Portfolio Greenness and the Financial Performance of REITs

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There is an increasing body of evidence on the financial performance of "green" commercial properties, but not much is known about the implications of investments in such buildings for property companies. This paper investigates the effects of the energy efficiency and sustainability of commercial properties on the operating and stock performance of a sample of US REITs, providing insight into the net benefits of "green" buildings. We match data on LEED and Energy Star certified buildings with detailed information on REIT portfolios and calculate the share of "green" properties for each REIT over the 2000-2011 period. In order to control for the endogeneity between environmental and financial performance, we use two instrumental variables – locational greenness and local environmental government policies. We estimate a two-stage regression model and document that the greenness of REITs is positively related to three measures of operating performance – return on assets, return on equity and the ratio of funds from operations to total revenue. We also document that there is no significant relationship between the greenness of property portfolios and abnormal stock returns, suggesting that stock prices already reflect the higher cash flows deriving from investments in more efficient properties. However, REITs with a higher fraction of "green" properties display lower market betas, which may be related to their reduced exposure to shocks in energy prices and environmental legislation.

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I. Introduction

Investors increasingly incorporate information on the environmental, social and governance (ESG) performance of corporations into their investment decisions. The real estate sector is of specific interest from an environmental perspective, as it has been well-documented that the sector is responsible for 40 percent of global greenhouse gas emissions, for 55 percent of the global usage of wood, and for about 75 percent of electricity consumption in the US alone.[1] More efficient use of energy and other resources by the real estate sector can structurally reduce these numbers, and thus lower the demand for increasingly scarce (and costly) natural resources.

Importantly, improved sustainability performance in the real estate sector may very well be aligned with enhanced financial performance, through lower operational costs as well as reduced portfolio risk. Indeed, a 2007 McKinsey report has suggested that many investments aimed at reducing carbon emissions from buildings could be made at a profit (Enkvist, Naucler, Rosander, 2007). The effect of energy efficiency and "sustainability" on financial performance in real estate markets has been mainly investigated at the asset level. The common question investigated in the literature is whether "green" certification of properties is related to cash flows and property valuations. The general evidence indeed shows positive financial effects associated with better environmental performance. For example, commercial buildings with energy efficiency ratings command significantly higher rents, higher and more stable occupancy rates, and higher prices than otherwise comparable conventional buildings (Eichholtz, Kok, Quigley, 2010; Fuerst, McAllister, 2011). On the other hand, lower levels of energy efficiency and sustainability have been associated with an increased risk of obsolescence (Kok, Jennen, 2011).

[1] See, for example: RICS, 2005. Green Value. RICS, London and Vancouver. See also: Energy Information Agency, EIA, http://www.eia.gov.

To improve the environmental performance of their property portfolio, building owners have to incur capital expenditures. The existing body of empirical research on "green" buildings, considers just benefits, and while it is enticing that "green" buildings command price premiums, it may take a similar investment to "green" the building. Indeed, there is no convincing empirical evidence that shows the return on retrofits, or "green" investments for a building owner. Thus far, cost-benefit analyses at the building level have not been possible, except for a few case studies (Ciochetti, McGowan, 2009; Kats, 2003).

The operating and stock performance of property companies – Real Estate Investment Trusts (REITs) – is the eventual outcome of the interplay between the costs and benefits from investments in "green" properties. Investigating this interplay may shed some light on the question whether investments in the greenness of buildings creates value for property investors. As the operating and stock performance of US REITs is readily observable, and since it is possible to obtain building-level information about their investment portfolios, REITs provide an ideal vehicle for empirical research on the financial implications of the environmental performance of property portfolios.

We match data on LEED and Energy Star certified buildings with detailed information on REIT portfolios and calculate the share of "green" properties for each REIT over the 2000-2011 period. In order to control for the well-documented endogeneity between environmental and financial performance, we use two instrumental variables – locational greenness and local environmental government policies. Estimating a two-stage regression model, our findings indicate that portfolio greenness is positively related to the operating performance of REITs. We document that if a REIT increases the weight of green properties within the portfolio by one percent, the return on assets (ROA) increases by around two percent for LEED certified

properties and by about half a percent for Energy Star certified properties. We also find that if a REIT increases the share of green properties within the portfolio by one percent, the return on equity (ROE) increases by around five percent for LEED certified properties and by at least one percent for Energy Star certified properties. Our findings are robust to using alternative measures of operating performance, such funds-from-operations (FFO) as a fraction of total revenue. Our results suggest that REITs are in the still in an early phase of incorporating elements related to energy efficiency and sustainability into their investment portofolios and have substantial opportunities to enhance operating returns by investing in "green" certified buildings or in commercial building retrofits.

We then address the impact of portfolio greenness on the stock performance of REITs. We find no consistent significant relationship between greenness and abnormal returns, but we document that the greenness of REIT portfolios is negatively related to the estimated market beta. We explain the latter finding by the fact that green properties may be less exposed to energy price fluctuations and to vacancy risk. REITs, through the property portfolio that they own, are also less exposed to these influences, and therefore less prone to fluctuations in the business cycle. On the other hand, the absence of a relation between abnormal stock performance and portfolio greenness suggests that stock prices may already reflect the higher cash flows deriving from investments in more efficient properties.

The remainder of this paper is organized as follows: the next section summarizes the literature on corporate social responsibility, "green" buildings and financial performance. The third section describes our construct of portfolio greenness and the financial data on REITs. In the fourth section, we outline the model, making explicit our controls for endogeneity, and we discuss our main findings. The final section provides the conclusion.

II. Literature Review

A. Corporate Social Responsibility and Corporate Financial Performance

To date, there is no empirical research assessing the relation between investments in the energy efficiency or sustainability of commercial buildings, and the financial performance of their owners – equity REITs or other property investors. However, the real estate investment industry can make inferences from a well-developed strand of literature that studies the broader concept of corporate social responsibility (CSR) and its impact on the financial performance of corporations in general.

The effects of many different types of CSR on corporate financial performance have been documented extensively. It has for example been argued that a stronger commitment to CSR translates into greater loyalty of employees, customers and local communities (Ribstein, 2005), as well as improved reputation (Turban, Greening, 1997). This may eventually lead to better financial performance. For instance, Lev, Petrovis, and Radhakrishnan (2010) document that growth in charitable contributions is positively related to subsequent revenue growth. A meta-analysis of the literature, conducted by Margolis, Elfenbein, and Walsh (2007), evaluated 167 studies produced between 1972 and 2007. The authors find a small, but overall positive relationship between CSR and financial performance, and also conclude that the literature does not provide firm conclusions regarding the direction of causality. Dividing the broad CSR into different categories, it is documented that charitable contributions, information about corporate misdeeds, environmental performance as well as broader assessment of CSR through observer perceptions and self-reported social performance have the strongest association with financial performance.

An important caveat of all research into the financial implications of CSR is the issue of causality. Margolis and Walsh (2003) and Orlitzky, Schmidt, and Rynes (2003) claim that firms with weak financial performance are less likely to engage in socially responsible behavior simply because less profitable companies have fewer resources to allocate towards CSR activities than highly profitable companies. Waddock and Graves (1997) refer to this concept as the *slack resource theory*. Contrasting, Lev, Petrovis, and Radhakrishnan (2010) do not find convincing evidence that revenue growth substantially contributes to corporate giving.

Moderating factors also influence the relation between CSR and financial performance. The *competitiveness hypothesis* posits that in extremely competitive environments, companies' profit margins narrow, placing shareholder value and firm well-being at risk, thus compelling management to cut costs. In such circumstances, companies may even engage in socially "irresponsible" activities such as compromising product safety, unethical treatment of employees, or misleading customers (Campbell, 2007). Similarly, at the other end of the spectrum, in monopolistic environments with virtually no competition, reputation and customer loyalty holds no threat to the profitability of the firm and CSR thus becomes less relevant. Indeed, according to Campbell (2007), healthy levels of competition alongside with stable profitability increase the likelihood of investing in CSR efforts in order to uphold the reputation of the firm, and to avoid losing the trust of its suppliers and customers, which would compromise firm profitability.

B. The Greenness of REITs and Financial Performance

The literature on corporate social responsibility in real estate companies (REITs) has mainly focused on corporate governance hitherto (Bauer, Eichholtz, Kok, 2010; Ghosh, Sirmans, 2003; Ghosh, Sirmans, 2005). The few studies on the motivations for CSR activity in the real estate

market in the United States are survey-based. Pivo (2008) surveys nearly 200 CEOs of REITs, real estate operating companies and property development companies. The results show that over 40 percent of the companies have invested in "green" buildings. The respondents consider "concern for risk and return," "opportunities to outperform," and "moral responsibility" as the strongest drivers of so-called responsible property investment. Conversely, insufficient information on the financial performance of "green" building and the lack of tenant demand score highest among the list of obstacles to responsible property investment.

Two recent studies further survey the global universe of listed property companies and unlisted property funds on environmental performance at the portfolio level (Bauer et al., 2011a; Kok, Bauer, Eichholtz, 2011a). It is documented that the strongest environmental performers are mostly among the larger and listed property companies, with Australian firms demonstrating outstanding performance. Smaller companies, especially from Asia, generally perform poorly. Bauer et al. (2011a) provide a first analysis on the relationship between environmental performance and the operating performance of the listed property companies. Although the direction of causality cannot be established, the authors find the relation to be positive and significant. In their subsequent study Kok et al. (2011a) find the same positive association between financial performance and "greenness," but the authors also show that the property type in which a fund invests is a key driver of its environmental performance. Office investors are generally relatively "green," while investors in residential and industrial space typically display worse environmental performance.

