Sustainability and Private Equity Real Estate Returns

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Abstract

This paper explores private equity real estate fund performance and voluntary environmental, social, and governance (ESG) disclosures. Using data from the National Council of Real Estate Investment Fiduciaries (NCREIF), it examines the relationship between performance for funds in the Open Ended Diversified Core Equity (ODCE) Index and reporting to the Global Real Estate Sustainability Benchmark (GRESB), a platform for disclosure about fund/firm-level ESG strategies. The empirical analyses suggest four conclusions. First, there has been substantial adoption of and reporting to GRESB in the last 5 years, suggesting that reporting to GRESB is a form of table stakes for ODCE members. Second, GRESB participation and performance are both significant predictors of cross-sectional fund returns. Third, GRESB participation and performance are associated with the price appreciation component of fund total returns but not with the income component. Fourth, the relationships between fund returns and GRESB participation and scores are independent of local economic conditions. These results close an important gap in the literature about private equity real estate fund performance and ESG/climate change mitigation efforts in commercial real estate markets.

Keywords: Private Equity, Real Estate, ESG, Sustainability, GRESB, Benchmarking

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1. Introduction and Background

Private capital markets have grown in size and importance over the last 20 years. In 2020, there were more than $7T of private assets under management (AUM) at more than 11,000 funds; private equity real estate (PERE) represents approximately 20% of this capital (Baboolall, 2021). Concurrently, climate change and responses to it have also grown in importance. Recent data indicate that the earth's surface temperature and atmospheric concentrations of greenhouse gasses are reaching their highest ever levels, underscoring evidence from the Intergovernmental Panel on Climate Change (IPCC) on the rapid, wide-spread, and intensifying nature of the climate crisis and its anthropogenic causes.[1] Given the size of the market and that buildings in the United States consume approximately 35% of all energy produced and produce approximately 16% of greenhouse gas emissions (GHGs) (Eichholtz et al., 2019), the environmental performance of commercial real estate has never been more important.

Firms can do both well and good in this space as environmental, social, and governance (ESG) certified assets, particularly those designed and managed to address climate change, have proven to outperform traditional comparable assets (Eichholtz et al., 2010; Holtermans and Kok, 2019). Important for this paper, the plurality of the empirical research focuses on assets—both buildings (Fuerst and McAllister, 2011) and securitized mortgages (An and Pivo, 2020). Evidence about fund and firm performance is thinner, and overwhelmingly oriented towards publicly-traded markets (Real Estate Investment Trusts-REITs) where information is more plentiful (Ling et al., 2014) and ESG activity disclosure is a far more common behavior (Coën et al., 2018; Devine and Yönder, 2021).

The limited prior focus on private firms and emerging private firm data from the Global Real Estate Sustainability Benchmark (GRESB) suggest an opportunity and need to close the knowledge gap around ESG behavior among PERE funds. Described more fully in the Data section, GRESB is a non-profit organization that supports a platform and process for voluntary disclosure about ESG activities across multiple dimensions for real estate and infrastructure funds and firms. GRESB utilizes the disclosed information to create a set of standardized and validated data as well as benchmarks. REITs have been disclosing their ESG activities to GRESB for some time (Feng

[1]See: https://www.ipcc.ch/assessment-report/ar6/

and Wu, 2021). That PERE funds have also begun to voluntarily disclose their ESG activities to GRESB opens a window to important actions (and information) that heretofore were largely unobservable and which may prove to be material in evaluating fund value and performance.

In this context, we create a novel data set merging Open Ended Diversified Core Equity (ODCE) fund performance data from the National Council of Real Estate Investment Fiduciaries (NCREIF) with fund ESG reporting data from GRESB. Using this data set, we examine the extent to which ODCE fund performance is associated with voluntary ESG reporting. ODCE funds are are infinite life vehicles that invest using low leverage in stabilized operating properties with geographic and property type diversification. The integration of the GRESB and ODCE data facilitates exploration of PERE fund behavior among a sample of relatively similar private equity funds, attenuating concerns about sample selection bias and endogeneity rising from missing information regarding fund/firm quality and investment strategies.

Our paper connects three threads in the literature. The first is research identifying factors associated with cross-sectional and time series variation in fund and firm returns (Eugene and French, 1992; Couts, 2019). This is a mature literature that has expanded commensurate with the growth of data available for analysis (Harvey and Liu, 2021). It details the presence of hundreds of factors with significant relationships though distinguishes between theory and data mined contributions, the challenges of overcoming endogeneity concerns, and the temporal limits of factors identified in academic research (Feng et al., 2020; Giglio and Xiu, 2021; McLean and Pontiff, 2016). The factor and firm performance literature explores real estate via analyses of both REITs and PERE (Naranjo and Ling, 1997; Allen et al., 2000; Ling et al., 2014). This work motivates and shapes our inquiry, especially given the extent to which it identifies macro-economic, market, and fund/firm characteristics influence variation among private equity fund returns (Arnold et al., 2019). Our paper builds on Arnold et al. (2019) and examines the role of voluntary ESG disclosures as a potential factor driving PERE returns.

Additionally, our work connects to the literature exploring physical climate risk within financial markets–also known as climate finance (Hong et al., 2020). The foundational climate finance literature draws on the work of Matthews et al. (2009) which elucidates the mechanism of long-term climate change: cumulative carbon emissions leading to permanent temperature change. Importantly, Matthews et al. (2009) details the complexity of carbon-climate modeling and provides a simplified empirical model. Recent empirical climate finance work explores physical risks associated with climate change in asset prices (Alok et al., 2020; Barnett et al., 2020), investor behavior (Krueger et al., 2020), and residential real estate (Kousky et al., 2020; Murfin and Spiegel, 2020). This work influences our paper by demonstrating the complexity of climate risk in multiple markets and its contours relative to fixed location assets. It also helps to show how different perspectives and geography shift market equilibrium (Baldauf et al., 2020). As much of the climate finance real estate work focuses on housing and the residential mortgage market (Issler et al., 2020; Ouazad and Kahn, 2019), we contribute by applying lesson from the factor literature and climate finance to commercial real estate and focus on fund level performance and the firm behavior designed to mitigate climate change.

The third research thread to which our paper connects is the sustainable real estate literature. This body of work demonstrates the connectivity between ESG oriented investments and asset, firm, and fund-level performance (Eichholtz et al., 2010, 2019; Clayton et al., 2021). In the sustainable real estate literature, there is significant price and performance differentiation between ESG certified and traditional comparable assets, with evidence echoing across asset classes (Pivo and Fisher, 2011; Chang and Devine, 2019; Gabe et al., 2021; Devine and Yonder, 2021) and time (Holtermans and Kok, 2019). Findings from the debt markets are complementary and illustrate the relationship of ESG certification to default (Kaza et al., 2014; An and Pivo, 2020). This literature also examines ESG certifications and behavior relative to differentiated returns and valuations among publicly listed real estate firms (Eichholtz et al., 2012; Coën et al., 2018; Devine and Yönder, 2021). Recent work on REITs reveals that firms reporting to GRESB tend to have lower costs of debt and higher valuations Feng and Wu (2021).

There is not, to the best of our knowledge, work exploring voluntary ESG disclosures among PERE funds. It is this gap we seek to close, drawing on the theory and prior evidence within these three strands of literature.

2. Data & Descriptive Analysis

GRESB is a voluntary ESG performance reporting framework for real assets, providing standardized and validated data to the capital markets. The investor-driven program originated in The Netherlands in 2009 because other existing and well-known, yet more general, sustainability and ESG benchmarking tools proved a poor fit for the unique aspects of real assets.

GRESB provides an industry-specific measurement toolkit for the built environment, assessing fund/firm-level performance for commercial real estate assets and, since 2017, infrastructure assets.

GRESB Assessments are dynamic, undergoing continuous review to ensure materiality of content and alignment with several international reporting frameworks such as the Global Reporting Initiative (GRI), the Sustainable Accounting Standards Board (SASB), the Taskforce on Climate-Related Financial Disclosures (TCFD), the Paris Climate Agreement, the United Nations Principles for Responsible Investment (PRI) and Sustainable Development Goals (SDGs), and region-specific disclosure guidelines and regulations. The dominant GRESB tool, and the one utilized in this study, is the Real Estate Assessment. It is an annual voluntary survey completed at the fund/firm-level in the spring, with results first validated (during the summer) and then compiled to track fund/firm performance both year over year and in comparison with peer organizations. Each year in the fourth quarter, GRESB produces a Real Estate Benchmark, a Real Estate Development Benchmark, an Infrastructure Fund Benchmark, and an Infrastructure Asset Benchmark, as well as providing each participating organization with a comparative business analysis. GRESB scores are assigned on a zero-to-five-star basis.

