technical details on the RepRisk rating methodology, please refer to: https://www.reprisk.com/news-research/resources/methodology.

responsibility), 1 (positive but less than 10% of portfolio companies), 2 (less than 50% of portfolio companies), 3 (less than 90%) and 4 (more than 90% of portfolio companies). For PE firms that did not report ESG responsibility centralisation, we assumed the share of portfolio companies with ESG responsibility to be 0%. With this approach, the analysis takes a conservative stance, avoiding potential overestimation of the ESG responsibility centralisation impact. We thereby ensure that the analysis is grounded in the available information while maintaining a cautious perspective on the potential ESG influence within the dataset. Using this variable follows the logic of Cumming and Johan (2007) who state that RI is more common at PE firms where ESG management decisions are centralised. Relatedly, Gallagher and Gardner (2006) state that the centralisation of investment management responsibility is important at asset management firms outside the PE industry.

The ESG impact controlling (*ESG Controlling*) variable is set up as a dummy, i.e., 1 (ESG impact controlling) and 0 (no ESG impact controlling). Q. Zhang and Wong (2022), and Cambrea, Paolone, and Cucari (2023), both pointed us to the important role of monitoring/overseeing for effective ESG management. More generally, Hammami and Zadeh (2020) demonstrate that improved ESG monitoring leads to enhanced investment efficiency.

The ESG value enhancement plans (*ESG Value Enhancement*) variable captures the effect of predefined ESG development plans that PE firms compose and execute for their portfolio companies. The variable is formed as a dummy with 1 for PE firms that utilize ESG value enhancement plans and 0 otherwise. The responses by PE investors to the survey of Zaccone and Pedrini (2020) already revealed that ESG value-creation plans are material to many firms. These findings are supported by Indahl and Jacobsen (2019). Crifo and Forget (2013) also state that shareholder engagement is an important pillar of PE investing strategies. Outside the PE industry, Bizoumi, Lazaridis, and Stamou (2019) argue that the creation of ESG plans helps in business operations. On a company level, Kurznack, Schoenmaker, and Schramade (2021) show that ESG strategy setting and alignment is an important lever of long-term value-creation.

The ESG reporting frequency (*ESG Reporting*) variable measures how often portfolio companies have to report to PE firms on their ESG development. The scale ranges from 0 to 4, i.e. 0 (no reporting), 1 (less frequently than annually), 2 (annually), 3 (semi-annually) and 4 (quarterly or more frequently). We were pointed at this variable by Harymawan, Nasih, Agustia, Putra, and Djajadikerta (2022), who provide evidence that ESG reporting enhances investment efficiencies. Several scholars also confirm the importance of ESG information disclosure for firm performance, e.g., Z. Chen and Xie (2022), and Wen, Ho, Gao, and Yu (2022). According

to Arvidsson and Dumay (2022), however, ESG performance is rather driven by the quality of ESG reporting than its quantity.

Our analysis includes further control variables which account for PE investor characteristics, fund structures and the socioeconomic environment. *Fund Size* indicates the funds raised in terms of USD. *Dry Powder* represents the USD amount of committed capital which has not yet been invested. *Called Down* indicates the percentage share of limited partners' (LP) capital commitments that have been used by the PE investor. The *Fund Net Asset Value* (*NAV*) is the current value of the portfolio by August 2022. The *EPI Index* provides us with information on the state of ESG policies and actual development in the country where the respective PE firm is headquartered. Control variables were identified in reference to the relevant PE literature (Barber & Yasuda, 2017; Bernstein, Lerner, & Mezzanotti, 2019; Cumming, Fleming, & Schwienbacher, 2009; Phalippou & Gottschalg, 2009).

RESULTS

In Table 1, we regress ESG portfolio footprints against fund financial returns. Model 1 indicates a significant negative effect of worse ESG footprints on the IRR, i.e., a lower (= worse) ESG portfolio footprint is statistically associated with a higher likelihood of observing lower financial returns for the respective funds. In models 2 and 3, we cross-checked these results with other financial return metrics (investment multiples, benchmark outperformance) whereby both models confirmed the previous results. For models 1-3 we use the baseline set of control variables whereby for models 4-6 we apply an extended set of controls. As the extended control variables are not available for all funds in our dataset, the sample size diminishes consequently. Models 4 and 5 additionally confirm the effect of ESG footprints on IRRs and investment multiples.

[Table 3 near here]

We conduct further robustness checks on these results by performing subsample regression analyses. In table 4 we present our findings, clustered by fund size. We divide the sample into funds with a fund size of more than €5bn (models 7 & 10), between €1bn and €5bn (models 8 & 11) and less than €1bn (models 9 & 12). For models 7-9, we again apply the baseline controls whereas models 10-12 use the extended set of control variables. The results are illustrated for net IRR as the dependent variable. Our analysis confirms the value impact of ESG footprints

only for funds with fund sizes of more than €1bn. We do not find any significant effects for smaller funds. We also conduct robustness checks with other dependent variables which are available upon request.