From a theoretical perspective, the *competitiveness hypothesis* seems to fit the real estate market well. Real estate markets are characterized by monopolistic competition, where entities produce differentiated products, "green" buildings in this case, serving a competitive market with

healthy levels of profit. Investments in the energy efficiency and sustainability of properties may not only lead to the "normal" advantages of CSR, such as attracting institutional investors or providing better work environments, etc., but presumably, buildings certified for energy efficiency or sustainability consume less resources and generate lower operating costs. According to the US Green Building Council (USGBC), LEED-certified buildings have lower operating costs and provide healthier and safer working environments for occupants. The Energy Star program claims that buildings with the Energy Star label generally consume 35 percent less energy and emit 35 percent less carbon dioxide than average uncertified buildings. In addition, the literature also shows that more efficient properties generate premiums on rents and sales prices, compared to investments in standard properties, thus providing enhanced income to their owners.

For instance, research by Eichholtz et al. (2010) assesses the rents and transaction prices of 694 LEED and Energy-Star-certified office buildings, relative to non-certified, comparable buildings in the United States. Controlling for differences in building quality, rents are documented to be about five percent higher for LEED-certified office properties, and some three percent higher for Energy-Star-rated buildings; the reported increments for transaction prices are 11 percent and 19 percent, respectively. These findings corroborate with a rapidly growing body of comparable studies (Fuerst, McAllister, 2011; Miller, Spivey, Florance, 2008; Wiley, Benefield, Johnson, 2010).

In a more recent paper, Eichholtz, Kok and Quigley (in press) study the financial dynamics of "green" buildings during the global financial crisis – 2007 to 2009 – using a much larger sample compared to previous studies and applying propensity score weights in the estimation of "green" increments. The results show that premiums to certified buildings have not

been affected significantly by the large increases in the supply of green buildings between 2007 and 2009, or by the recent downturn in the US property market. The economic premium to green buildings has fallen slightly, but rents and occupancy rates of green properties are still significantly higher than those of comparable properties.

The paper also attempts to confront the lack of information on green investment costs. Having access to the data on energy efficiency (*i.e.*, kBTU usage per square foot) as measured and reported in the certification process, the link between energy efficiency, rents and asset value is investigated. The results show that variations in energy efficiency are fully reflected into rents and asset values. Importantly, estimates of the capitalization of energy savings are not related to uncertain estimates of the costs of constructing or retrofitting buildings. The authors also find that variations in rents and asset values systematically depend on other indicia of sustainability determined in the certification process. Importantly, since the observed "green" premiums are larger than the value represented by direct energy cost savings, it can be concluded that both greater energy efficiency of green buildings as well as their intangible rewards (e.g., higher productivity owing to improved working environment, effect on corporate image) play a role.

Risk factors may also play an important role in the implications of environmental performance of the portfolio. The existing studies at the building level show a higher occupancy level for "green" buildings as compared to conventional buildings, so the gross rental cash flows generated by a more efficient property portfolios will likely be less volatile as compared to the gross cash flows of less sustainable portfolios.

Also, as more efficient properties are less exposed to energy price shocks through their lower energy consumption, investing in "green" properties might decrease the owner's market risk (which is highly correlated with movements in energy prices). Legislative risk is another

important consideration for property owners. Federal and local governments are increasingly targeting the built environment with mandates to reduce the resource consumption of the building stock. This may lead to risk of obsolescence for non-efficient properties, forcing property owners to spend additional capital expenditures on their portfolio. Thus, real estate companies investing in the energy efficiency and sustainability of the properties in their portfolio may benefit from a decrease in risks at the property level, in addition to lower risks occurring from the scrutiny of institutional investors regarding the corporate social responsibility of their operations.

III. Green Buildings and REITs

A. Green Building Data

To measure the greenness of property portfolios, we follow the existing literature on the financial performance of "green" buildings in the United States. Green buildings are those certified by the US Green Building Council's LEED program, or buildings that have received an Energy Star certificate from the Environmental Protection Agency (EPA). These two leading certification programs aim to encourage energy-efficiency and sustainability in the (re)development of properties in United States (and beyond).

The US Green Building Council (USGBC) initiated the LEED program in 1998. It provides third-party verification that a building is designed and constructed using strategies aimed at improving performance across the following dimensions: energy consumption, water use, CO_2 emissions, indoor environmental quality, and stewardship of resources. The certification

covers six different components of sustainability, including energy performance and material selection.[2]

The market adoption of the LEED label is growing rapidly, and the total number of LEED-certified commercial buildings as of August 2011 was 10,121. There are also 31,705 commercial buildings registered in the LEED system (these are not yet LEED-certified). Nearly one third of new construction in the United States is comprised of LEED-certified buildings, rising from two percent in 2005.[3] Kok, McGraw, and Quigley (2011b) document that the early adopters of the LEED system (as a fraction of the total market) are Chicago and Phoenix, while for example New York and Dallas started to adopt LEED certification later.

The Energy Star label is focused solely on energy management and consumption. Founded in 1992 by the U.S. Environment Protection Agency (EPA) and the U.S. Department of Energy (DOE), the program provides web-based tools for the assessment of energy consumption and evaluates the efficiency of buildings' energy use with respect to a base building of similar size and quality. Contrary to LEED, the Energy Star program rates buildings on their actual energy consumption; thus, it only applies to completed and fully operational properties.

The EPA started certifying residential real estate in 1995 and extended its program to office buildings in 1999. Retail space, hotels, and warehouses have been labeled since 2001, 2002, and 2005 respectively. As of August 2011, 15,146 commercial buildings had received an Energy Star label. Currently, office buildings are still the dominant property type in the Energy Star universe, representing about 38 percent of all certified buildings.

[2] See http://www.usgbc.org for more information.
[3] McGraw-Hill Construction, 2010. Green Outlook 2011: Green Trends Driving Growth.

We obtain data on all properties in the portfolios of US REITs from the SNL Real Estate database.[4] Using GIS software, we convert the addresses of buildings in the database into a unique combination of longitude and latitude, and then match the dataset to LEED and Energy-Star-certified buildings, using the files maintained by the USGBC and EPA, respectively.[5] We also collect data on the exact scores provided by LEED and Energy Star, measuring the "greenness" of each certified property in the REIT portfolio. We extract the year of certification from the EPA and USGBC databases, and the year of acquisition and the year of sale from the SNL database. We create annual "snapshots" of the property portfolio for each REIT and identify the LEED or Energy-Star-certified properties therein, creating a dynamic dataset of the "greenness" of REIT portfolios. For instance, if a REIT acquired a property in 2005, sold the property in 2008, and the property was certified in 2006, then the property is counted as "green" in 2006 and 2007 only.[6]

Figure I presents the dynamics of the greenness of portfolios of US equity REITs from January 2000 through August 2011. The figure does neither cover REITs that are delisted or acquired, nor does it include REITs that are excluded from the NAREIT index. Overall, we investigate the portfolios of 128 REITs, of which some 60 percent own green buildings.

We document that there are 708 LEED registered properties owned by REITs as of August 2011. Registered properties pass some stages of evaluation and are expected to be certified later. Of the LEED registered properties owned by REITs, around 70 percent are certified within 1.7 years. Considering these average figures, we therefore expect that REITs will

[4] SNL Real Estate combines news and data on real estate companies around the world. The universe covered includes over 750 companies and more than 110,000 properties in 38 different countries.
[5] In some cases, we revert to manual matching, *e.g.*, when the owner of a certified building is a REIT according to the green property database but our software cannot find a perfect match in the REIT property portfolio.
[6] Green property data by REIT is in the Appendix.

own around 350 to 500 LEED certified properties by the end of 2012. In 2001, the very first LEED-registered building appeared in a REIT portfolio, but especially after 2006, we notice a substantial increase in the number of LEED-registered properties. The number of REITs owning LEED registered properties seems to reach its peak around 70.

– Insert Figure I here –

REITs have owned Energy-Star-certified properties since the beginning of the sample period (January 2000). As of August 2011, 71 REITs own an aggregate of 919 Energy Star certified properties. Similar to LEED certified properties, we observe a substantial increase in the number of Energy-Star-certified properties owned by REITs after 2006. This increase slows down near the end of the sample period, and the number of REITs owning Energy Star certified properties is stable around 70.

Figure II shows average scores for LEED and Energy Star certified properties owned by REITs. By design, the minimum Energy Star score is 75. Although Energy Star scores are fluctuating within a small bandwidth, we observe a slight decline in the average Energy Star scores after 2006, as REITs strongly increased the number of certified properties in their portfolios. With respect to LEED, we observe that REITs initially own highly rated properties, but the average sustainability score of the certified properties declines subsequently. This might be related to the increase in existing buildings that are now rated by the USGBC, as opposed to mostly new construction at the beginning of the sample period. Presumably, obtaining a LEED certificate is more difficult for existing buildings, leading to lower scores.