(Insert Figure 1 here)

The GRESB real estate program has experienced extensive market adoption; the 2020 GRESB benchmark covered more than 1,200 funds/firms and 4.8T USD in value of assets under management, representing 96,000 assets in 64 countries; Figure 1, Panel A provides a map of the real estate assets covered under GRESB reporting as of 2020, by CBSA. Of the 921 continental U.S. CBSAs, approximately one in four contains at least 10 GRESB assets, with 67 CBSAs having more than 50. Visual inspection confirms that investors in major institutional investment markets and gateway cities are heavy adopters of GRESB reporting. As seen in Figure 2, reporting to GRESB has grown significantly over the last ten years, both in terms of fund/firm count and assets under management. Indeed, 953 of the approximately 1,200 participating funds/firms in 2020 are non-listed funds, suggesting that while the market penetration of this innovation is in the early stages, adoption by private equity funds is substantial.

(Insert Figure 2 here)

The Real Estate Assessment is broken into three components: Management; Performance; and, Development. The Management component describes organizational ESG strategy and leadership policies along with information about risk management and investor engagement. Performance data captures fund/firm level performance across an array of ESG elements on standing investments. Importantly, as of 2020 the addition information on asset-level disclosure is required, governing building characteristics and (where available) energy and water consumption, waste creation and divergence, and greenhouse gas emissions. Development data describes attributes of ESG during construction (if assets in a fund/firm are new builds). Both quantitative and qualitative data are collected, with scoring weighted more toward the former (70% vs. 30%). Topics covered under each component range from resource consumption and emissions performance data to diversity, equity, and inclusion policies and metrics. Notably, green building certification accounts for approximately 10% of GRESB scoring under the Performance category. GRESB component scores are expressed as a percentage, and scoring takes asset allocation and property type distribution into account for both scoring and benchmarking purposes.[2] For the purpose of this study we focus on the Management and Performance components as they are reported for all funds/firms, whereas Development data are only available for funds/firms actively engaged in asset construction, which represents a small portion of the sample funds.

NCREIF provides investment performance indices and firm, fund, and asset-level performance data for U.S. commercial properties and their associated entities. The organization compiles quarterly data on PERE fund returns, composition, geographic distribution, property values, characteristics, and operating details. In this study we will examine the PERE funds included in the NCREIF ODCE index.[3] This index tracks open-end funds pursuing a core investment strategy, generally characterized by low risk, low levered, stable properties geographically diversified across U.S. markets. ODCE represents investment returns on 38 open-end, comingled funds which have been

[2]For more detailed information on GRESB questionnaires and component scoring, please visit: https://documents.gresb.com/

[3]Per NCREIF, ODCE funds must have (based on market value): 80% of their real estate assets invested in PERE properties; 95% invested in U.S. real estate; at least 80% invested in office, industrial, apartment, and retail assets; at least 80% invested in operating properties; and, no more than 65% invested in in a single property type or region.

report on both a current and historical basis since ODCE's inception in 1977; 24 funds are currently active in the index. As of Q2 2021, the ODCE funds represented approximately $218B in net assets, earning an annual total return of 8.02%. Figure 1, Panel B presents the real assets under ODCE ownership as of 2020, by CBSA. Of the 921 continental US CBSAs, ODCE assets are clustered in approximately 21% of the markets, with only 26 CBSAs housing more than 50 ODCE assets. As with GRESB assets, ODCE assets are predominantly situated in major institutional investment markets and gateway cities, at yet an even higher concentration that observed in GRESB reporting (Figure 1, Panel A).

As environmental sustainability commitments and reporting are voluntary in most markets, efforts to study adoption and impacts are often plagued by selection bias. The intersection of GRESB and ODCE funds offers a unique laboratory, as all funds currently active on the index have adopted GRESB Real Estate Assessment reporting over the recent years. As seen in Table 3 Panel A, more than half the funds reported as of 2015 and the balance of the funds adopted GRESB since that time; no fund has stopped reporting to GRESB once adopted. During this horizon, the year-over-year performance of ODCE funds has overwhelmingly been the maintenance of their current GRESB rating. However, each year two to three funds experience a downgrading, while between two and five funds experience an upgrading. Panel B provides deeper insight into the performance record according to GRESB component, as well as the sub-component measuring Building Certifications. Generally, each category has experienced upward trends in their year-over-year performance, with some corrections evident; such corrections may reflect notable changes in the stated goals of the component, such as the prescribed asset-level consumption and emissions data requirements instituted as part of the Performance component in 2020. These generally-improving scores may reflect funds modifying their policies and practices to adhere to GRESB goals, or changes in policies and practices independent of "rating-chasing" behavior.

(Insert Figure 3 here)

T-tests compare overall GRESB performance of ODCE PERE funds and non-ODCE funds/firms which also report to GRESB. Results indicate ODCE funds outperform the balance of the reporting organizations, both in global and regional GRESB rankings and benchmarking; these results are highly statistically significant. ODCE funds also outperform their counterparts in both the Management and Performance components, albeit at lower degrees of statistical significance.[4]

Table 1 provides summary statistics information for the 376 fund-quarter ODCE observations studied here. *GRESB Reporting* indicates that 70% of these observations coincide with GRESB reporting, while the balance predate GRESB reporting for each fund; no ODCE fund stopped GRESB reporting after they began. Fund *GRESB Ratings* scales from zero to five stars, with the zero star category representing both earned zero stars (rare) and periods of non-GRESB reporting. The table details the distribution of all dependent and independent variables utilized in this study, including various measures of fund returns, fund financial and asset-specific control variables, and a number of local control variables. These geographic, demographic, macroeconomic, and climatic controls aim to address possible endogenous drivers of GRESB adoption; see the Empirical Strategies section for an in-depth discussion of these variables.

(Insert Table 1 here)

Figure 4 details our first analysis. Panel A compares the quarterly cumulative returns for all ODCE funds to the subset of those funds that are actively GRESB reporting.[5] This highlights superior returns for GRESB funds. Notably, both sets of funds are similarly impacted by systemic market changes, indicating an ESG return premium but not a growth premium, consistent with Holtermans and Kok (2019). Panel B presents the linear prediction of the average *Total Return* and 95% confidence intervals for ODCE funds which report to GRESB, sorted into three buckets: those which experienced a *GRESB Score* downgrade; those which had an unchanged *GRESB Score*; and, those which experienced a *GRESB Score* upgrade; this final bucket includes initial GRESB reporting as well. Results indicate an improving expected *Total Return* with each improving *GRESB Score* change bucket

[4]T-test results suppressed to conserve space, yet are available upon request. Development component results are not examined as ODCE funds are, by definition, not active real estate developers.

[5]We also compare GRESB-reporting ODCE funds to non-GRESB reporting ODCE funds, and the relationship holds. This comparison, while more insightful, is suppressed to preserve data privacy for the late-adopting GRESB funds.

status. Together these descriptive results provide the basis for inferential work exploring the relationships observed here.

(Insert Figure 4 here)

3. Methodology

We start by sorting PERE fund-quarters into portfolios according to various definitions of GRESB adoption, including: *GRESB* participation/reporting (yes or no); the direction of change in *GRESB Score*; and the year-over-year change in *GRESB Score*. We then use these portfolios to explore which attributes contribute most/least to *GRESB Score* (as compared to their possible contribution level), and how non-listed funds reporting to GRESB perform against each other, against their non-participating in-sample counterparts, and against their publicly-listed counterparts, by year.

Next, we examine the relationship between GRESB reporting and fund-level return for a sample of non-listed ODCE funds from 2015Q1 to 2019Q4. Specifically, we sort the ODCE funds according to their GRESB reporting activity and then examine the return performance of the resulting GRESB and non-GRESB portfolios in quarter t. The former (the portfolio of GRESB adopters) is likely to be making ESG investments than the latter. Both portfolios are re-balanced at the end of each year, consistent with the frequency of GRESB reporting (announced Q4 each year). We expect to see that our portfolio of GRESB adopters outperforms the non-GRESB portfolio because the literature finds that funds/firms with more environmentally certified properties are associated with better operating performance (Devine and Yonder, 2021).