[Table 4 near here]

We furthermore test for geographic differences by creating subsamples for funds that are backed by US-headquartered PE firms (models 13-15) and European PE investors (models 16-18). This analysis is motivated by Van Duuren et al. (2016), who already stated that ESG investing is more prominent among European than US investors. While our analysis confirms the effect of ESG footprints on IRRs, findings on the other two return metrics are inconsistent. While the baseline control models indicate only a significant effect for investment multiples, the extended models on the other side only point to a significant effect for benchmark outperformance. Our results on regional differences are thus inconclusive.

[Table 5 near here]

For analysis 2, table 6 illustrates our results of regressing several ESG management instruments against fund-level ESG portfolio footprints. Model 19 indicates that the PRI signatory status improves ESG footprints, i.e. the commitment of PE investors to the UN PRI charter is statistically linked to lower (better) ESG portfolio footprints. Our analysis also indicates a strongly significant impact of ESG responsibility centralisation, i.e. delegating ESG responsibility to the portfolio company management is statistically associated with worse (higher) ESG portfolio footprints. We furthermore identify ESG value enhancement plans as a strong driver of ESG portfolio footprints. Our analysis does not present evidence for any effect of ESG impact controlling or the ESG reporting frequency. All findings are confirmed by model 20 where we again applied the extensive set of control variables.

[Table 6 near here]

DISCUSSION

Theoretical Implications

This paper shows that superior ESG portfolio footprints are statistically related to better-performing PE funds. Furthermore, our research provides robust evidence supporting the role of ESG value enhancement plans and centralized ESG management in contributing to better

ESG portfolio footprints. By systematically integrating ESG strategies and streamlining management approaches, PE investors can effectively drive positive ESG outcomes within their portfolio companies, ultimately benefiting both financial performance and sustainability objectives.

With the question of the role of ESG in the PE industry, it is evident that ESG management has emerged as a pivotal tool for value creation within this sector. Nonetheless, the academic literature has largely overlooked its implications for financial performance and the materiality of ESG management instruments. Our analysis confirms the positive impact on financial returns and sheds light on the effectiveness of ESG management instruments. By doing so, we also extend the literature that found positive effects of RI for investment strategies outside the PE industry (e.g. Cornett et al., 2016; Flammer, 2015).

The positive performance impact of ESG footprint improvements might be driven by several factors. For one, it could be easier for PE investors to obtain financing for target companies that are more ESG-compliant (Cornell, 2021). Considering the importance of deal financing for PE transactions, this could have a substantial impact on the underlying economics of deal-making. As discussed by Raimo, Caragnano, Zito, Vitolla, and Mariani (2021), the relevance of ESG disclosure also extends to the ease of debt financing. Furthermore, it can also be a way of managing the risk exposures of the underlying portfolio (Folqué, Escrig-Olmedo, & Santamaria, 2021) or as a move of establishing regulatory compliance (Long & Johnstone, 2021). Our results invite to develop an impact-driven perspective beyond this conventional narrative

Kölbel et al. (2020) state that among various contributing factors, shareholder engagement stands out as a cornerstone for the development of ESG practices. This finding gains additional importance in the context of PE investors which often secure majority stakes in their target companies (Wright, Gilligan, & Amess, 2009), fostering a bigger capacity for intense and impactful shareholder engagement. We believe that this unique setting allows PE investors to actively drive ESG development at their portfolio companies which can then directly translate into financial value impact:

Enhancing portfolio company performance through ESG-related shareholder engagement can be achieved through multifaceted approaches which could focus on, for instance, sustainable innovation, supply chain sustainability, reporting and transparency or board composition and diversity. Sustainable innovation addresses pressing environmental challenges, fostering both

business growth and positive societal impact (F.-W. Chen, Fu, Wang, Tsai, & Su, 2018). Supply chain sustainability can mitigate risks and bolster a portfolio companies' resilience while also answering growing consumer demands for responsibly sourced products (Seuring & Mueller, 2008). Effective reporting and transparency can enhance investor confidence (Ferri, Tron, Colantoni, & Savio, 2023) and drive better internal ESG performance (Mervelskamper & Streit, 2017). Moreover, a diverse board composition ensures robust oversight of sustainability strategies, aligning with the studies that show how board diversity positively affects ESG performance (e.g. Harjoto, Laksmana, & Lee, 2015; Velte, 2016). By strategically navigating these channels, PE investors can harness the power of ESG-related shareholder engagement to enhance the organisational performance of their portfolio companies, fostering innovation and enhancing their societal and environmental contributions.

We interpret our findings in the context of Gompers, Ishii, and Metrick (2003), who presented evidence that a higher concentration of shareholder rights amongst fewer investors leads to higher firm valuations and sales growth. Buyout firms that have the highest level of shareholder rights are likely to be better equipped to increase valuations and drive sales growth of their portfolio companies.

In addition to the observed positive impact of RI on portfolio companies' sales growth, a compelling argument emerges regarding the potential for ESG management within portfolio companies to drive substantial cost reductions. While empirical evidence in the literature addressing this effect remains limited, several scholars have begun to shed light on this aspect. Yawika and Handayani (2019) propose that the implementation of sustainable management practices can lead to notable reductions in operational costs. This connection stems from the notion that adopting sustainable practices often prompts companies to optimize resource utilization, streamline processes, and minimize waste, resulting in enhanced operational efficiency and cost savings. Furthermore, Kotsantonis, Pinney, and Serafeim (2016) further support this argument by highlighting instances where ESG practices have directly contributed to cost savings. By minimizing resource inefficiencies and optimizing operational processes, companies that prioritize ESG management can not only improve their corporate sustainability but also foster more streamlined and cost-effective operations, ultimately enhancing their financial performance.