B. The Greenness of REITs

We construct three dynamic measures of portfolio greenness for each REIT. First, we count the number of properties certified as green for each year and each REIT, standardized by the total number of properties owned by the REIT in the corresponding year. Second, for each REIT we sum the square feet of all properties certified as green for each year and standardize the sum by the total square feet of the property portfolio owned by the same REIT in the corresponding year. Third, we sum the green scores of each LEED and Energy Star property in a REIT portfolio for every year and standardize the score by the total number of properties in the REIT portfolio in the corresponding year. The formulas are as follows:

$$(1)\ Buildings\_Certified_{it}^{g} = \frac{\#\ of\ Certified\ Properties_{it}^{g}}{\#\ of\ Properties_{it}} x100$$

$$(2)\ Sqft\_Certified_{it}^{g} = \frac{\sum_l Sqft\ of\ Certified\ Property_{ilt}^{g}}{\sum_l Sqft\ of\ Property_{ilt}} x100$$

$$(3)\ Score\_Certified_{it}^{g} = \frac{\sum_l Score\ of\ Certified\ Property_{ilt}^{g}}{\#\ of\ Properties_{it}} x100$$

where *i* stands for REIT *i, t* stands for year *t*, *l* stands for property *l* and *g* is the certification, which is either LEED or Energy Star.

In Panel A of Table I, we present the average and standard deviation for each of the greenness measures calculated by the formulas above. For the REITs owning at least one LEED certified property, the average property portfolio covers about three percent of the overall portfolio. In the greenest REIT portfolio, 14 to 17 percent are LEED certified properties,

depending on the measure. Some 8 percent of the REIT portfolios include LEED registered properties and 43 percent of the portfolio of the greenest REIT is LEED registered.

Energy Star certified properties are more frequently observed in the property portfolios of REITs: 10 to 13 percent of the portfolios are Energy Star certified. The "greenest" REIT has Energy Star certified properties covering 76 to 86 percent of the property portfolio, for the greenness measures calculated using the number of properties and square feet of properties, respectively.

– Insert Table I here –

Figure III shows the diffusion of green properties within REIT property portfolios during the sample period. The diffusion is measured by the ratio of the square feet of green properties to the total square feet of REIT property portfolios. Until 2003, certified properties were not observed in REIT property portfolios. Especially for Energy Star, there was a recent surge in certified properties in REIT portfolios. In 2010, some 6 percent of REIT portfolios were Energy Star certified and around 1 percent represented LEED certified properties. We note that these numbers are low relative to the fraction of LEED and Energy Star certified space in US commercial property markets, as recently documented by Kok et al. (2011b).

– Insert Figure III here –

Figure IV presents some scatter plots on the fraction of certified properties in REIT property portfolios and basic financial characteristics. Panel A shows the relation between portfolio greenness and firm size. For both types of certification, portfolio greenness is higher for

larger REITs. Quite obviously, size matters for the adoption of green innovations by REITs, as documented previously in the literature (Bauer et al., 2011a)

In Panel B of Figure IV, the portfolio greenness is related to firm age. A negative relation between portfolio greenness and firm age can be observed, both for LEED and for Energy Star certifications. Presumably, it is easier for younger REITs to adapt their property portfolios and to adopt new technologies. In addition, these REITs have been building up their portfolio during a more recent period, when certified properties were more readily available.

– Insert Figure IV here –

B. Financial Data

In addition to "green" data on REIT property portfolios, we gather financial data from SNL Real Estate. To avoid selection bias, the data also cover REITs that do not own any green certified properties. For REITs that own green-certified properties, we collect time series data that is long enough to include the years in which the REITs did not own green certified properties, to capture any differences in the financial performance of these REITs. To analyze stock performance, we first estimate a standard 4-factor model, following Fama and French (1993) and Carhart (1997), for each REIT in the sample, using daily stock data.[7] As a result, we obtain estimated abnormal returns and market betas annually for each REIT.

In Panel B of Table I, we show descriptive statistics for the REIT sample, distinguishing between the full sample and those REITs that have LEED and Energy Star certified properties in

[7] We use the NAREIT Index as a proxy for the market return and the SMB, HML and MOM factors from the Kenneth French Data Library.

their portfolio. The mean return on assets (ROA) is 3.25 percent while the mean return on equity (ROE) is 7.40 percent. The average estimated market beta is 0.84. For REITs owning at least one LEED-certified property, we observe that the average ROA decreases to 1.35 percent in the years when REITs own at least one LEED certified property. However, it is important to note that REITs started to own LEED-certified properties and increased the greenness of their portfolios especially in the period after 2006, which coincides with a sharp downturn in the real estate market.

Table 1 also shows averages for some other financial variables, including the debt to asset ratio, the logarithm of total assets, the price to book ratio and the years since the IPO. We also present the dominant property type in which each REIT invests: 26 percent of the REITs in our sample are retail REITs, while 14 percent are office REITs. Residential REITs cover 13 percent of the sample. The REITs that own LEED certified properties are mainly office and retail REITs, covering 36 percent and 20 percent of the sample, respectively. Indeed, certification programs for commercial real estate assets were first developed for commercial office and retail, followed belatedly by rating schemes for industrial property and "alternative" property types, such as self-storage and healthcare. Energy Star certified properties are predominantly owned by office and retail REITs.

IV. Method and Results

A. Endogeneity Issues

We aim to investigate whether the greenness of a property portfolio has any effect on the financial performance of REITs. There is an ongoing debate in the CSR literature regarding the causality problem between CSR and corporate financial performance (Orlitzky et al., 2003;

Waddock, Graves, 1997). Since well-performing companies generate higher cash flows, they might have excess cash that can be spend on CSR investments. If we apply this to certification of properties, for REIT with a better past financial performance, it might be more feasible to afford the capital expenditures necessary to retrofit existing properties or to invest in environmentally labeled properties.

On the other hand, the literature also shows that green-certified properties perform better than conventional but otherwise comparable properties (Eichholtz et al., in press; Fuerst, McAllister, 2011), which may imply that REITs owning these "green" properties do better than their peers that have a portfolio of conventional properties. Thus, the direction of causality is unclear.

To control for this endogeneity problem, we apply a two-stage methodology. In the first stage, we use instrumental variables that are correlated with our construct of portfolio greenness, but that are not correlated with the residuals in the second stage. As instrumental variables, we exploit a measure for the greenness of the location in which a property is located, and a measure of local green building policies for the MSA in which a property is located, following Kok et al. (2011b). The authors calculate locational greenness measures dividing the total square footage of "green" office properties by the total square footage of all properties located in an MSA for each year, separately for LEED and Energy Star certified properties. In addition, the authors create a simple measure of the "intensity" of green-building-related policies, aggregating LEED-related policies registered by the US Green Building Council at the city, county, and state level by MSA by year.

Presumably, when there are more green properties in the locations where REITs operate and own properties, REITs might include a larger number of green properties in their portfolio, in

order to satisfy the green demand in those locations, or just to behave in line with the local market norm. Similarly, if local governments support or mandate energy efficiency in properties by specific policies in the locations in which REITs operate and own properties, REITs might be influenced by those policies. Overall, the locational greenness and the locational green policy might influence the greenness decision of a REIT but should not have an impact on the financial performance of the REIT.

In order to use these two variables as instruments in our analyses, we first calculate property portfolio weights by each MSA for each REIT annually, by summing the number of properties in each MSA and dividing this by the total number of properties within the 48 MSAs for each REIT.

We then multiply the weights with the corresponding locational greenness measure and the locational green policy intensity measure for each MSA. We aggregate the multiplications for each year for each REIT, which results in a weighted greenness measure and a weighted green policy intensity measure for the locations where each REIT owns properties:

$$(4)\ WLG_{it} = \sum_{j=1}^{48} Locational\ Greenness_{jt} * Portfolio\ Weights_{ijt}$$

$$(5)\ WLGPL_{it} = \sum_{j=1}^{48} Locational\ Green\ Policy\ Intensity_{jt} * Portfolio\ Weights_{ijt}$$

where *i* stands for REIT *i*, *j* stands for MSA *j* and *t* stands for year *t*. *WLG* is the weighted locational greenness and *WLGPL* is the weighted locational green policy. [8]

[8] We find that there is a significant correlation with the instruments and the greenness of REITs, at the 1 percent significance level, but there is no significant correlation with the residuals from performance equations in the second stage. Appendix Table A1 presents the scatterplots of the REIT greenness measures with the instruments. Panel A shows that portfolio greenness increases with weighted locational greenness. LEED portfolio shares are increasing

Using our portfolio greenness construct, we investigate whether the greenness of REITs has an effect on financial performance. We follow a two-stage procedure: in the first stage, we regress the greenness measures on the vector of control variables used in the second stage plus the instruments created above. In the second stage, we then regress different measures of financial performance on each green measure, in addition to the vector of control variables. We use heteroscedasticity-robust and firm-clustered standard errors in the second stage.[9] The first stage and second stage regressions are as follows:

$$(6)\ Greenness_{it} = \partial_0 + \partial_1 WLG_{it} + \partial_2 WLGPL_{it} + \sum_k \partial_k Z_{kit} + \vartheta_{it}$$

$$(7)\ Financial\ Performance_{it} = \theta_0 + \theta_1 \widehat{Greenness}_{it} + \sum_k \theta_k Z_{kit} + \varepsilon_{it}$$

where *i* stands for REIT *i*, and *t* stands for year *t*. *Greenness* stands for *Standardized Number of Certified Properties*, *Standardized Square Footage of Certified Properties* or *Standardized Score of Certified Properties*, for both LEED and Energy Star certifications. *Financial Performance* stands for ROA, ROE, Funds from Operations (FFO)/Total Revenue, α and β. *Z* covers a vector of control variables.