Our baseline regressions examine whether GRESB reporting predicts quarterly total return in a multivariate context. Fama-MacBeth analyses regress quarterly fund-level returns against our GRESB proxies, controlling for a wide range of fund characteristics highlighted by the literature.

$$r_{i,t} = \alpha + \beta(GRESB_{i,y-1}) + \gamma X_{i,t-1} + \epsilon_t \tag{1}$$

where $r_{i,t}$ is the total return of fund i on quarter t. $GRESB_{i,y-1}$ is defined as either an indicator variable for *GRESB* adoption or the overall *GRESB Score* which each participating fund obtains at the end of the prior year. $X_{i,t-1}$ is a vector of characteristics of fund i on quarter $t-1$, including: the chain-linked total return from quarter $t-4$ to $t-1$ ($PastReturn$), the geographic Herfindahl index ($GeoHHI$), the property-type Herfindahl index ($TypeHHI$) (Ling et al., 2018), the logarithm of fund size ($ln(Assets)$), the ratio of total debt to fund size ($Leverage(\%)$), and the ratio of cash and cash equivalents to fund size ($Cash$). Controlling for $PastReturn$ is important in the context of this analysis because investors might tilt their holdings toward funds with better past performance (Couts, 2019)). As the outperformance of ESG-committed funds might be a manifestation of their size and/or excessive use of debt, we control for their size and use of debt using $ln(Assets)$ and $Leverage(\%)$, respectively. $GeoHHI$ and $TypeHHI$ are calculated using the squared proportion of a fund's market value of properties invested across MSAs or property types. Herfindahl–Hirschman indices (HHIs) measure the extent of concentration of a fund's property portfolio. The coefficient of interest is β. A positive coefficient estimate indicates that GRESB adoption or the level of fund ESG commitment positively predicts PERE fund performance.

To further control for the impact of unobserved fund-level heterogeneity on fund performance in the cross section, we include fund-type fixed effects in the cross-sectional regressions. Finally, a panel analysis robustness test will employ the above equations, but with fund-type and year-quarter fixed effects included to allow for comparison across model specifications.

We next examine the channel(s) through which *GRESB Score* predicts subsequent fund returns. Specifically, we conjecture that higher valuation of sustainable funds is likely attributed to: (1) managerial ESG commitment ($Management$); (2) superior fund-level ESG-related performance ($Performance$); and/or, (3) asset-level environmental certification ($Certification$). Given that $Performance$ is partially derived from $Certification$, we replace $GRESB_{i,y-1}$ in equation (1) with $Management$ and $Performance$ or $Management$ and $Certification$, respectively to avoid potential multicollinearity issue; our findings are qualitatively similar if we include all three components in the same regression.

We decompose quarterly total returns into an income return component ($Income\ Return$) and a price appreciation component ($Appreciation\ Return$). Ghent et al. (2019) find that the income return component is homogeneous across commercial real estate indices and exhibits little volatility, whereas the price appreciation component varies significantly across the two markets.[6] This is likely due to the fact that rental income changes slowly and is much easier to predict than changes in capitalization rates (Ling et al., 2021). In the context of this study, while information on GRESB adoption might be capitalized into PERE returns at a timely manner, its effect on rental income may take time to materialize. In other words, GRESB adoption is likely associated with higher future rental growth rate captured by the price appreciation component rather than higher current level of rental income. This also helps us mitigate concerns regarding funds with high-quality assets self-selecting to adopt the GRESB standard.

3.1. Potential Endogenous Adoption Drivers

Research exploring the impact of sustainability on fund/firm performance is often plagued by omitted variable bias and causality issues. As this study is not a randomized control trial, our data may be exposed to a number of sources of bias in both sample selection and measurement of the treatment. These issue arise in two categories: first, better performing funds/firms and managers may be more likely to invest in sustainability (Margolis et al., 2009); and second, an out-sized demand for sustainable assets may exist in some markets (Addoum et al., 2020). We benefit from uniquely deep data and have designed our study to address as many of these issues as possible.

In the last set of analyses, we measure the impact of several variables which may shape a market's propensity to demand environmental investments, consistent with the extant finance and economics literature. We first explore three climate intensity proxies, capturing the impact of heating (HDD) and cooling (CDD) needs, as well as total climate intensity (TDD). This data is collected from the NOAA and the National Centers for Environmental Information. Consistent with the literature (Qiu and Kahn, 2019; Clayton et al., 2021; Addoum et al., 2020), we use this metric as a proxy for potential demand for environmental sustainability at the asset level. The number of degree days measures the deviation of the local temperature from an ambient temperature of 65 degrees Fahrenheit. Heating degree days measure the absolute deviation below this standard and cooling degree days measure the absolute deviation above the standard. Summed together, they can serve as a proxy for for weather variability. The larger the number of

[6] The absence of volatility in the income return component does not suggest that cash flows from property investments are smooth. In fact, the volatility in the cash flows is reflected in the price appreciation component and income return is reflective of cap rates.

degree days, the more costly an inefficient building may prove. Therefore, properties in areas with larger needs for heating or air-conditioning due to the local climate will benefit more from energy efficient building practices.

Next, in the spirit of Engle et al. (2020), we proxy for local awareness and demand of sustainability-related issues using geographically-weighted population density (*Density*), education attainment (*Bachelor*), and the number of electric car charging stations (*ELE*). *Density* measures thousands of residents per ZIP code, which teases out a possible urban versus rural mindset regarding sustainability commitments. *Bachelor* captures the share of the population over 25 years old within a ZIP code with a 4-year college degree or higher, serving as a proxy for educational attainment. These demographic data are obtained from the U.S. Census and American Community Survey.

ELE captures the density of electric vehicle charging stations situated near each ODCE PERE fund asset. We hypothesize that an electric vehicle charging station will only be operated where it is demanded. Since people usually refuel their automobiles near their homes and work locations, an electric vehicle charging station is a strong proxy for the local presence of electric vehicles. Alternative fuel vehicles are an accepted proxy for environmentally-sustainable ideology in the literature (Kahn and Vaughn, 2009; Bond and Devine, 2016b). The U.S. Department of Energy provides a continuously-updated database of every clean fuel station in the U.S. A count of the electric vehicle charging stations (the most prevalent form of alternative fuel for passenger automobiles) situated within each property's ZIP code serves as a proxy for the local market's propensity to be green. The number of electric car charge stations may proxy for a local sustainability demand, which may affect the corporate decision to make asset-level ESG investments in a geography, but should not be correlated with fund/firm financial determinants.

Finally, reflecting Cooper and Kaplanis (1994) and Cashman et al. (2019), we control for the fund preference for assets situated in their home markets (*HOMECON*) or markets where sustainable properties are more accessible (*GeoGRESB*). The latter captures the average of MSA-level percentages of GRESB-certified properties, weighted by the percentage of the fund's portfolio (in market value) allocated to each county at the end of the previous quarter.

We first perform a horse race between the above-described proxies for sustainability adoption and local demographic and economic variables. We then include all variables in the same regression. Due to limited sample size, this exercise is subject to multi-collinearity issues and its findings should be interpreted with caution.These proxies are perceived as shocks to the awareness of ESG issues among local stakeholders and are likely to confound our GRESB proxies. In particular, local investors who are more exposed to extreme weather conditions might pay more attention to fund-level environmental sustainability (e.g., GRESB adoption) (Hong et al., 2021). It might be claimed that there could be unobservables related to location quality affecting both asset-level ESG investments and fund financials. This is why we utilize a large set of controls related to education, business activity, and the quality of property portfolio, etc.

4. Results, Discussion, and Implications

Building upon the initial sorting analysis, we explore the extent to which reporting to GRESB is associated with a fund's quarterly total return. Table 2 indicates that GRESB participation, when measured using a binary approach, is associated with a 0.31% quarterly (or 1.24% annualized) increase in total return, holding other factors constant. When compared to the mean total return of 1.94 %, the statistically significant result is also economically significant.

With respect to PERE funds' GRESB performance, the models demonstrate that every one point increase in scoring is associated with a 0.06% quarterly or .24% increase in annualized total returns. The result is independent of the fund's past returns–which are also significant predictors of quarterly returns. Here, both prior returns and fund type fixed effects increase the model fit though they do not materially change the GRESB reporting or scoring coefficients. Additionally, the participation and performance findings are independent of geographic and asset type Herfindahl indices accounting for fund concentration levels by place and asset type where managers can attenuate risk through diversification. Table 7 robustness tests, described in Subsection 4.1, offer additional context for the contribution and connect with recent work by Couts et al. (2020).