Another avenue through which ESG management can significantly impact the financial value of portfolio companies is by driving increased productivity within their operations. Deng, Li, and Ren (2023) establish a connection between corporate ESG performance and enhanced

labour productivity. This suggests that companies that prioritize ESG initiatives not only contribute positively to social and environmental causes but also benefit from more productive workforces. Moreover, Tunio et al. (2021) present further evidence that labour productivity plays moderating role in the relationship between CSR on financial performance. This highlights the link between productive human capital and overall financial value creation. Welch and Yoon (2022) underscore that the integration of ESG aspects within corporate strategies can lead to more efficient allocation of corporate resources. This emphasizes that ESG management is not just a pursuit for social and environmental change but a strategic approach that can directly impact a company's financial bottom line. By cultivating an environment that improves workforce productivity and resource allocation as well as aligns business strategies with ESG principles, portfolio companies can create a synergy that drives superior financial performance and a successful ESG transformation.

Practical Implications

Thoughtful ESG management in the PE industry can serve as a proactive response to evolving regulatory frameworks. By prioritizing ESG practices within their portfolio companies, PE firms can position themselves as stewards of responsible and compliant investment practices. This approach not only mitigates legal risks but also aligns investments with the changing expectations of regulatory authorities and stakeholders. Through regulatory compliance, PE firms demonstrate their commitment to addressing contemporary societal and environmental challenges.

The commitment to ESG management can tangibly influence valuation and sales growth within the PE landscape. PE firms, equipped with their unique ability to take advantage of concentrated shareholder rights, can actively drive positive ESG changes across their portfolio companies. This engagement translates into improved operational performance, making these companies more attractive to potential buyers. Such practices underscore the interconnectedness between RI and financial success. Moreover, the implication of ESG management in the PE industry lies in its potential for long-term value creation which enhances portfolio resilience to ESG-related risks. By incorporating ESG considerations, PE firms build the foundation for consistent performance across the investment lifecycle.

ESG management provides an avenue for PE firms to secure a competitive edge in an increasingly challenging market environment. Firms that integrate ESG principles into their investment strategies align with a broader societal shift towards sustainability and responsible

business practices. The competitive advantage derived from ESG management positions PE firms as responsible leaders in the industry. This reputation can foster trust, strengthen relationships with stakeholders and impact the overall attractiveness of their investment offerings.

Limitations & Future Research

Our results come with some limitations, the most obvious being sample size. While this study employs the most complete and extensive sample which can be created with public databases, it is still smaller than Metrick and Yasuda (2010) with 238 funds and Lerner and Schoar (2004) with 243 funds (but larger than Bernile, Cumming, and Lyandres (2007) with 42 funds). Out of these three studies, Bernile et al. (2007) are the only scholars who also explicitly include European funds in their analysis. The sample size limitation can be explained by the focus on European markets which allowed us to analyse a much more developed ESG regulatory environment with strong investor preferences for ESG considerations. Furthermore, we mitigated the sample size issue by compiling fund-level metrics by aggregating 2039 portfolio companies.

Second, scholars may be inclined to challenge that the RepRisk scores are not ESG performance measures like the typical ESG ratings used for public markets and that they provide only limited insights about ESG transformations at the level of portfolio companies. We argue that, quite the opposite, while the informativeness of ESG ratings is being debated and contested (e.g. Berg, Kölbel, & Rigobon, 2022; Charlin, Cifuentes, & Alfaro, 2022; Edmans, 2023; Munoz-Torres, Fernandez-Izquierdo, Rivera-Lirio, & Escrig-Olmedo, 2019), RepRisk-based ESG footprints give a direct insight into the outcomes of companies' ESG policies and -practices in terms of scandals and criticism picked up by media and civil society. It is an objective measure covering all fund-level investments and does not suffer from similar shortcomings as ESG ratings, e.g., limited comparability due to asynchronous measurement, bias due to reliance on self-reported data, less than full coverage of fund-level investments. Also, given our focus on private markets, RepRisk scores are the only available quantitative ESG measure.

A limitation of our study could also be our exclusive focus on Europe-focused buyout funds. As a combined sample of different asset classes within private equity or the European and the North American industry could introduce confounding factors, we proactively chose this approach. Considering different regulatory environments or market dynamics this could otherwise lead to potentially misleading interpretations. While this research design allowed us

to take an in-depth exploration of this specific segment, it restricts the generalizability of our findings to a broader private equity context. An additional limitation relates to our use of UN PRI survey data which was not available for all funds in our sample. While the survey data from UN PRI is among the most comprehensive sources available for gaining insight into ESG operations at PE firms, this may introduce selection bias and potential gaps in our analysis. To address both limitations, we took a variety of measures to enhance the robustness of our conclusions. We conducted thorough sensitivity analyses and applied rigorous statistical methodologies with varying sample compositions to ensure the robustness of our findings.