Alphas and betas are obtained from the following equation, as first proposed by Fama and French (1993) and Carhart (1997), using daily stock return data. Since alpha and beta are

more with locational greenness than Energy Star portfolio shares. We also observe a similar pattern with weighted locational greenness policy intensity. As we expect, if the locations in which REITs operate are greener, then REITs tend to certify more properties in their portfolios.

[9] In unreported estimations, we additionally apply GLS estimation for random effects with and without clustering standard errors for firms, following Petersen (2009). GLS estimation with random effects provides slightly more efficient estimators than OLS, but the results do not change significantly.

estimated variables, Equation (7) is estimated applying variance-weighted least squares for the alpha and beta estimations, using the standard errors of alphas and betas obtained from Equation (8) as weights:[10]

$$(8)\ R_{it} = \alpha_i + \beta_i\left(R_m - R_f\right)_t + \delta_{i1}SMB_t + \delta_{i2}HML_t + \delta_{i3}MOM_t + \epsilon_{it}$$

where *i* stands for REIT *i*, and *t* stands for day *t*. R_m is return on the NAREIT index, *SMB, HML* and *MOM* are Fama and French (1993) and Carhart (1997) factors.

B. The Greenness of REIT Portfolios and Operating Performance

In our analyses, we address both operating performance and stock performance. We present the empirical results on returns on assets (ROA) in Table II. We regress ROA on six different measures of predicted greenness measures. (The first stage regressions are not presented here.[11]) Mature REITs enjoy a significantly higher ROA. Also, the price to book ratio, a proxy for investment opportunities, is positively related to ROA. The control variables on property type and years are not report, but we do not find significant differences in ROA across property types, and as expected, returns on assets decrease significantly during the crisis period.

Importantly, in all estimations we document that the predicted greenness of REITs is significantly and positively related to return on assets. The results are robust to using LEED or Energy Star certifications, and robust to the three different measures of portfolio greenness. The

[10] The second stage results are robust to applying ordinary least squares (OLS) in the second stage.
[11] First stage regression results available from the authors upon request.

results are economically significant as well: a 1 percent increase in the portolio weight of LEED-certified properties increases the ROA by 1.7 to 2.2 percent annually. For Energy Star certified properties the effect is slightly smaller, with a 1 percent increase in green portfolio share associated with a 0.35 to 0.76 percent increase in ROA.

The substantial difference in the economic effects of the two certifications types may be explained by the different effects that both measures may have on the bottom line of REITs. As documented in Eichholtz et al. (in press), Energy-Star-certified properties have, on average, rents that are about 2 percent higher than in conventional properties. This "green" premium is about 6 percent for LEED-certified buildings. So, the greenness of properties in REIT portfolios matters beyond savings on energy alone.

– Insert Table II here –

In the ROE estimations, presented in Panel B of Table II, we find that the predicted greenness variables are positively related to ROE in all stratifications. The models include the same control variables as in the ROA estimations and the signs of the coefficients are as expected. The explanatory power, measured by the R-squared, is similar for both the ROA and the ROE estimations.

The estimated coefficients imply substantial economic effects of including green properties in REIT portfolios: a 1 percent increase in the portfolio weight of LEED-certified properties is associated with an increase in return on equity of 4.3 to 5.5 percent. For Energy-Star-certified properties, a 1 percent increase in portfolio weight increases ROE by 0.75 to 1.85 percent.

As a robustness check, we also analyze the effects of portfolio greenness on a direct measure of cash flows, proxied by funds from operation over total revenue. Results are presented in Table III. The financial controls generally have the expected signs. Price to market is positively related with FFO/Total Revenue, implying that when there are more growth opportunities, the funds from operations from the assets are higher. Mature REITs a enjoy higher FFO ratio, which may be related to having an established property portfolio.

The results on the portfolio greenness measures suggest that a 1 percent increase in LEED-certified properties in REIT portfolios increases FFO/Total Revenue by 13.19 to 16.74 percent. The share of FFO in total revenue also increases by 2.36 to 4.81 percent if REITs increase the percentage of Energy Star certified properties.

– Insert Table III here –

C. The Greenness of REIT Portfolios and Stock Performance

We then investigate the impact of the greenness measures on stock performance and systematic risk. First, we estimate a 4-factor model, following Fama and French (1993) and Carhart (1997), using daily stock returns. We estimate this model by year for each REIT. Thus, we obtain alphas (abnormal returns) and market betas by year and by REIT, and we subsequently use these estimates as dependent variables in Equation (7). Since the dependent variables are estimated coefficients from the first stage, we use a variance-weighted least squares estimation in the second stage, weighting the variance-covariance matrix with standard errors from the first stage.

Table IV presents the estimation results using alpha as the measure for financial performance. The results do not show any statistically significant effect of the greenness

variables as measured by LEED certification on the abnormal stock performance of REITs. However, we document significantly positive effects of the fraction of Energy Star properties in REIT portfolio shares on abnormal returns. We find that when there is a 1 percent increase in Energy Star portfolio share, abnormal returns significantly increase by 0.8 to 2.4 percent.

The statistically insignificant results for the LEED measure of portfolio greenness may imply that the market already incorporates the greenness of REITs, and this factor is thus reflected in the stock price. Certification of properties is public information, it has been widely documented that "green" properties enjoy premiums, so the increased cash flows are priced in by investors, and there is no "surprise effect" at earnings announcement, which may lead to abnormal returns, as documented by Derwall et al (2005).

– Insert Table IV here –

In Panel B of Table IV, we show estimation results of beta regressions on indicators of portfolio greenness and a vector of control variables. The control variables generally have the expected signs. For instance, market risk increases with investment opportunities proxied by price to book. The statistics for model Chi-square are substantially higher than for the alpha estimates; the beta regressions have better explanatory power than the alpha regressions.

In all six regressions, predicted measures of portfolio greenness are negatively and significantly related to market betas. The relationship appears to have substantial economical significance. We find that the market beta of a REIT decreases by 0.06 to 0.07 when the portfolio weight of LEED-certified properties increases with one percent. The impact of Energy Star

certification on beta is slightly lower: a one percent increase in the portfolio weight of Energy-Star-certified buildings reduces beta by 0.007 to 0.01.

These results may be explained in two ways. First, properties designated as more efficient consume less energy and other resources, so these properties are less exposed to price fluctuations of natural resources and providing a hedge against the fat-tail risk of energy price shocks. Second, the literature consistently shows that more efficient properties have higher and more stable occupancy rates than conventional, non-efficient buildings. Since the occupancy of commercial buildings is very closely related to the business cycle, this may explain the fact that REITs owning more "green" buildings face a lower market risk – proxied by beta.

V. Concluding Remarks

While there is an emerging literature that studies the financial implications of energy efficiency and sustainability on the financial performance of commercial buildings, there has been no such research into the performance of the investors that actually own these "green" properties. Importantly, such analysis may provide a better understanding of the net financial benefits of investments in the "greening" of properties, leading to vital new insights in the returns to investments in energy efficiency and sustainability.

This paper investigates the impact of energy efficiency and sustainability of commercial properties on the financial performance of US REITs. We create six dynamic greenness variables using the weight of green properties in the overall REIT portfolio for both LEED and Energy Star certifications. We match data on LEED and Energy Star certification with property-level data on REIT portfolios, documenting that there are more than 700 LEED-registered properties on the

balance sheet of 44 REITs as of August 2011. Additionally, we observe that there are 919 Energy-Star-certified properties owned by 71 REITs as of August 2011.

We document that the number of green-certified properties increased strongly during the recent downturn in the real estate markets, notwithstanding severe capital and liquidity constraints, in line with the findings of Eichholtz et al. (in press), who show that in the face of the historically severe downturn, the number of green-certified properties continued to grow exponentially, with no significant change in the financial premiums commanded by "green" properties. REITs seem to be persistent in pursuing the greening of their property portfolios.

The impact of greenness on corporate financial performance is addressed while controlling for the well-documented causality problem between CSR and corporate financial performance (Margolis, Walsh, 2003; Orlitzky et al., 2003; Waddock, Graves, 1997). Following the methodology of Kok et al. (2011b), we use two instrumental variables that may influence the greenness decision of a REIT but should not have an impact on the financial performance of the REIT: the weighted locational greenness and the weighted locational intensity of green policies.

We apply a two-stage estimation procedure, first regressing the greenness variables on the instruments and a set of control variables. In the second stage, we then model corporate financial performance as a function of predicted portfolio greenness and the set of controls used in the first stage. Overall, our findings indicate that the greenness of REIT portfolios is positively related to operating performance. We find that if a REIT increases the share of "green" properties in its portfolio by one percent, its return on assets increases by 1.7 to 2.2 percent for LEED-certified properties and by 0.35 to 0.76 percent for Energy-Star-certified properties.

Furthermore, we document that the predicted greenness variables have significantly positive effects on REITs' return on equity as well. If a REIT increases the share of green

properties within the portfolio by one percent, the return on equity significantly increases by 4.3 to 5.5 percent for LEED-certified properties and by 0.75 to 1.85 percent for Energy-Star-certified properties.

The greenness of REIT portfolios also affects cash flows. A one percent increase in the share of LEED-certified properties in REIT portfolios raises the ratio between FFO and Total Revenue by 13.19 to 16.74 percent. The share of FFO in total revenue also increases by 2.36 to 4.81 percent if REITs expand the share of Energy-Star-certified properties in the portfolio by one percent.

We find that the market appears to incorporate the impact of LEED certification in the stock price, since there is no significant relationship between predicted greenness and abnormal returns. However, we document statistically significant and positive effects of Energy Star portfolio shares on alphas.