(Insert Table 2 here)

The results speak to the importance of both participation and performance relative to sustainability and ESG reporting schemes. Here, GRESB participation illustrates the coarse distinction whereas GRESB Scores help to isolate a more nuanced concept associated with differentiated returns beyond the traditional factors that help to explain return patterns including leverage, total assets, and cash positions. The GRESB Score coefficient t-statistic surpasses the threshold proposed by Harvey et al. (2016) for new substantive contributions to traditional modeling frameworks.

Speaking to the implications of these results, we expect that as the adoption of voluntary disclosure grows within this cluster of funds, differentiated out-performance is unlikely to hold and will transition towards a discount for failure to disclose and engage in ESG activities (Kok et al., 2011). Consequently, ESG reporting appears to be a form of table stakes among elite funds/firms and is unlikely to abate given anticipated policy regime shifts both in the U.S. and globally (Deborah Cloutier et al., 2021).[7]

Exploring fund returns using a different lens, Table 3 describes which components of GRESB scores are associated with subsequent fund returns. Two GRESB components are significantly associated with total returns: *Management* and *Performance*. An increase in *Management* from the lower to the upper quartile is associated with a .2% increase in quarterly returns where *Performance* is negatively associated with subsequent quarterly returns, a prima facia unexpected result.[8] ESG building certifications are not significant predictors of fund returns where they are predictors of asset level returns (Eichholtz et al., 2010).[9] Importantly, traditional control variables for fund return models also do not appear to confound the coefficients. Neither prior returns nor fund type fixed effects materially change the results in Table 3

[7]The question of the extent to which firms that have been reporting for longer know better how to score well on GRESB arose and was discarded given a two factors. First, firms may utilize external expertise to prepare/submit their GRESB reporting, effectively buying themselves the GRESB expertise that would otherwise be garnered by a firm reporting for a number of years. Second, the GRESB Grace Period allows first-time reporting firms to not make their results public for one year. This affords anyone interested a one-year period to familiarize their organization with GRESB reporting and calibrate their procedures accordingly.

[8]The difference between the upper and lower quartiles of *Management* is 19, $19 \times 0.01\% \approx 0.2\%$

[9]The finding that building certifications are not a material predictor of returns at the fund level warrants a bit more discussion given the robust literature indicating differentiation between ESG certified and traditional buildings. We attribute the finding to diffusion of ESG certifications in the market (Kok et al., 2011) and the durability of their out-performance (Holtermans and Kok, 2019). Given the nature of reporting at the fund level and that ODCE funds are buying core assets in core markets, there is a high probability they are all buying a majority ESG certified space. That limited variation limits the ability of this channel to influence fund level returns.

though they are significant predictors, findings consistent with the private equity literature (Kaplan and Schoar, 2005) (and its applications to commercial real estate (Arnold et al., 2019)).

(Insert Table 3 here)

We interpret the *Management* result as congruent with management theory contending funds/firms generate value from ESG activities via two channels: product differentiation and corporate image (McWilliams and Siegel, 2001). Applied to commercial real estate, signals about these two channels are observed in differentiated returns as well as signals about where funds/firms trade or where returns deviate from the net value of their underlying real estate assets. Where the prior analysis described elements of product differentiation, the sample (and attendant sample selection issues) is helpful here in illustrating the substantive nature of the corporate image element relative to the management coefficient. As each of the ODCE funds is an elite, high performing, professionally managed organization, the Management result here seems to reflect improved and differentiated corporate image for reporting ESG behavior and activities. Since GRESB is a fund/firm-level reporting platform, this result is conceptually consistent with the lack of significance for the building certification component of disclosures.

Though unexpected on their face, we interpret Performance category results as an adjustment to changes within the GRESB reporting scheme. 2020 was the first year funds and firms had to provide asset-level waste, water, energy, and emissions data (on an as-possible basis). There was an observable step back in reporting, and for those funds/firms which did continue to GRESB report (including all ODCE funds) the overall Performance category results suffered. We also acknowledge the potential for COVID related workflow effects. Though not part of the data used for analysis, 2021 GRESB results indicate a 24% increase in reporting in this category. This suggests that the negative coefficient for performance was likely related to funds/firms adjusting to evolving reporting requirements. The results provide useful signals about the channels through which private funds/firms harvest value from ESG activities. Further, the results provide utility for future work as it seeks to make comparisons across and between private funds working in other asset classes (Hong et al., 2020; Giglio and Xiu, 2021).

In addition to describing the components of GRESB related to total returns, we also examine the relationship between GRESB reporting and the principal components of fund returns. Table 4 demonstrates that the price appreciation component of total return is positively and significantly associated with GRESB participation and performance whereas the income appreciation component is not. Both the binary and continuous measurements of GRESB reporting are significant predictors of income appreciation as they were for total returns. Similar to the results presented in the cross-sectional return models, the GRESB Score t-statistic is quite high and overcomes the threshold test from Harvey et al. (2016) for making a material and meaningful contribution to a factor based model.

(Insert Table 4 here)

The results appear to suggest that the disclosure of ESG activities to GRESB is anticipatory. That is, among successful elite private funds, revelations about ESG oriented actions portend higher future rental growth capitalized in price appreciation as compared the capitalization of higher current levels of rental income. This finding adds ballast and dimensionality to the *Management* finding above. It is also congruent with the literature on private equity performance (Harris et al., 2014) where prior returns, persistence, and subsequent fundraising are also anticipatory (Kaplan and Schoar, 2005). The connections to the broader literature and the results from Table 4 raise questions about the extent to which understanding phenomena like this confound the predictability of future returns. In informationally symmetrical and efficient markets, advantages can be short lived (McLean and Pontiff, 2016). In private equity where asymmetrical information abounds, it will be useful to investigate this phenomenon across time.

4.1. Endogeneity and Robustness Tests

Consistent across the finance and economics literature, climate, political economy, and demography are known predictors of various phenomena. They are useful controls and variables of interest in real estate (Kok et al., 2011), municipal bonds (Goldsmith-Pinkham et al., 2019), and mutual funds (Alok et al., 2020)—albeit at different levels of specificity and importance. For example when analyzing the signals about climate change and mutual fund performance, county level data provided helpful contours for Alok et al. (2020). In commercial real estate, spatial relationships and local economic conditions are known drivers of value (Anas, 1990) and recent analyses suggest that urban spatial structure factors are helpful in mitigating endogeneity concerns (Gabe et al., 2021).

In Table 5, we explore the relationship between PERE fund return predictability, ESG behavior, and local demographic, economic, and climatic conditions. Using a horse race approach, we find no evidence that local spatial and economic factors are significant predictor of fund returns. Moreover, the relationship between fund returns and ESG disclosure/behavior is not abrogated by spatial or political economy factors. Further, both ESG reporting scheme participation and performance are significant predictors of fund returns; with performance offering greater explanatory power across the model types.

(Insert Table 5 here)

These findings are, to a large extent, expected in the context of ODCE fund definitions/requirements and fund level reporting. We interpret the results here as evidence that elite private real estate funds/firms are required, as a condition of listing in the ODCE index, to have substantial geographically and asset type diversification and that individual local political and economic forces, while influential at the asset level, wash out and fail to influence returns over and above the other factors in the model. This is not to say that spatial factors are not important–there is ample evidence elsewhere indicating that they are. Instead, it seems that across an elite, professionally managed, diversified core PERE firms purchasing similar assets from a structural and locational basis, these conditions do not have a super or supra effect on returns.

The results from additional variations of the model provide a robustness check on the aggregated local economic measurement in Table 45. Table 6 indicates that when decomposed to individual measures detailed in the sub-section on endogeneity, we find that only the total degree days metric is significant. This is consistent with the prior literature (Kahn and Vaughn, 2009; Bond and Devine, 2016a) and indicates that climate intensity proxies, like extreme weather events, are material factors in fund level variation (Alok et al., 2020).

(Insert Table 6 here)

Finally, as a robustness test of our baseline results, we re-examine the findings from Table 2 using panel regression techniques with standard errors are clustered at the fund level. The aim of this exercise is to strip away some of the traditional capital markets risk and observe the extent to which the ESG reporting participation and performance findings hold. Following Couts (2019), we replace the raw returns on the left hand side of the model with Fama-French-Carhart Alphas. This removes the systematic capital markets risk from the model and leaves behind signals about idiosyncratic risk. Critically, in Table 7 we observe that GRESB reporting is positively related to PERE Fama-French-Carhart risk-adjusted returns in the cross section. As expected, the size and strength of the effects are smaller than when focused on raw total returns, a helpful outcome that provides additional context and framing of the initial results in Table 2. Differing from Table 2, GRESB participation is significant while GRESB scores are not.