We hope that future research will build on our work. One direction can be to apply greater granularity by analysing ESG footprints of portfolio companies directly. Next to company-level RepRisk scores, scholars could draw on raw ESG data (e.g., GHG emissions, energy consumption or work-related accidents) to gain insights on specific areas of improvement for ESG transformations and ESG disciplines that are well executed or need further improvements by PE investors. Such primary data can either be obtained by directly collaborating with PE investors or by gaining access to the portfolio company raw data curated by the ESG Data Convergence Project[3] (which we did not have the privilege to do). Future studies could adopt a comprehensive approach by simultaneously investigating the operational aspects and the risk or return implications of RI, a dimension that has largely been explored in isolation by previous scholars. Our research has underscored the critical interplay between these two dimensions, highlighting that the operational considerations surrounding ESG practices are intricately intertwined with their corresponding impacts on investment returns. Recent studies support this approach as scholars revealed that robust ESG integration often leads to enhanced operational efficiencies, improved stakeholder relations within companies (Kotsantonis et al., 2016) and reduced risk exposure (Van Duuren et al., 2016). This, in turn, contributes to long-term financial performance and resilience (Friede, Busch, & Bassen, 2015). By exploring the operational side of ESG alongside its risk or return effects, future research can provide a more holistic understanding of how sustainable practices influence investment outcomes, yielding insights that are not only theoretically robust but also practically informative for investors, LPs and policymakers.

[3] We enquired access to the database of the ESG Data Convergence Project but were told that the data is not available for academic purposes. For further information on the inititative, please see here: https://www.esgdc.org/

Lastly, it would also be interesting to see future scholars addressing our research questions with a sample of venture capital and growth equity investors. Considering the strong footprint of these asset classes on impact investing, it would provide meaningful insights for a group of practitioners that are already at the forefront of RI.

Furthermore, future scholars could enrich the literature by examining our research question within the context of venture capital and growth equity investors. The influence of these asset classes on impact investing underscores the potential for valuable insights. Given the proactive stance that venture capital and growth equity investors already adopt towards responsible investing (Camilleri, 2020; Randjelovic, O'Rourke, & Orsato, 2003), investigating their practices could result into findings that are highly relevant for practitioners at the forefront of RI. Prior studies highlight the role venture capital plays in shaping sustainable innovation (Haldar, 2019; Pradhan, Arvin, Nair, & Bennett, 2020). A focused exploration of these investor groups could therefore contribute novel dimensions to the ongoing discussion of RI practices, indicating paths towards sustainable and impactful investment strategies.

CONCLUSION

Our study shows that ESG management and financial value-creation are closely interconnected for PE investors. Portfolios of PE-backed companies with better ESG footprints are associated with statistically and economically significant higher financial returns. We present a statistical relationship between improving the ESG footprint of a fund by 50% and a potential increase in the fund's IRR by up to 12.4%. This suggests that an effective ESG transformation of portfolio companies leads to higher returns for investors.

In comparison to other investors and asset classes, buyout investors usually hold majority stakes in their portfolio companies. This concentration in shareholder rights allows them to actively steer ESG development in their portfolio. In other words: PE investors are the only investors that can 1:1 implement their “ESG vision” in their portfolio companies instead of just serving as advisors or external stakeholders like in other asset classes and investment scenarios. This interpretation is then also backed by the second part of our analysis where we determine which ESG management instruments are related to better ESG footprints and which are not. We provide evidence that the best portfolio ESG footprints are realized when PE firms are bundling much of the ESG responsibility in the investment team instead of delegating ESG management to portfolio company management teams. With this setup, PE firms can actively drive the ESG

transformation in their portfolio and strengthen the argument on the importance of concentrated shareholder rights as a critical success factor.

Just like centralized ESG responsibility, ESG transformations also benefit from dedicated ESG value enhancement plans. PE investors are better off when they have defined a clear ESG development plan which they execute accordingly over the investment lifetime. Not all ESG management instruments appear equally effective, however. On the other hand, we cannot make an argument for a value contribution of ESG impact controlling and the reporting frequency on ESG data. We consequently argue that PE investors could rather treat their ESG management systems as a value-creation channel instead of solely answering the demands of clients and regulators with it.

Given the inherent challenges of obtaining data in the PE industry, the analysis presented in this study represents the most comprehensive and insightful investigation possible with publicly available data. We have to acknowledge that the private nature of PE investments inherently limits the accessibility of detailed information, creating constraints on data quality and completeness. Despite these limitations, our study utilizes the best available sources and employs rigorous methodologies to address our research questions. While acknowledging potential biases and data constraints, our analysis represents a significant step forward in shedding light on the critical intersection of ESG, and financial returns in the PE sector.

Our study's findings have significant implications for the field of impact investing. Impact investing is fundamentally cantered around achieving positive ESG outcomes alongside financial returns. We provide evidence that within the PE sector, where investors often hold majority stakes in portfolio companies, there exists a clear link between effective ESG management and higher financial returns. This connection underscores the potential for impact investors to harness the power of ESG integration not only as a framework to align with ethical values and social objectives but also as a potent driver of financial value creation. By emphasizing the tangible relationship between improved ESG footprints and increased financial returns, our study highlights how impact investors can leverage their influence to actively steer portfolio companies towards ESG excellence. This insight positions PE investors as pivotal players in advancing ESG considerations within the broader investment landscape and emphasizes that RI can indeed generate substantial financial rewards, making it a attractive proposition for both impact-driven and financially-oriented investors.