Importantly, we also document that the predicted measures of portfolio greenness negatively affect market betas in all estimations. A one percent increase in the weight of green properties within the overall REIT portfolio decreases market beta by 0.06 to 0.07 for LEED-certified properties and by 0.007 to 0.01 for Energy-Star-certified properties. Since green properties are less exposed to energy price fluctuations and to vacancy risk, REITs and the property portfolios they own are also less exposed to these influences, and thereby less exposed to the business cycle.

Our results suggest that the benefits of "green" property investments ouweigh the costs. This has some implications for investors in US REITs. The fact that the average percentage of certified properties in REIT property portfolios is still low – 2 percent for LEED and 5-7 percent for Energy Star – suggests that REITs are in the early phase of investing in the greenness of the

properties in their portfolios, a notion that is supported by the large number of buildings that are already registered, but not yet certified by LEED. This indicates strong growth in green building certification in years to come. This development confirms evidence regarding the nascent greenness of REITs and other property companies, as documented in a recent survey of a large sample of property investors around the world (Kok et al., 2011a).

Given our key findings that portfolio greenness is positively related to operating performance and negatively related to risk, these market developments provide a positive outlook for the return on equity and the return on assets of REIT investors, and are likely to make REIT returns less responsive to the business cycle.

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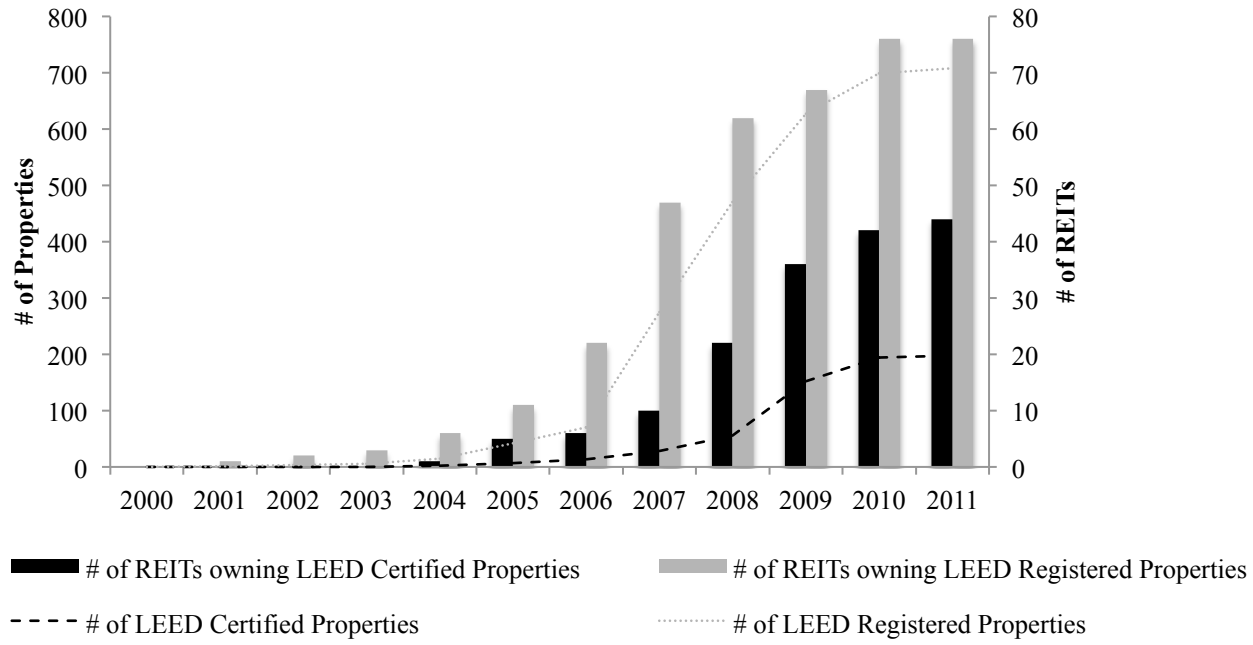
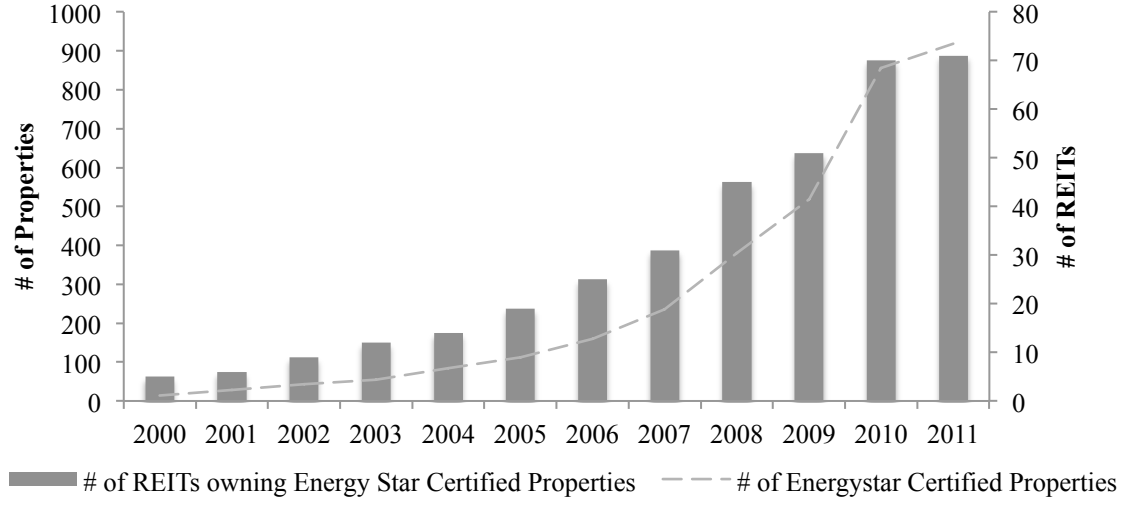
Figure I
Green Buildings in the Portfolios of US REITs

A. LEED Registered and LEED Certified Buildings

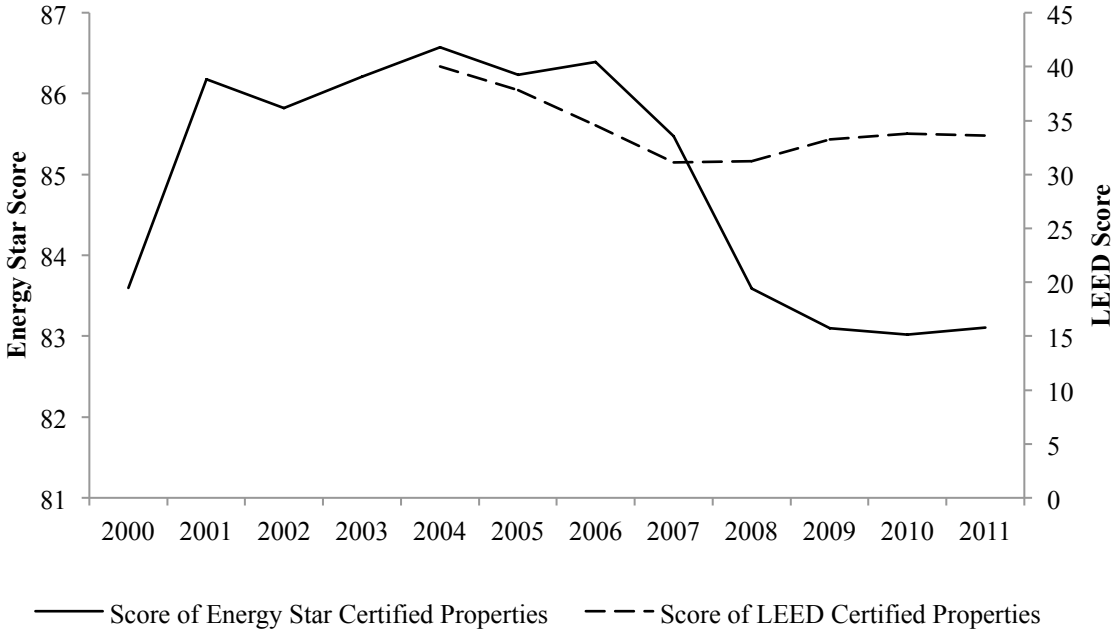


B. Energy Star Certified Buildings



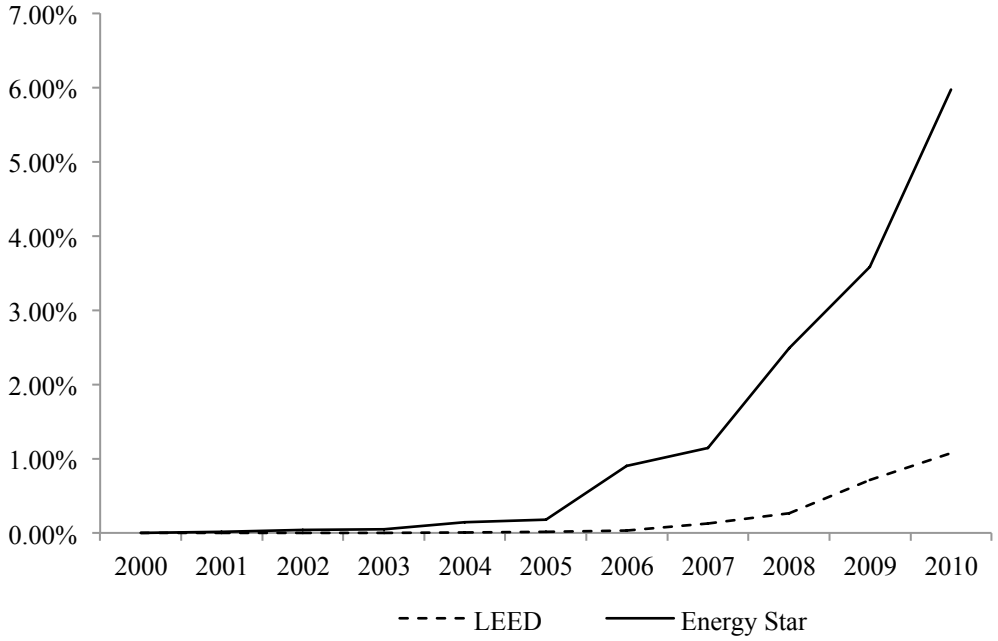
Notes: The figure shows the combined annual green portfolio of US REITs from 2000 to 2011. Panel A shows the properties that are LEED registered and certified and the REITs owning those properties. Panel B shows the properties that are Energy Star certified and the REITs owning those properties

Figure II
Average Certification Scores



Notes: The figure presents average LEED and Energy Star scores for the certified properties owned by REITs.