(Insert Table 7 here)

5. Conclusions

Given substantial growth in the private capital markets and the collective need to address climate change, this paper explored the relationship between PERE fund disclosure of ESG activities and fund level financial performance. Specifically, the paper examined the extent to which ODCE fund returns are materially related to GRESB reporting. We combine data from NCREIF with reporting from GRESB at the fund level to assess how elite, well managed, professional private equity funds perform relative to their peers. This is important in commercial real estate where firm/fund strategy, type, and management quality can all vary within competition for the same assets.

Informed by theory and prior evidence, our models suggest four conclusions. First, reporting to GRESB has become a form of table stakes among ODCE funds. Second, both GRESB participation and variation in performance were significant predictors of fund total returns, all else equal. Third, GRESB participation and variation in performance were associated with variation in the price appreciation component of fund total returns though they were not associated with the income component. Fourth, the relationships between fund returns and GRESB participation/scores were not obscured by local economic, demographic, and climatic conditions when those conditions are measured either in aggregate or individual specifications.

The results are consistent with the arc of the climate finance and sustainable real estate literature focused on firms (e.g., Devine and Yonder (2021).

In equilibrium, it seems that there is differentiated performance among private market participants for disclosing information about the ESG, or climate change mitigation activities, in which they have engaged. The results are also consistent with the asset oriented sustainable real estate literature where there is evidence of differentiated performance between ESG certified assets and their non-certified counterparts (Eichholtz et al., 2010; Holtermans and Kok, 2019).

We are on the precipice of major change in the policy landscape addressing climate action and carbon disclosure (Deborah Cloutier et al., 2021). Consequently, the results here offer insight into the advantages firms/funds have captured as first movers in this space. They also raise questions, like those from McLean and Pontiff (2016), on the duration of these advantages as greater volumes of information become public or what a new information equilibrium means for asset pricing models in commercial real estate (and beyond). The results point to opportunities to for additional research. Future research could leverage granular property-level data to study the relation between the income return component and the price appreciation component. Future work might also explore causal pathways in the relationships identified above.

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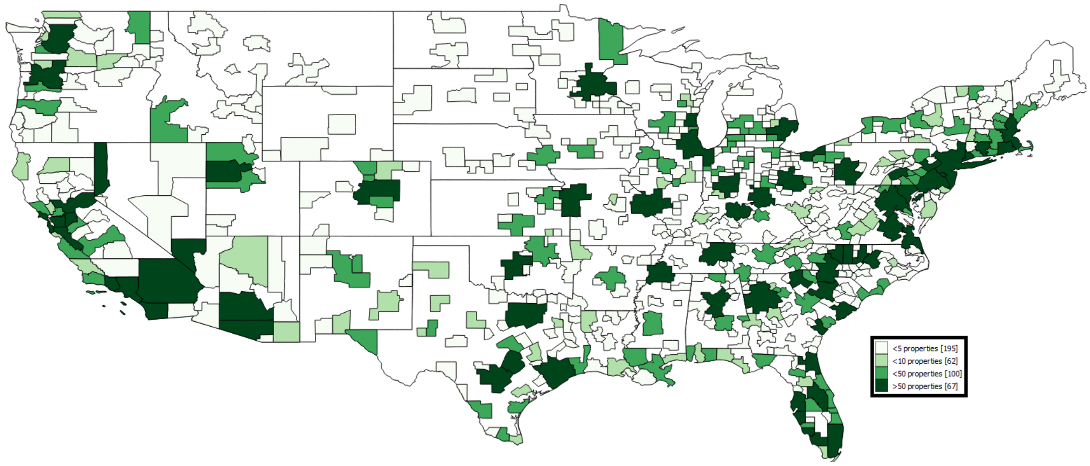
6. Tables & Figures

GRESB and ODCE Asset Density, by CBSA

Panel A: GRESB Real Estate Assessment Assets



Panel B: ODCE Assets

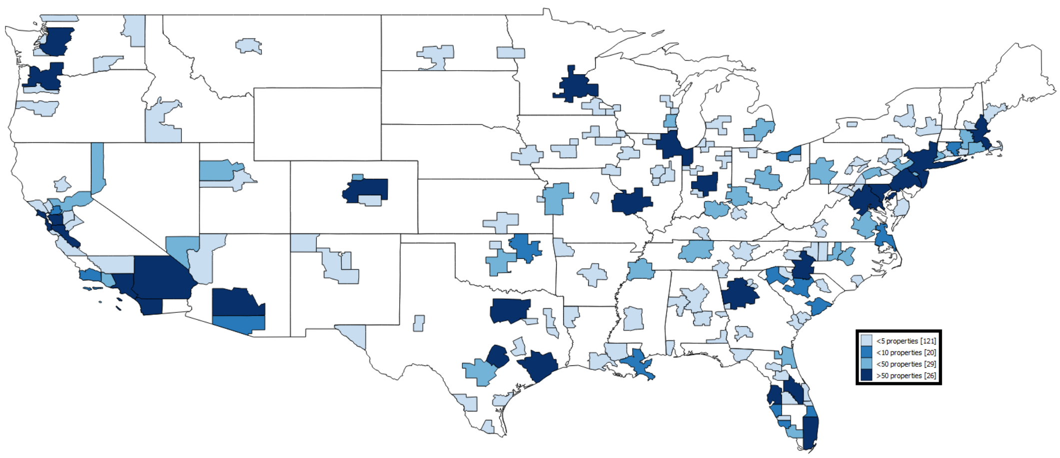


Figure 1: Both maps highlight the density of assets within continental U.S. Core Based Statistical Areas (CBSAs). Of the 921 CBSAs, the map identifies only CBSAs in which there is a non-zero number of assets observed. Panel A presents the asset count reported to the 2020 GRESB Real Estate Assessment across all funds/firms; Panel B presents the asset count associated with ODCE funds in 2020. Each map breaks asset count into four categories: fewer than 5 assets; 5-10 assets; 10-50 assets; and, more than 50 assets. Higher asset counts are represented with darker shades.

GRESB Real Estate Assessment Survey Adoption Over Time,
by Firm Count and Assets Under Management

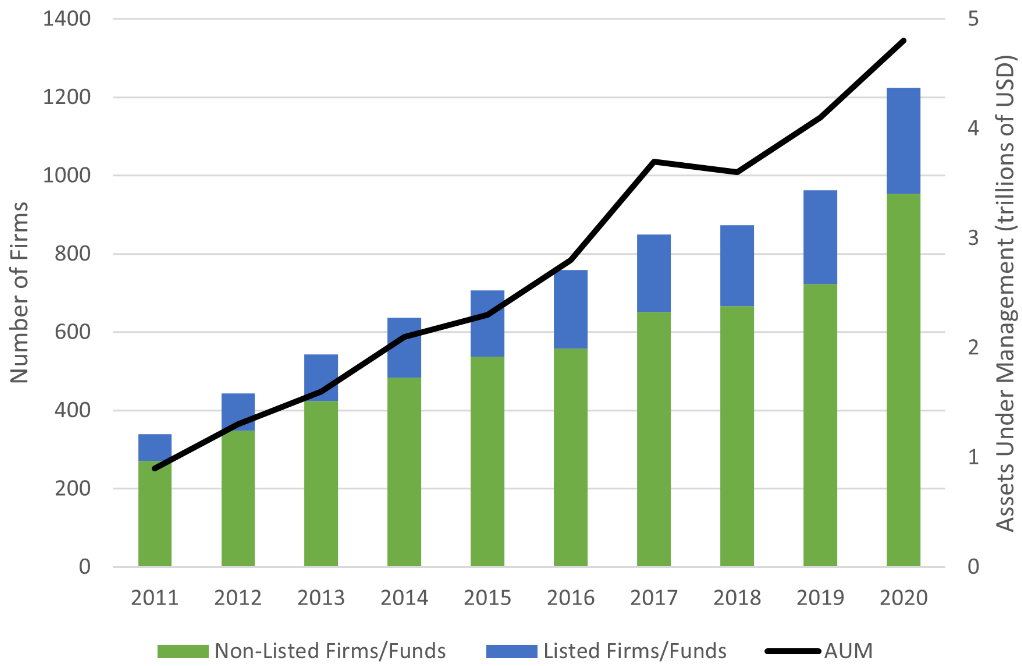
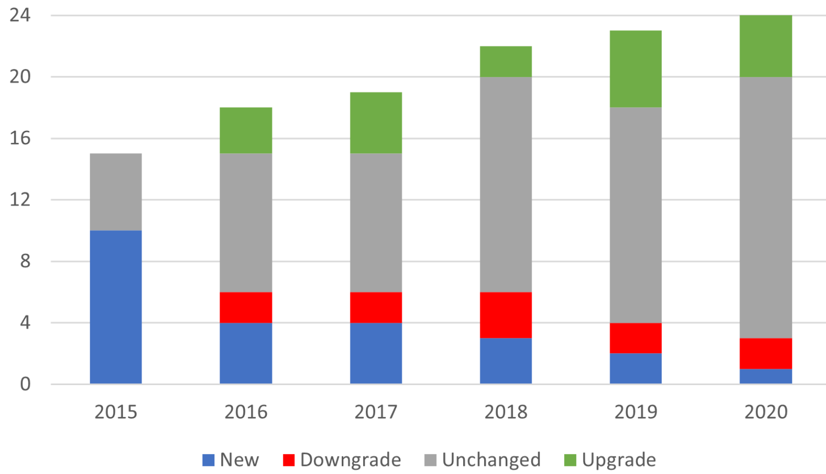