With this contribution, we hope to motivate further scholars for exploring ESG in the context of the PE sector. Our study builds the foundation for this research as the first empirical study of the effect of ESG management in the context of PE investors. As we continue to witness a growing interest in ESG issues across industries, scholars can also pay attention to their impact in the PE industry. PE firms have a significant influence on the companies they invest in and their actions can have both positive and negative effects on ESG factors. Therefore, future scholars can continue to explore the relationship between PE and ESG, examining how firms can integrate ESG considerations into their investment decisions and how they can promote sustainable and responsible practices within their portfolio companies. Such work can be crucial in advancing sustainable- and financial prosperity at the same time.

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TABLES

Table 1: Cross-Section Summary Statistics

Variable	Obs.	Min.	Max.	Mean	Std. Dev.
Net IRR	206	-0.14	1.16	0.23	0.16
Investment Multiple	193	0.45	4.18	1.74	0.56
Benchmark Outperformance	155	-41.40	60.90	2.62	14.71
ESG Footprint	206	1.00	5.09	1.99	0.84
PRI Signatory Dummy	206	0.00	1.00	0.68	0.47
Fund Size[1]	206	32.44	25424.28	3177.04	4308.26
Dry Powder	206	0.00	17027.50	576.58	1635.78
# Portfolio Companies	206	1.00	62.00	12.00	9.76
EPI Index	206	51.10	77.90	65.40	10.81
Called Down[2]	188	18.51	100.00	83.66	21.30
Fund NAV	188	0.00	23202.80	2699.40	4498.19
ESG Responsibility	206	0.00	4.00	0.73	1.44
ESG Impact Controlling	206	0.00	1.00	0.17	0.37
Value Enhancement Plans	206	0.00	1.00	0.20	0.40
ESG Reporting Frequency	206	0.00	4.00	0.50	1.16

(1) Fund size is stated in USD.

(2) Contributed capital / committed capital

Table 2: Linear Correlation Matrix
(Pearson Correlation Coefficient)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
(1) Net IRR	1.00	0.35**	0.80**	-0.12	0.03	0.05	0.23**	-0.13	0.03	-0.22**	0.07	0.15*	0.22**	0.14*	0.06	-0.03
(2) Investment Multiple		1.00	0.41**	-0.19**	0.02	-0.07	-0.18*	0.18*	-0.01	0.36**	0.03	-0.05	0.01	-0.06	0.02	-0.09
(3) Benchmark Outperformance			1.00	-0.18*	0.05	0.00	0.09	0.01	0.12	0.07	0.00	0.15	0.16*	0.13	0.06	-0.01
(4) ESG Footprint				1.00	-0.14*	0.16*	0.14*	-0.03	-0.36**	-0.06	0.13	0.03	-0.09	-0.03	0.04	0.08
(5) PRI Signatory Dummy					1.00	-0.17*	-0.08	-0.06	0.70**	-0.05	-0.16*	0.35**	0.31**	0.34**	0.72**	0.30**
(6) Fund Size						1.00	0.66**	0.20**	-0.14*	-0.04	0.86**	-0.01	0.02	0.00	0.02	0.02
(7) Dry Powder							1.00	-0.10	-0.07	-0.45**	0.41**	0.04	0.08	0.05	0.01	0.01
(8) # Portfolio Companies								1.00	-0.02	0.31**	0.18*	0.05	0.09	0.06	0.08	0.12
(9) EPI Index									1.00	-0.02	-0.12	0.26**	0.27**	0.29**	0.46**	0.19**
(10) Called Down										1.00	0.06	-0.03	-0.08	-0.04	-0.02	0.07
(11) Fund NAV											1.00	-0.07	-0.02	-0.06	-0.01	-0.03
(12) ESG Responsibility												1.00	0.86**	0.97**	0.48**	0.81**
(13) ESG Impact Controlling													1.00	0.89**	0.42**	0.62**
(14) Value Enhancement Plans														1.00	0.48**	0.81**
(15) ESG Investment Selection															1.00	0.42**
(16) ESG Reporting Frequency																1.00

* and ** indicate statistical significance at 5% and 1% level, respectively.

Table 3

Results of Regression Analyses I

This table represents the regression results of analysis 1 in which financial return metrics serve as dependent variables. Model 1-3 use the baseline set of control variables whereas model 4-6 use an extended set of controls. Standard errors are in parentheses. *, **, and *** indicate statistical significance at 10%, 5%, and 1% level, respectively.