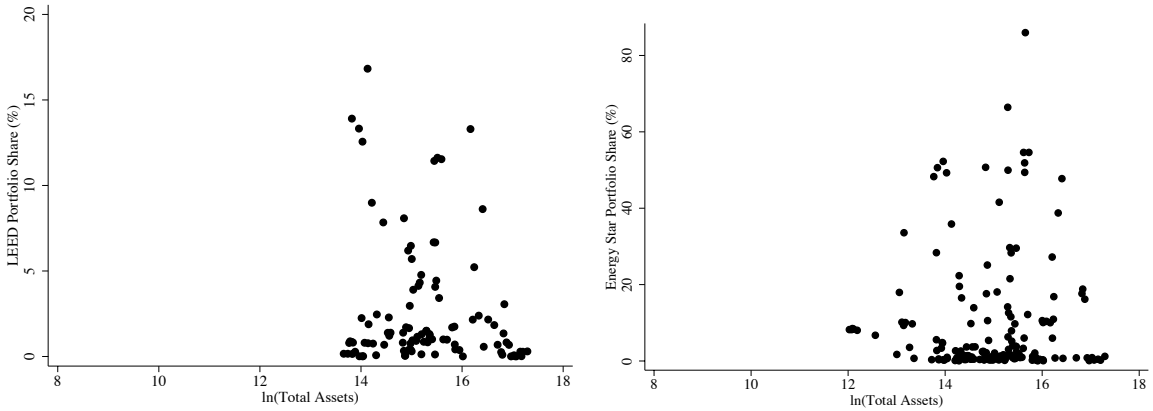
Figure III
The Diffusion of Green Properties in REIT Property Portfolios



Notes: The figure presents the diffusion of LEED and Energy Star certified properties within REIT property portfolios as a ratio of green square feet over total square feet of REIT portfolios.

Figure IV
Correlations of Portfolio Greenness of REITs with Financial Controls

A. Portfolio Greenness and Total Assets



B. Portfolio Greenness and Firm Age

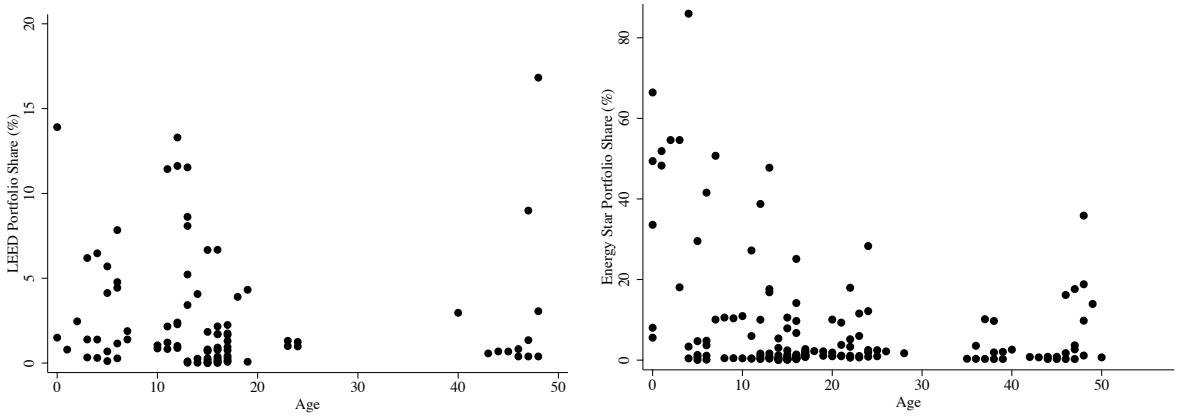


Table I
Descriptive Statistics
Portfolio Greenness and Financial Characteristics
(2000-2010)

Panel A. Greenness Measures

	LEED					Energy Star				
	Obs.	Mean	Std. Dev.	Min	Max	Obs.	Mean	Std. Dev.	Min	Max
Number of Certified Properties (%)	101	2.26	2.38	0	14.29	233	5.62	9.89	0	75.76
Sqft of Certified Properties (%)	86	2.64	3.42	0	16.83	138	7.03	14.04	0	85.98
Number of Registered Properties (%)	101	8.52	9.28	0	42.86					

Panel B. Financial Measures

	All Observations					LEED					Energy Star				
Variable	Obs.	Mean	Std. Dev.	Min	Max	Obs.	Mean	Std. Dev.	Min	Max	Obs.	Mean	Std. Dev.	Min	Max
Return on Assets (%)	1000	3.25	4.95	-16.81	86.28	101	1.35	2.52	-7.73	6.62	233	1.80	3.63	-16.59	12.18
Return on Equity (%)	1000	7.40	11.92	-111.13	114.40	101	3.01	10.35	-74.86	17.76	233	4.25	11.35	-74.86	32.92
FFO/Total Revenue (%)	897	46.19	67.37	-602.88	923.08	94	31.76	15.89	-42.39	56.11	224	32.18	37.77	-196.13	305.88
Alpha (x252)	732	0.01	0.27	-1.50	2.14	94	-0.03	0.26	-0.88	0.70	207	-0.02	0.27	-0.96	1.28
Beta	732	0.84	0.30	-0.40	1.68	94	0.99	0.21	0.33	1.62	207	0.96	0.21	0.38	1.60
ln(Total Assets)	1000	14.32	1.34	8.06	17.29	101	15.33	0.95	12.15	17.29	233	15.08	0.88	12.19	17.29
Price-Book Ratio	1000	202.36	107.26	9.98	744.74	101	195.65	125.85	18.89	689.49	233	179.32	98.78	9.98	609.08
Age	1000	15.83	11.91	0	57.00	101	16.94	12.23	0	48.00	233	18.55	13.79	0	57.00
Office	1000	0.14	0.35	0	1	101	0.36	0.48	0	1	233	0.24	0.43	0	1
Industrial	1000	0.06	0.23	0	1	101	0.08	0.27	0	1	233	0.06	0.23	0	1
Retail	1000	0.26	0.44	0	1	101	0.20	0.40	0	1	233	0.28	0.45	0	1
Residential	1000	0.13	0.34	0	1	101	0.07	0.26	0	1	233	0.07	0.25	0	1

Notes: Panel A shows descriptive statistics of greenness measures. In Panel B, we present descriptive statistics of operating and stock performance measures and also control variables for the whole sample, the sample of REITs owning at least one LEED certified property and the sample of REITs owning at least one Energy Star certified property, respectively. Alpha and beta are obtained by REIT by year from the 4-factor model following Fama and French (1993) and Carhart (1997) for the sample using daily stock data. Then, we multiply alphas and standard errors of alphas by 252 to obtain annual alphas - a year is assumed to be 252 trading days.

Table II
Regression Results
Greenness of REIT Portfolios and Operating Performance
(2000-2010)