Figure 2: The graph describes adoption of the annual GRESB Real Estate Assessment Survey by funds/firms for the past decade. The bar graph measures the number of funds/firms completing the survey, broken down into public (listed) and private (non-listed) funds/firms, with values denoted on the left axis. The line graph measures the total value of assets under management by those funds/firms, measured in trillions of USD and denoted on the right axis.

ODCE Funds GRESB Real Estate Assessment Survey Results, by Year

Panel A: ODCE Funds GRESB Adoption and Score Movements



Panel B: ODCE Funds GRESB Score Component Breakdown

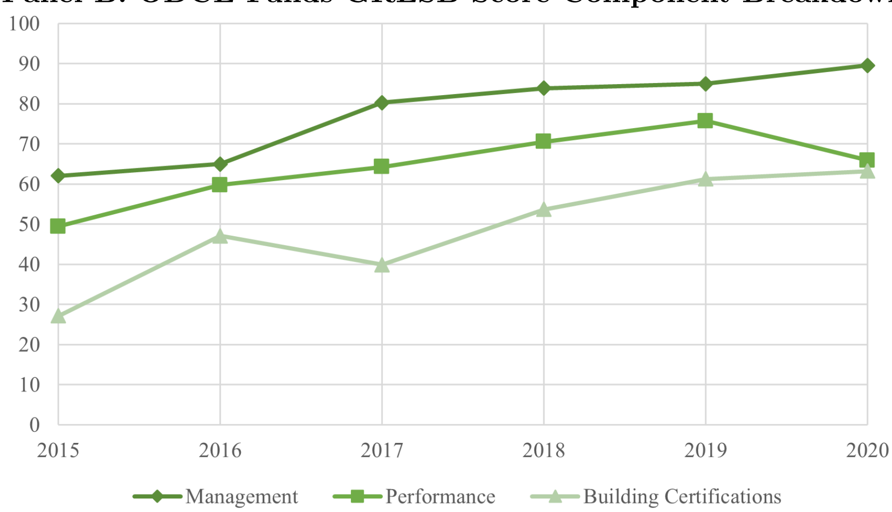
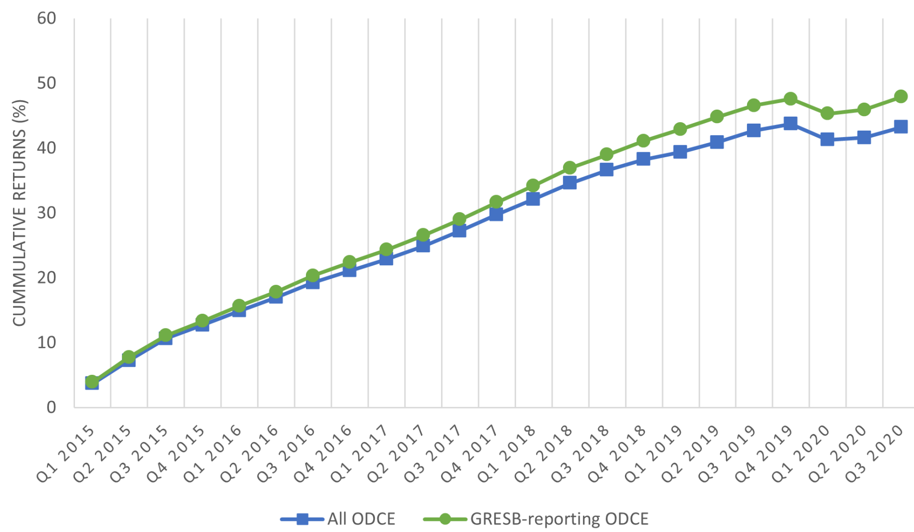


Figure 3: GRESB Reporting Year represents the previous fiscal year data. Panel A describes adoption and year-over-year score change for the GRESB Real Estate Assessment survey by NCREIF ODCE funds. The bar graph measures the number of funds adopting the Real Estate Assessment survey, broken down into newly reporting funds (blue) those experiencing GRESB score downgrade/unchanged/upgrade (red/grey/green) over the previous year; GRESB scores scale from 0 to 5 stars. Panel B presents the yearly average GRESB Component rating for ODCE funds for the 2 (of 3) pertinent GRESB Real Estate Assessment components (Management and Performance), and for Building Certifications scores (representing a substantial portion of the Performance component).

Panel A: ODCE Cumulative Returns, by GRESB Reporting



Panel B: ODCE Total Returns, by GRESB Score Change

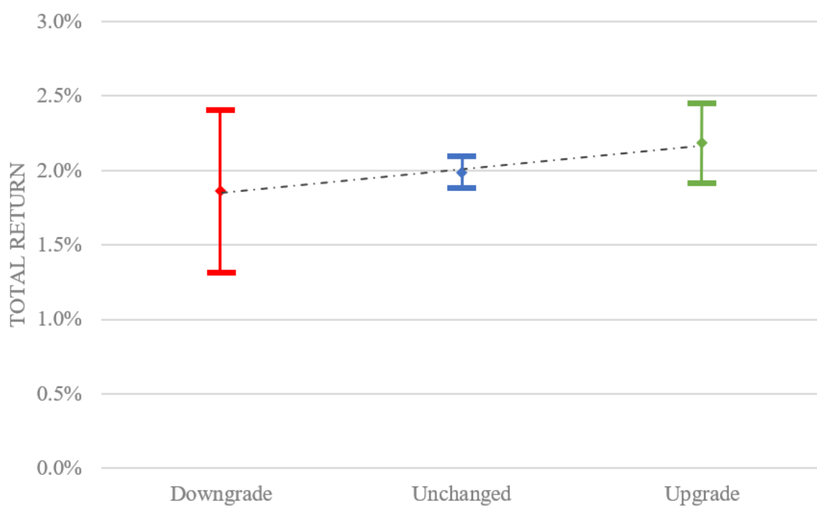


Figure 4: These figures present the relationship between ODCE fund returns and GRESB reporting. Panel A presents the value-weighted cumulative returns for all ODCE funds (blue line) and ODCE funds participating in the GRESB Real Estate Assessment (green line). Panel B presents the average and 95% confidence interval for GRESB-reporting ODCE fund *Total Return* sorted into three buckets: those experiencing a *GRESB Score* downgrade, those with an unchanged *GRESB Score*, and those experiencing a *GRESB Score* upgrade. The upgrade bucket includes initial GRESB reporting years.