Variable	(1) Model 1	(2) Model 2	(3) Model 3	(4) Model 4	(5) Model 5	(6) Model 6
ESG Footprint	-0.031**	-0.144***	-2.989*	-0.40**	-0.128**	-2.927
	(0.014)	(0.054)	(1.659)	(0.016)	(0.054)	(1.801)
PRI Signatory Dummy	0.020	0.110	-1.218	0.053	0.115	0.823
	(0.033)	(0.118)	(3.509)	(0.036)	(0.120)	(3.826)
Fund Size	-4.786e-6	4.203e-6	0.000	-1.992e-5***	-5.976e-5**	-0.001
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)
Dry Powder	3.221e-5***	-5.047e-5	0.001	4.026e-5***	6.487e-5	0.003**
	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.001)
# Portfolio Companies	-0.001	0.009*	0.062	-0.001	0.007*	-0.027
	(0.001)	(0.004)	(0.136)	(0.001)	(0.004)	(0.155)
EPI Index	-0.001	-0.008	0.108	-0.003	-0.010*	0.038
	(0.002)	(0.005)	(0.169)	(0.002)	(0.005)	(0.184)
Called Down				-5.339e-6	9.080e-5***	0.001*
				(0.000)	(0.000)	(0.001)
Fund NAV				1.519e-5	4.134e-5**	0.000
				(0.000)	(0.000)	(0.001)
Constant	0.354***	2.394***	1.490	1.519e-5***	1.770***	-4.823
	(0.100)	(0.363)	(11.498)	(0.000)	(0.421)	14.061
Observations	206	193	155	179	178	134
R-squared	0.096	0.093	0.052	0.162	(0.198)	0.081
Dependent Variable	Net IRR	Investment Multiple	Benchmark Outperformance	Net IRR	Investment Multiple	Benchmark Outperformance
Controls Set	Baseline	Baseline	Baseline	Extended	Extended	Extended
Sample	Total Sample	Total Sample	Total Sample	Total Sample	Total Sample	Total Sample

Table 4

Results of Regression Analyses II

This table represents the regression results of analysis 1 for different fund size subsamples. The dependent variable is the net IRR. Model 7-9 use the baseline set of control variables whereas model 10-12 use an extended set of controls. Standard errors are in parentheses. *, **, and *** indicate statistical significance at 10%, 5%, and 1% level, respectively.

Variable	(7) Model 7	(8) Model 8	(9) Model 9	(10) Model 10	(11) Model 11	(12) Model 12
ESG Footprint	-0.059*	-0.108***	-0.007	-0.072**	-0.109***	-0.010
	(0.032)	(0.035)	(0.018)	(0.028)	(0.036)	(0.021)
PRI Signatory Dummy	0.001	0.042	-0.010	-0.093	0.109	0.018
	(0.095)	(0.067)	(0.046)	(0.085)	(0.073)	(0.048)
Fund Size	-6.137e-6	7.047e-6	1.481e-5	-1.988e-5**	2.968e-6	0.000*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Dry Powder	2.789e-5***	9.957e-5***	0.000	1.782e-5	0.000***	0.000*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
# Portfolio Companies	-0.001	-0.002	-0.002	0.001	-0.001	-0.006
	(0.002)	(0.002)	(0.003)	(0.001)	(0.002)	(0.004)
EPI Index	0.001	-0.004	0.000	0.003	-0.008**	-0.001
	(0.004)	(0.003)	(0.002)	(0.003)	(0.003)	(0.002)
Called Down				-3.831e-5**	7.238e-6	1.901e-5*
				(0.000)	(0.000)	(0.000)
Fund NAV				1.457e-5***	1.110e-5	0.000***
				(0.000)	(0.000)	(0.000)
Constant	0.337	0.626***	0.258	0.597***	0.738***	0.158
	(0.211)	(0.196)	(0.167)	(0.200)	(0.242)	(0.206)
Observations	47	69	90	47	59	73
R-squared	0.272	0.297	0.016	0.501	0.407	0.279
Dependent Variable	Net IRR	Net IRR	Net IRR	Net IRR	Net IRR	Net IRR
Controls Set	Baseline	Baseline	Baseline	Extended	Extended	Extended
Sample	+€5bn Funds	€1bn-€5bn Funds	<€1bn Funds	+€5bn Funds	€1bn-€5bn Funds	<€1bn Funds

Table 5

Results of Regression Analyses III

This table represents the regression results of analysis 1 for different geographic subsamples. The dependent variable are financial return metrics. Model 13-15 focus on European PE investors whereas model 16-118 look at US PE investors. Standard errors are in parentheses. *, **, and *** indicate statistical significance at 10%, 5%, and 1% level, respectively.