Panel A: Return on Assets						
VARIABLES	LEED	LEED	LEED	Energy Star	Energy Star	Energy Star
	(1)	(2)	(3)	(4)	(5)	(6)
Number of Certified Properties	2.21*			0.76**		
(Predicted)	[1.18]			[0.38]		
Sqft of Certified Properties		1.69*			0.35**	
(Predicted)		[0.96]			[0.16]	
Score of Certified Properties			0.06*			0.01**
(Predicted)			[0.03]			[0.00]
Total Assets	-0.67*	-0.68*	-0.64*	-1.05***	-0.71*	-1.04***
(in log)	[0.37]	[0.38]	[0.37]	[0.40]	[0.38]	[0.39]
Price-Book Ratio	0.01**	0.01**	0.01**	0.02***	0.01**	0.02***
	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]
Age	0.06**	0.05**	0.06**	0.06***	0.06**	0.07***
	[0.02]	[0.02]	[0.02]	[0.02]	[0.02]	[0.02]
Property Type Controls	Y	Y	Y	Y	Y	Y
Year-Fixed Effects	Y	Y	Y	Y	Y	Y
Constant	10.83**	11.13**	10.46**	15.20***	11.51**	15.09***
	[4.70]	[4.74]	[4.68]	[4.99]	[4.82]	[4.97]
Observations	1,000	1,000	1,000	1,000	1,000	1,000
R-squared	0.17	0.16	0.17	0.17	0.17	0.17
Panel B: Return on Equity						
VARIABLES	LEED	LEED	LEED	Energy Star	Energy Star	Energy Star
	(1)	(2)	(3)	(4)	(5)	(6)
Number of Certified Properties	5.54**			1.85***		
(Predicted)	[2.48]			[0.69]		
Sqft of Certified Properties		4.32**			0.75**	
(Predicted)		[2.05]			[0.29]	
Score of Certified Properties			0.14**			0.02***
(Predicted)			[0.06]			[0.01]
Total Assets	-0.49	-0.53	-0.42	-1.41*	-0.53	-1.39*
(in log)	[0.55]	[0.55]	[0.54]	[0.78]	[0.54]	[0.77]
Price-Book Ratio	0.03***	0.03***	0.03***	0.04***	0.03***	0.04***
	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]	[0.01]
Age	0.09**	0.08*	0.09**	0.11**	0.09**	0.11**
	[0.04]	[0.04]	[0.04]	[0.04]	[0.04]	[0.04]
Property Type Controls	Y	Y	Y	Y	Y	Y
Year-Fixed Effects	Y	Y	Y	Y	Y	Y
Constant	10.37	11.22	9.44	20.83**	11.20	20.56**
	[7.38]	[7.44]	[7.31]	[10.13]	[7.37]	[10.05]
Observations	1,000	1,000	1,000	1,000	1,000	1,000
R-squared	0.18	0.18	0.18	0.18	0.18	0.18

Notes: Table II shows the second stage results of the two-stage regression for the REIT data ranging from 2000 to 2010. In the first stage, *Number of Certified Properties, Sqft of Certified Properties* and *Score of Certified Properties* are predicted by *WLG, WLGPL,* the instruments, and the vector of control variables used above in the second stage. Then, ROA (in percentage) is estimated on predicted *Number of Certified Properties, Sqft of Certified Properties* and *Score of Certified Properties,* separately, additional to the vector of control variables. Heteroscedasticity robust and firm clustered standard errors are in brackets.
* indicates significance at the 10 percent level.
** indicates significance at the 5 percent level.
*** indicates significance at the 1 percent level.

Table III
Regression Results
Greenness of REIT Portfolios and FFO/Total Revenue Estimations
(2000-2010)

VARIABLES	(1) LEED	(2) LEED	(3) LEED	(4) Energy Star	(5) Energy Star	(6) Energy Star
Number of Certified Properties	16.74**			4.81**		
(Predicted)	[7.28]			[2.36]		
Sqft of Certified Properties		13.19**			2.36***	
(Predicted)		[5.90]			[0.90]	
Score of Certified Properties			0.42**			0.05**
(Predicted)			[0.18]			[0.03]
Total Assets	2.72	2.56	2.90	0.57	2.43	0.62
(in log)	[2.62]	[2.66]	[2.59]	[3.09]	[2.60]	[3.07]
Price-Book Ratio	0.02	0.02	0.02	0.05**	0.03	0.05**
	[0.02]	[0.02]	[0.02]	[0.02]	[0.02]	[0.02]
Age	0.08	0.05	0.08	0.14	0.08	0.14
	[0.18]	[0.18]	[0.18]	[0.18]	[0.18]	[0.18]
Property Type Controls	Y	Y	Y	Y	Y	Y
Year-Fixed Effects	Y	Y	Y	Y	Y	Y
Constant	179.66***	182.41***	176.86***	203.25***	184.03***	202.56***
	[37.51]	[38.17]	[37.07]	[42.81]	[37.02]	[42.60]
Observations	904	904	904	904	904	904
R-squared	0.45	0.45	0.45	0.45	0.45	0.45

Notes: Table III shows two-stage regression results for the REIT data ranging from 2000 to 2010. In the first stage, *Number of Certified Properties, Sqft of Certified Properties* and *Score of Certified Properties* are predicted by *WLG, WLGPL,* as instruments, and the vector of control variables used above in the second stage. Then, FFO/Total Revenue (in percentage) is estimated on predicted *Number of Certified Properties, Sqft of Certified Properties* and *Score of Certified Properties,* separately, additional to the vector of control variables. Heteroscedasticity robust and firm clustered standard errors are in brackets.
* indicates significance at the 10 percent level.
** indicates significance at the 5 percent level.
*** indicates significance at the 1 percent level.

Table IV
The Greenness of Property Portfolios and Stock Performance
(Alpha and Beta, 2000-2010)

Panel A. Alpha Estimations

VARIABLES	(1) LEED	(2) LEED	(3) LEED	(4) Energy Star	(5) Energy Star	(6) Energy Star
Number of Certified Properties (Predicted)	0.057 [0.037]			0.024** [0.012]		
Sqft of Certified Properties (Predicted)		0.043 [0.030]			0.008* [0.004]	
Score of Certified Properties (Predicted)			0.001 [0.001]			0.000** [0.000]
Total Assets (in log)	-0.008 [0.006]	-0.008 [0.006]	-0.007 [0.006]	-0.021** [0.010]	-0.008 [0.006]	-0.020** [0.010]
Debt Ratio	0.000*** [0.000]	0.000*** [0.000]	0.000*** [0.000]	0.001*** [0.000]	0.000*** [0.000]	0.000*** [0.000]
Price-Book Ratio	-0.001** [0.001]	-0.001** [0.001]	-0.001** [0.001]	-0.001 [0.001]	-0.001** [0.001]	-0.001 [0.001]
Age	-0.008 [0.006]	-0.008 [0.006]	-0.007 [0.006]	-0.021** [0.010]	-0.008 [0.006]	-0.020** [0.010]
Property Type Controls	Y	Y	Y	Y	Y	Y
Year-Fixed Effects	Y	Y	Y	Y	Y	Y
Constant	0.197** [0.095]	0.043 [0.092]	0.025 [0.091]	0.217* [0.122]	0.058 [0.093]	0.213* [0.121]
Observations	750	750	750	750	750	750
Model Chi2	55.57	55.24	55.56	57.40	56.32	57.40
Prob.	0.000	0.000	0.000	0.000	0.000	0.000

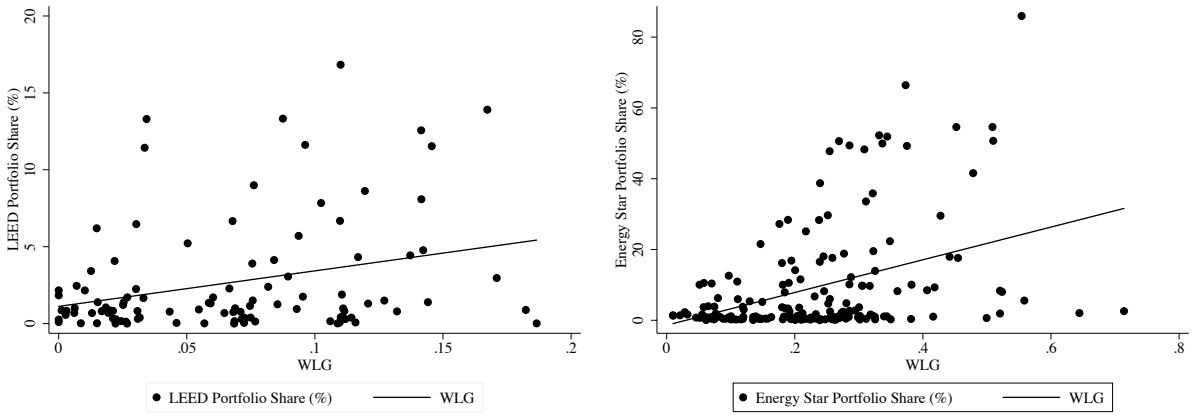
Panel B. Beta Estimations

VARIABLES	(1) LEED	(2) LEED	(3) LEED	(4) Energy Star	(5) Energy Star	(6) Energy Star
Number of Certified Properties (Predicted)	-0.068*** [0.010]			-0.012*** [0.003]		
Sqft of Certified Properties (Predicted)		-0.057*** [0.008]			-0.007*** [0.001]	
Score of Certified Properties (Predicted)			-0.002*** [0.000]			-0.000*** [0.000]
Total Assets (in log)	0.149*** [0.002]	0.150*** [0.002]	0.148*** [0.002]	0.153*** [0.003]	0.149*** [0.002]	0.153*** [0.003]
Price-Book Ratio	0.000*** [0.000]	0.000*** [0.000]	0.000*** [0.000]	0.000** [0.000]	0.000*** [0.000]	0.000** [0.000]
Age	-0.000 [0.000]	-0.000 [0.000]	-0.000 [0.000]	-0.000** [0.000]	-0.000 [0.000]	-0.000** [0.000]
Property Type Controls	Y	Y	Y	Y	Y	Y
Year-Fixed Effects	Y	Y	Y	Y	Y	Y
Constant	-1.334*** [0.030]	-1.348*** [0.031]	-1.322*** [0.029]	-1.365*** [0.037]	-1.328*** [0.030]	-1.363*** [0.037]
Observations	750	750	750	750	750	750
Model Chi2	7165.64	7167.21	7165.68	7135.14	7159.13	7135.23
Prob.	0.000	0.000	0.000	0.000	0.000	0.000