Summary Statistics

	Average	Std Dev	p25	p50	p75
Return Variables					
Total Return	1.94	0.94	1.45	1.81	2.29
Income Return	0.91	0.19	0.79	0.90	1.02
Appreciation Return	1.04	0.91	0.56	0.91	1.37
GRESB Variables					
GRESB	0.70	0.46	0	1	1
GRESB Score	2.23	1.83	0	2.5	4
Fund Control Variables					
Past Return	6.09	2.92	4.78	5.76	7.91
GeoHHI	0.10	0.07	0.09	0.10	0.11
TypeHHI	0.30	0.06	0.27	0.28	0.31
Ln(Assets)	22.69	0.97	21.93	22.77	23.32
Leverage (%)	0.23	0.05	0.20	0.23	0.25
Cash	2.17	1.25	1.19	1.89	2.83
Local Variables					
HDD	944	750	81	754	1572
CDD	313	298	64	188	541
TDD	1296	543	825	1019	1705
Density	13,149	5,409	8,869	12,840	16,193
Bachelor	44.14	2.92	42.48	44.28	46.07
ELE	1.68	0.89	1.07	1.51	1.90
HOMECON	4.61	5.49	0.00	3.31	9.00
GeoGRESB	0.04	0.00	0.04	0.04	0.04

Table 1: The table presents summary statistics for the sample of 376 ODCE fund-quarter observations. *GRESB* is a dummy variable capturing participation in the annual Real Estate Assessment and *GRESB Score* scales from zero to five (stars); both are set to zero for fund-quarters in which a fund does not participate in the GRESB Real Estate Assessment. *Past Return* represents the trailing 3-quarter chain-linked Total Return. *GeoHHI* and *TypeHHI* present Herfindahl indices based on geography and property type, respectively (Ling et al., 2018). *Cash* reports the ration of cash and cash equivalents to total assets. *HDD*, *CDD*, and *TDD* represent the average heating, cooling, and total (combined heating and cooling) degree days weighted by the market value of properties across all climate divisions in which a fund owns properties. *Density* represents the average of population density, weighted by the market value of properties across all ZIP codes in which a fund owns properties. *Bachelor* represents the average percentage of population over 25 years old that has attained a Bachelor's Degree or higher, weighted by the market value of properties across all counties in which a fund owns properties. *ELE* presents the number of publicly-accessible electric stations per 1,000 people, weighted by the market value of properties across all ZIP codes in which a fund owns properties. *HOMECON* presents the percentage of the market value of properties that is allocated to a Fund's headquarters CBSA. *GeoGRESB* presents the average MSA-level percentages of GRESB-certified properties, weighted by the percentage of the fund's portfolio (in market value) allocated to each county at the end of the previous quarter.

Baseline Analysis of GRESB and PERE Fund Returns, in the Cross-Section

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
GRESB		0.310**			0.268**			0.268**	
		(2.63)			(2.20)			(2.20)	
GRESB Score			0.062***			0.062***			0.062***
			(3.21)			(3.06)			(3.09)
Past Return				0.045**	0.031	0.027	0.047**	0.032	0.028
				(2.18)	(1.44)	(1.21)	(2.24)	(1.48)	(1.26)
GeoHHI	-2.462	-2.994	-2.142	-2.169	-2.464	-1.565	-2.010	-2.334	-1.416
	(-1.04)	(-1.13)	(-0.86)	(-0.91)	(-0.87)	(-0.61)	(-0.84)	(-0.82)	(-0.55)
TypeHHI	-0.207	0.766	0.849	-0.366	0.447	0.606	-0.348	0.465	0.633
	(-0.16)	(0.52)	(0.56)	(-0.34)	(0.36)	(0.46)	(-0.32)	(0.38)	(0.48)
Ln(Assets)	-0.070	-0.065	-0.098	-0.039	-0.038	-0.073	-0.039	-0.039	-0.073
	(-1.15)	(-1.25)	(-1.66)	(-0.72)	(-0.72)	(-1.26)	(-0.73)	(-0.73)	(-1.26)
Leverage (%)	1.058	1.796	1.195	1.549	1.707	1.358	1.574	1.727	1.384
	(0.80)	(1.72)	(1.08)	(1.30)	(1.54)	(1.33)	(1.33)	(1.56)	(1.36)
Cash	-0.068*	-0.054	-0.060	-0.064	-0.060	-0.059	-0.063	-0.059	-0.057
	(-1.80)	(-1.34)	(-1.50)	(-1.70)	(-1.51)	(-1.55)	(-1.65)	(-1.48)	(-1.50)
Constant	3.813***	3.044***	3.912***	2.769**	2.404**	3.208**	0.131	0.120	0.164
	(2.97)	(3.22)	(3.49)	(2.33)	(2.32)	(2.74)	(1.18)	(1.20)	(1.15)
Fund Type FE	No	No	No	No	No	No	Yes	Yes	Yes
R-squared	0.360	0.454	0.415	0.423	0.514	0.481	0.425	0.516	0.483
Observations	376	376	376	376	376	376	376	376	376

Table 2: All models are estimated using Fama-MacBeth regressions with Newey-West standard errors. The dependent variable in all estimations is *Total Return*. *GRESB* is a dummy variable tracking GRESB Real Estate Assessment participation and *GRESB Score* represents the earned score on that Assessment, scaling from zero to five. The omitted category for model estimations (1), (2), and (3) is *Past Return*, which is included in model estimations (4), (5), and (6). Fund Type fixed effects are further included in model estimations (7), (8), and (9). ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

GRESB Score Components and PERE Fund Returns, in the Cross-Section

	(1)	(2)	(3)	(4)	(5)	(6)
Management	0.010***	0.004**	0.011***	0.003**	0.011***	0.003**
	(3.81)	(2.37)	(4.31)	(2.49)	(4.31)	(2.54)
Performance	-0.008***		-0.008***		-0.008***	
	(-2.98)		(-2.87)		(-2.88)	
Certification		-0.000		0.001		0.001
		(-0.10)		(0.49)		(0.43)
Past Return			0.010	0.019	0.011	0.020
			(0.35)	(0.64)	(0.38)	(0.69)
GeoHHI	-2.661	-1.984	-1.991	-1.246	-1.833	-1.019
	(-0.95)	(-0.83)	(-0.65)	(-0.48)	(-0.59)	(-0.39)
TypeHHI	1.086	0.290	1.032	0.157	1.055	0.183
	(0.75)	(0.19)	(0.84)	(0.12)	(0.85)	(0.14)
Ln(Assets)	-0.061	-0.066	-0.034	-0.042	-0.034	-0.042
	(-1.04)	(-1.13)	(-0.62)	(-0.74)	(-0.62)	(-0.74)
Leverage (%)	1.931*	2.051**	1.863*	2.000*	1.891*	2.039**
	(1.92)	(2.11)	(1.91)	(2.07)	(1.95)	(2.13)
Cash	-0.049	-0.054	-0.055	-0.061	-0.053	-0.059
	(-1.38)	(-1.22)	(-1.71)	(-1.52)	(-1.65)	(-1.46)
Constant	2.807**	3.082***	2.177**	2.503**	0.000	0.000
	(2.73)	(2.91)	(2.10)	(2.33)	(0.00)	(0.00)
Fund Type FE	No	No	No	No	Yes	Yes
R-squared	0.485	0.460	0.551	0.523	0.553	0.525
Observations	376	376	376	376	376	376

Table 3: All models are estimated using Fama-MacBeth regressions with Newey-West standard errors. The dependent variable in all estimations is *Total Return*. *Management* and *Performance* are two of the three components of overall *GRESB Score*. *Certification* is a sub-component of *Performance* capturing the impact of green and healthy building certification of PERE fund assets, and comprising the largest individual portion of the *GRESB Score*. The omitted category for model estimations (1) and (2) is *Past Return*, which is included in model estimations (3) and (4). Fund Type fixed effects are further included in model estimations (5) and (6). ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Decomposition of GRESB Impact on PERE Fund Income and Appreciation Returns, in the Cross-Section

	(1)	(2)	(3)	(4)	(5)	(6)
		– Income Return –			*– Appreciation Return –*	
GRESB		0.030			0.242*	
		(1.28)			(1.96)	
GRESB Score			-0.014*			0.077***
			(-2.02)			(4.05)
Past Return	-0.003	-0.006	-0.005	0.045*	0.033	0.028
	(-0.36)	(-0.55)	(-0.45)	(2.07)	(1.52)	(1.33)
GeoHHI	-2.501***	-2.328***	-2.857***	0.247	-0.252	1.220
	(-3.89)	(-3.47)	(-4.47)	(0.10)	(-0.09)	(0.49)
TypeHHI	-0.481	-0.259	-0.591*	0.385	1.003	1.484
	(-1.50)	(-0.82)	(-1.92)	(0.39)	(0.85)	(1.20)
Ln(Assets)	-0.059***	-0.064***	-0.046***	0.012	0.018	-0.034
	(-4.32)	(-4.87)	(-3.12)	(0.23)	(0.37)	(-0.65)
Leverage (%)	1.234***	1.046***	1.448***	0.109	0.502	-0.262
	(3.20)	(3.00)	(3.28)	(0.10)	(0.45)	(-0.30)
Cash	0.001	-0.000	-0.002	-0.062	-0.057	-0.054
	(0.19)	(-0.03)	(-0.24)	(-1.71)	(-1.50)	(-1.52)
Constant	0.303	0.306	0.304	-0.175	-0.189	-0.143
	(1.21)	(1.21)	(1.21)	(-1.19)	(-1.20)	(-1.12)
Fund Type FE	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.540	0.564	0.577	0.382	0.482	0.460
Observations	376	376	376	376	376	376