Variable	(13) Model 13	(14) Model 14	(15) Model 15	(16) Model 16	(17) Model 17	(18) Model 18
ESG Footprint	-0.040**	-0.115*	-1.865	-0.058**	-0.202	-5.037*
	(0.020)	(0.061)	(2.335)	(0.026)	(0.137)	(2.772)
PRI Signatory Dummy	0.107**	0.301*	2.401	-0.057	-0.358	1.926
	(0.053)	(0.160)	(5.231)	(0.067)	(0.357)	(8.599)
Fund Size	-2.982e-5***	-9.580e-5***	-0.003*	-1.228e-5	-2.118e-5	0.000
	(0.000)	(0.000)	(0.002)	(0.000)	(0.000)	(0.001)
Dry Powder	7.551e-5***	8.786e-5	0.007***	2.731e-5**	2.723e-5	0.002
	(0.000)	(0.000)	(0.003)	(0.000)	(0.000)	(0.001)
# Portfolio Companies	-0.002	0.010*	-0.072	0.002	-0.001	0.231
	(0.002)	(0.005)	(0.220)	(0.002)	(0.010)	(0.204)
EPI Index	-0.002	-0.007	0.192			
	(0.002)	(0.007)	(0.270)			
Called Down	-1.315e-6	8.280e-5***	0.002*	-8.186e-7	0.000	0.002
	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.001)
Fund NAV	2.110e-5***	6.712e-5***	0.002	6.590e-6	3.782e-6	0.000
	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.001)
Constant	0.391**	1.404**	-22.488	0.363***	1.483**	-5.099
	(0.182)	(0.563)	(21.085)	(0.130)	(0.694)	(14.096)
Observations	133	132	91	46	46	43
R-squared	0.230	0.243	0.152	0.260	0.180	0.206
Dependent Variable	Net IRR	Investment Multiple	Benchmark Outperformance	Net IRR	Investment Multiple	Benchmark Outperformance
Controls Set	Extended	Extended	Extended	Extended	Extended	Extended
Sample	Europe	Europe	Europe	US	US	US

Table 6

Results of Regression Analyses IV

This table represents the regression results of analysis 2 where the dependent variable is the fund-level ESG portfolio footprint. Model 19 uses the baseline set of control variables while model 20 uses the extended set (both excl. EPI index). Standard errors are in parentheses. *, **, and *** indicate statistical significance at 10%, 5%, and 1% level, respectively.

Variable	(19) Model 19	(20) Model 20
PRI Signatory Dummy	-0.261**	-0.242*
	(0.130)	(0.137)
ESG Responsibility	0.508***	0.539***
	(0.153)	(0.151)
ESG Impact Controlling	-0.502	-0.531
	(0.367)	(0.356)
ESG Value Enhancement Plans	-1.663**	-1.693***
	(0.670)	(0.645)
ESG Reporting Frequency	0.151	0.142
	(0.093)	(0.097)
Fund Size	1.817e-5	2.708e-5
	(0.000)	(0.000)
Dry Powder	4.029e-5	8.081e-6
	(0.000)	(0.000)
# Portfolio Companies	-0.004	-0.001
	(0.006)	(0.007)
Called Down		-4.387e-5
		(0.000)
Fund NAV		-4.523e-7
		(0.000)
Constant	2.105***	2.388***
	(0.132)	(0.301)
Observations	206	179
R-squared	0.134	0.170
Dependent Variable	ESG Footprint	ESG Footprint
Controls Set	Baseline	Extended
Sample	Total Sample	Total Sample

APPENDIX

Table A1: Summary Statistics

Variable	Description	Source
Net IRR	Net internal rate of return (after fees and carried interest)	PitchBook
Investment Multiple	Total value of a fund relative to the amount of capital paid into the fund to date (Total Value to Paid-In Capital)	PitchBook
Benchmark Outperformance	Net IRR after deducting the PitchBook benchmark net IRR	PitchBook
ESG Footprint	RepRisk rating	RepRisk
PRI Signatory Dummy	UN PRI signatory status	UN PRI
Fund Size	Total amount of capital committed by investors	PitchBook
Dry Powder	Committed but unallocated capital	PitchBook
# Portfolio Companies	Number of portfolio companies (excl. add-on companies)	PitchBook
EPI Index	Measure for the environmental performance of countries' policies	Yale University
Called Down	Percentage of capital commitments which have been drawn	PitchBook
Fund NAV	Current value of the portfolio	PitchBook
ESG Responsibility	Extent whether the responsibility of ESG management is with the portfolio company management	UN PRI
ESG Impact Controlling	Extent of monitoring of ESG development	UN PRI
Value Enhancement Plans	Extent of implementation of ESG value enhancement plans for portfolio companies	UN PRI
ESG Reporting Frequency	The frequency of portfolio companies' ESG reports throughout the year	UN PRI

Table A2: Cross-Section Summary Statistics for PRI Signatory Funds

Variable	Obs.	Min.	Max.	Mean	Std. Dev.
Net IRR	140	-0.09	1.16	0.24	0.17
Investment Multiple	133	0.45	4.18	1.75	0.55
Benchmark Outperformance	93	-41.40	60.90	3.18	15.40
ESG Footprint	140	1.00	5.09	1.91	0.85
PRI Signatory Dummy	140	1.00	1.00	1.00	0.00
Fund Size[1]	140	32.44	17,715.94	2,675.52	3,307.34
Dry Powder	140	0.00	6,099.40	485.35	1,093.18
# Portfolio Companies	140	1.00	62.00	11.64	9.96
EPI Index	140	51.10	77.70	70.53	8.28
Called Down[2]	131	20.60	100.00	82.93	21.42
Fund NAV	130	0.00	23,202.80	2,219.33	3,851.85
ESG Responsibility	140	0.00	4.00	1.07	1.64
ESG Impact Controlling	140	0.00	1.00	0.24	0.43
Value Enhancement Plans	140	0.00	1.00	0.29	0.46
ESG Reporting Frequency	140	0.00	4.00	0.74	1.34

(1) Fund size is stated in USD.