Table 4: All models are estimated using Fama-MacBeth regressions with Newey-West standard errors. The dependent variable in (1), (2), and (3) is *Income Return* and in (4), (5), and (6) is *Appreciation Return*. *GRESB* is a dummy variable tracking GRESB Real Estate Assessment participation and *GRESB Score* represents the earned score on that Assessment, scaling from zero to five. Fund Type fixed effects are included in all model estimations. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Horse Race of Sustainability Adoption Drivers and PERE Fund Returns

Definition of LOCAL	(1) *HDD*	(2) *CDD*	(3) *TDD*	(4) *Density*	(5) *Bachelor*	(6) *ELE*	(7) *HOMECON*	(8) *GeoGRESB*
Panel A: LOCAL control without GRESB variables								
LOCAL	-0.003*	0.000	-0.001	-0.000**	-0.022**	-0.087*	-0.086*	0.006
	(-1.95)	(0.24)	(-1.50)	(-2.64)	(-2.24)	(-2.07)	(-2.03)	(0.78)
Panel B: With LOCAL controls and *GRESB*								
GRESB	0.282**	0.266*	0.280**	0.226*	0.259**	0.256*	0.284**	0.287**
	(2.41)	(2.07)	(2.23)	(1.79)	(2.10)	(2.00)	(2.34)	(2.32)
LOCAL	-0.004**	-0.000	-0.001	-0.000**	-0.022**	-0.013	0.002	-5.394
	(-2.59)	(-0.27)	(-1.54)	(-2.17)	(-2.58)	(-0.30)	(0.21)	(-0.36)
Panel C: With LOCAL controls and *GRESB Score*								
GRESB Score	0.066***	0.060**	0.074***	0.062***	0.069***	0.065***	0.068**	0.069***
	(2.96)	(2.76)	(3.12)	(2.90)	(3.42)	(3.21)	(2.73)	(3.17)
LOCAL	-0.003**	0.000	-0.001	-0.000***	-0.026**	-0.073	-0.001	-19.890
	(-2.72)	(0.10)	(-1.49)	(-2.96)	(-2.56)	(-1.71)	(-0.12)	(-1.39)

Table 5: All models are estimated using Fama-MacBeth regressions with Newey-West standard errors. The dependent variable in all estimations is *Total Return*. Control variables included in all previous model specifications are included, with results suppressed to conserve space. Panel A presents the impact of each LOCAL variable on PERE fund *Total Return*. Panels B and C replicate those models, adding in the *GRESB* and *GRESB Score* variables, respectively. Fund Type fixed effects are included in all model estimations. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Stacked Sustainability Adoption Drivers and PERE Fund Returns

	(1)	(2)	(3)	(4)	(5)
GRESB		0.286**			
		(1.90)			
GRESB Score			0.080***		
			(2.81)		
Management				0.010**	0.006**
				(2.47)	(2.00)
Performance				-0.009	
				(-1.59)	
Certification					-0.003
					(-0.85)
ELE	-0.060	0.050	-0.005	-0.032	0.023
	(-0.94)	(0.72)	(-0.08)	(-0.47)	(0.30)
TDD	-0.003**	-0.003**	-0.003***	-0.004***	-0.004***
	(-2.24)	(-2.12)	(-2.80)	(-2.95)	(-3.85)
Density	0.000	-0.000	-0.000	0.000	0.000
	(0.67)	(-0.32)	(-0.17)	(0.83)	(0.71)
Bachelor	-0.054	-0.047	-0.051	-0.055	-0.065*
	(-1.56)	(-1.34)	(-1.49)	(-1.44)	(-1.75)
Past Return	0.046	0.023	0.019	0.070	0.051
	(1.61)	(0.69)	(0.78)	(1.45)	(1.37)
GeoHHI	-2.420	-2.012	-0.163	-0.217	-0.747
	(-0.84)	(-0.61)	(-0.06)	(-0.05)	(-0.24)
TypeHHI	0.707	-0.838	0.729	1.311	-0.662
	(0.48)	(-0.64)	(0.49)	(1.00)	(-0.47)
Ln(Assets)	-0.061	-0.043	-0.111	-0.090	-0.139
	(-0.88)	(-0.58)	(-1.38)	(-1.07)	(-1.71)
Leverage (%)	0.159	1.951	-0.130	-0.884	-0.338
	(0.13)	(1.19)	(-0.11)	(-0.42)	(-0.14)
Cash	-0.053	-0.042	-0.044	-0.048	0.005
	(-1.21)	(-0.83)	(-1.00)	(-1.02)	(0.10)
Constant	0.017	0.041	0.122	0.034	0.074
	(1.03)	(1.03)	(1.03)	(1.03)	(1.03)
Fund FE	Yes	Yes	Yes	Yes	Yes
R-squared	0.649	0.718	0.705	0.785	0.760
Observations	376	376	376	376	376

Table 6: All models are estimated using Fama-MacBeth regressions with Newey-West standard errors. The dependent variable in all estimations is *Total Return*. *Management* and *Performance* are two of the three components of overall *GRESB Score*. *Certification* is a sub-component of *Performance* capturing the impact of green and healthy building certification of PERE fund assets, and comprising the largest individual portion of the *GRESB Score*. Fund Type fixed effects are included in all model estimations. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Panel Analysis of GRESB and Risk-Adjusted PERE Fund Returns

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
GRESB		0.226***			0.138**			0.145**	
		(3.33)			(2.11)			(2.22)	
GRESB Score			0.004			-0.024			-0.023
			(0.19)			(-1.40)			(-1.31)
Past Return				0.122***	0.117***	0.126***	0.123***	0.117***	0.126***
				(8.64)	(8.16)	(8.87)	(8.66)	(8.15)	(8.85)
GeoHHI	1.143	0.407	1.106	1.163	0.713	1.409	2.148	2.001	2.041
	(1.07)	(0.39)	(0.99)	(1.18)	(0.74)	(1.41)	(1.46)	(1.34)	(1.40)
TypeHHI	-3.554***	-2.529***	-3.493***	-2.686***	-2.096**	-3.054***	-2.601***	-1.955**	-2.977***
	(-3.88)	(-2.68)	(-3.41)	(-3.43)	(-2.56)	(-3.66)	(-3.37)	(-2.45)	(-3.60)
Ln(Assets)	0.176***	0.163***	0.174***	0.168***	0.160***	0.181***	0.170***	0.162***	0.182***
	(4.88)	(4.64)	(4.64)	(5.18)	(5.07)	(5.45)	(5.23)	(5.12)	(5.46)
Leverage (%)	0.425	0.187	0.417	0.555	0.404	0.614	0.597	0.452	0.638
	(0.60)	(0.27)	(0.59)	(0.87)	(0.63)	(0.95)	(0.95)	(0.72)	(1.01)
Cash	-0.065***	-0.060**	-0.065***	-0.050**	-0.048**	-0.051**	-0.049**	-0.046**	-0.050**
	(-2.76)	(-2.49)	(-2.71)	(-2.31)	(-2.15)	(-2.35)	(-2.27)	(-2.08)	(-2.33)
Constant	-0.733	-0.772	-0.707	-1.614**	-1.601**	-1.812**	-1.784**	-1.827**	-1.912***
	(-0.87)	(-0.92)	(-0.83)	(-2.21)	(-2.22)	(-2.47)	(-2.43)	(-2.49)	(-2.60)
Fund Type FE	No	No	No	No	No	No	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.475	0.490	0.475	0.566	0.572	0.569	0.567	0.573	0.569
Observations	376	376	376	376	376	376	376	376	376

Table 7: All models are estimated using OLS with standard errors clustered at the fund level. The dependent variable in all estimations is Fama-French-Carhart Alphas. The omitted category for model estimations (1), (2), and (3) is *Past Return*, which is included in model estimations (4), (5), and (6). Quarter-Year fixed effects are included in all model estimations, and Fund Type fixed effects are included in model estimations (7), (8), and (9). ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.