(2) Contributed capital / committed capital

Table A3: Cross-Section Summary Statistics for PRI Non-Signatory Funds

Variable	Obs.	Min.	Max.	Mean	Std. Dev.
Net IRR	66	-0.14	0.74	0.22	0.14
Investment Multiple	60	0.69	4.10	1.73	0.57
Benchmark Outperformance	62	-36.54	51.53	1.79	13.69
ESG Footprint	66	1.00	4.77	2.16	0.82
PRI Signatory Dummy	66	0.00	0.00	0.00	0.00
Fund Size[1]	66	118.79	25,424.28	4,240.87	5,784.14
Dry Powder	66	0.00	17,027.50	770.10	2,414.02
# Portfolio Companies	66	2.00	49.00	12.79	9.35
EPI Index	66	51.10	77.90	54.53	6.72
Called Down[2]	57	18.51	100.00	85.33	21.10
Fund NAV	58	0.00	21,690.00	3,775.40	5,576.67
ESG Responsibility	66	0.00	0.00	0.00	0.00
ESG Impact Controlling	66	0.00	0.00	0.00	0.00
Value Enhancement Plans	66	0.00	0.00	0.00	0.00
ESG Reporting Frequency	66	0.00	0.00	0.00	0.00

(1) Fund size is stated in USD.

(2) Contributed capital / committed capital

Table A4: Cross-Section Summary Statistics for Funds less than €1bn

Variable	Obs.	Min.	Max.	Mean	Std. Dev.
Net IRR	90	-0.14	0.90	0.22	0.16
Investment Multiple	78	0.79	4.18	1.74	0.58
Benchmark Outperformance	62	-36.54	60.90	3.07	15.83
ESG Footprint	90	1.00	5.09	1.89	1.05
PRI Signatory Dummy	90	0.00	1.00	0.74	0.44
Fund Size[1]	90	32.44	976.83	412.11	240.72
Dry Powder	90	0.00	874.98	46.40	116.63
# Portfolio Companies	90	1.00	39.00	9.32	6.52
EPI Index	90	51.10	77.90	67.59	9.56
Called Down[2]	80	20.60	100.00	84.21	20.41
Fund NAV	77	0.00	1,186.30	321.66	278.52
ESG Responsibility	90	0.00	4.00	0.52	1.24
ESG Impact Controlling	90	0.00	1.00	0.09	0.29
Value Enhancement Plans	90	0.00	1.00	0.13	0.34
ESG Reporting Frequency	90	0.00	4.00	0.36	0.93

(1) Fund size is stated in USD.

(2) Contributed capital / committed capital

Table A5: Cross-Section Summary Statistics for Funds between €1bn and €5bn

Variable	Obs.	Min.	Max.	Mean	Std. Dev.
Net IRR	69	-0.08	1.16	0.25	0.18
Investment Multiple	68	0.69	4.10	1.81	0.60
Benchmark Outperformance	63	-41.40	40.00	1.94	13.54
ESG Footprint	69	1.03	3.90	1.95	0.58
PRI Signatory Dummy	69	0.00	1.00	0.65	0.48
Fund Size[1]	69	1,000.00	4,950.68	2,505.02	1,167.90
Dry Powder	69	0.00	3,383.91	459.39	748.85
# Portfolio Companies	69	2.00	49.00	12.84	9.34
EPI Index	69	51.10	77.70	63.50	11.09
Called Down[2]	61	18.51	100.00	82.16	22.61
Fund NAV	64	0.00	7,289.41	1,717.55	1,503.46
ESG Responsibility	69	0.00	4.00	0.97	1.61
ESG Impact Controlling	69	0.00	1.00	0.25	0.43
Value Enhancement Plans	69	0.00	1.00	0.28	0.45
ESG Reporting Frequency	69	0.00	4.00	0.61	1.25

(1) Fund size is stated in USD.

(2) Contributed capital / committed capital

Table A6: Cross-Section Summary Statistics for Funds of more than €5bn

Variable	Obs.	Min.	Max.	Mean	Std. Dev.
Net IRR	47	-0.09	0.86	0.23	0.15
Investment Multiple	47	0.45	3.04	1.66	0.45
Benchmark Outperformance	30	-15.96	60.63	3.12	15.14
ESG Footprint	47	1.28	4.77	2.24	0.68
PRI Signatory Dummy	47	0.00	1.00	0.60	0.50
Fund Size[1]	47	5,000.00	25,424.28	9,458.18	4,964.29
Dry Powder	47	0.00	17,027.50	1,763.86	3,009.74
# Portfolio Companies	47	1.00	62.00	15.91	13.51
EPI Index	47	51.10	77.70	64.01	12.04
Called Down[2]	47	21.64	100.00	84.65	21.39
Fund NAV	47	0.00	23,202.80	7,931.82	6,344.46
ESG Responsibility	47	0.00	4.00	0.77	1.51
ESG Impact Controlling	47	0.00	1.00	0.19	0.40
Value Enhancement Plans	47	0.00	1.00	0.21	0.41
ESG Reporting Frequency	47	0.00	4.00	0.64	1.39

(1) Fund size is stated in USD.

(2) Contributed capital / committed capital