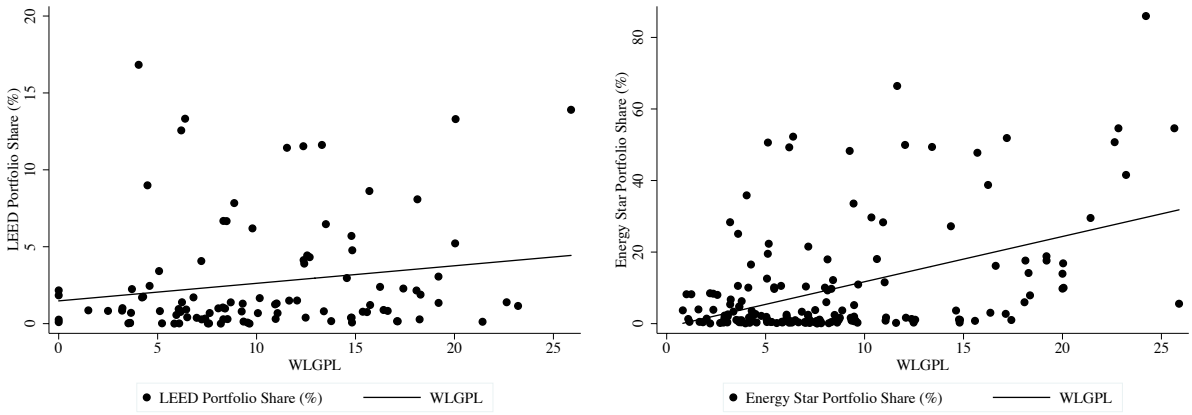
Notes: Table III shows two-stage regression results for the REIT data ranging from 2000 to 2010. In the first stage, *Number of Certified Properties, Sqft of Certified Properties* and *Score of Certified Properties* are predicted by *WLG, WLGPL,* as instruments, and the vector of control variables used above in the second stage. Then, alpha and beta are estimated on predicted *Number of Certified Properties, Sqft of Certified Properties* and *Score of Certified Properties,* separately, additional to the vector of control variables. We obtain daily alphas and market betas by REIT by year from the 4-factor model proposed by Fama and French (1993) and Carhart (1997) for the sample using daily stock data. Then, we multiply alphas and standard errors of alphas by 252 to obtain annual alphas - a year is assumed to be 252 business days. In the second stage, we apply variance weighted least squares weighting the variance covariance matrix with standard errors of alphas from the first stage. Standard errors are in brackets.
* indicates significance at the 10 percent level.
** indicates significance at the 5 percent level.
*** indicates significance at the 1 percent level.

Appendix Table A1
Correlations of Portfolio Greenness of REITs with Locational Controls

A. Portfolio Greenness and Weighted Locational Greenness



B. Portfolio Greenness and Weighted Locational Regulation



Notes: Portfolio greenness is calculated as a ratio of green square feet over total square feet of REIT portfolios. WLGPL stands for weighted locational policy intensity.

Appendix Table A2
Green Properties by REIT

REIT Name	Year of First LEED Certified Property	Year of First Energy Star Certified Property	Percentage of LEED Registered Buildings (2010)	Percentage of LEED Certified Buildings (2010)	Percentage of Energy Star Certified Buildings (2010)
Acadia Realty Trust	2008	2010	4.11%	1.37%	2.74%
Agree Realty Corporation		2010			3.70%
Alexander's, Inc.			20.00%		
Alexandria Real Estate Equities, Inc.	2007		8.64%	3.70%	
AMB Property Corporation					
American Assets Trust, Inc.					
American Campus Communities, Inc.			2.86%		
Apartment Investment and Management Company					
Ashford Hospitality Trust, Inc.		2004	1.00%		34.00%
Associated Estates Realty Corporation					
AvalonBay Communities, Inc.	2009		4.65%	0.58%	
BioMed Realty Trust, Inc.	2005		10.84%	4.82%	
Boston Properties, Inc.	2009	2000	36.81%	8.33%	32.64%
Brandywine Realty Trust	2009	2001	4.24%	2.12%	15.19%
BRE Properties, Inc.	2009		10.23%	3.41%	
Camden Property Trust			0.54%		
Campus Crest Communities, Inc.					
CapLease, Inc.	2005	2010	8.70%	4.35%	2.17%
CBL & Associates Properties, Inc.		2007	2.70%		4.05%
Cedar Shopping Centers, Inc.		2006			5.30%
Chatham Lodging Trust					
Chesapeake Lodging Trust		2010			20.00%
Cogdell Spencer Inc.		2010			1.47%
Colonial Properties Trust	2008	2000	4.46%	1.91%	19.11%
CommonWealth REIT	2009	2005	1.17%	0.19%	5.63%
CoreSite Realty			16.67%		

Corporation					
Corporate Office Properties Trust	2005		19.49%	3.31%	
Cousins Properties Incorporated	2009	2008	23.81%	14.29%	26.19%
DCT Industrial Trust Inc.		2010			0.23%
Developers Diversified Realty Corporation	2008	2007	0.53%	0.35%	1.94%
DiamondRock Hospitality Company		2005			8.70%
Digital Realty Trust, Inc.	2007	2009	28.57%	8.16%	1.02%
Douglas Emmett, Inc.		2006	3.03%		75.76%
Duke Realty Corporation	2008	2008	3.58%	1.92%	2.30%
DuPont Fabros Technology, Inc.			62.50%		
EastGroup Properties, Inc.		2000			0.41%
Education Realty Trust, Inc.					
Entertainment Properties Trust					
Equity LifeStyle Properties, Inc.					
Equity One, Inc.		2006	1.03%		1.03%
Equity Residential			0.22%		
Essex Property Trust, Inc.					
Excel Trust, Inc.			4.76%		
Extra Space Storage Inc.					
Federal Realty Investment Trust	2008	2006	3.23%	1.08%	2.15%
FelCor Lodging Trust Incorporated					
First Industrial Realty Trust, Inc.	2009	2010	1.03%	0.39%	0.13%
First Potomac Realty Trust	2009		8.43%	4.82%	
Franklin Street Properties Corporation	2007	2006	38.89%	13.89%	30.56%
General Growth Properties, Inc.	2006	2008	6.72%	2.10%	7.56%
Getty Realty Corp.					
Gladstone Commercial Corporation			4.62%		
Glimcher Realty Trust		2009	3.70%		3.70%
Government Properties Income	2010	2009	5.45%	1.82%	43.64%

Trust					
HCP, Inc.		2009	0.74%		1.93%
Health Care REIT, Inc.		2010	0.45%		0.45%
Healthcare Realty Trust Incorporated			0.48%		
Hersha Hospitality Trust		2007	0.00%		1.30%
Highwoods Properties, Inc.	2009	2007	2.73%	0.30%	17.58%
HMG/Courtland Properties, Inc.			0.00%		
Home Properties, Inc.			2.59%		
Hospitality Properties Trust		2004	0.42%		16.88%
Host Hotels & Resorts, Inc.		2003	8.00%		15.20%
Hudson Pacific Properties, Inc.	2010	2010	15.38%	7.69%	7.69%
Inland Real Estate Corporation	2008	2010	2.11%	0.70%	0.70%
InnSuites Hospitality Trust			0.00%		
Investors Real Estate Trust		2008	0.40%		1.59%
Kilroy Realty Corporation	2008	2009	10.00%	5.00%	7.86%
Kimco Realty Corporation					
Kite Realty Group Trust		2008	0.00%		5.26%
LaSalle Hotel Properties		2007	2.86%		5.71%
Lexington Realty Trust	2009	2006	3.28%	0.82%	2.05%
Liberty Property Trust	2004	2007	8.71%	4.49%	8.98%
LTC Properties, Inc.			0.00%		
Macerich Company		2009	7.06%		7.06%
Mack-Cali Realty Corporation		2000	0.36%		9.49%
Medical Properties Trust, Inc.			0.00%		
MHI Hospitality Corporation			0.00%		
Mid-America Apartment Communities, Inc.			0.00%		
Mission West Properties, Inc.	2010		1.80%	0.90%	
Monmouth Real Estate Investment Corporation			0.00%		
MPG Office Trust, Inc.	2008	2006	24.00%	12.00%	80.00%
National Health			0.00%		

Investors, Inc.					
National Retail Properties, Inc.		2008	0.08%		0.08%
Nationwide Health Properties, Inc.			0.15%		
Omega Healthcare Investors, Inc.			0.00%		
One Liberty Properties, Inc.		2010	0.00%		1.15%
Pacific Office Properties Trust, Inc.		2008	8.33%		16.67%
Parkway Properties, Inc.		2008	12.31%		13.85%
Pennsylvania Real Estate Investment Trust		2010	0.00%		4.35%
Piedmont Office Realty Trust, Inc.	2009	2002	17.86%	2.38%	47.62%
Plum Creek Timber Company, Inc.			0.00%		
Post Properties, Inc.		2006	5.45%		1.82%
Potlatch Corporation					
Presidential Realty Corporation			0.00%		
ProLogis	2007		1.89%	0.83%	
PS Business Parks, Inc.	2010	2010	0.96%	0.48%	0.48%
Public Storage			0.00%		
Ramco-Gershenson Properties Trust		2010	0.00%		2.22%
Rayonier Inc.					
Realty Income Corporation			0.00%		
Regency Centers Corporation	2009	2003	5.81%	1.01%	2.02%
Roberts Realty Investors, Inc.			0.00%		
Sabra Health Care REIT, Inc.			0.00%		
Saul Centers, Inc.	2008	2010	5.56%	1.85%	3.70%
Senior Housing Properties Trust		2010	0.63%		0.31%
Simon Property Group, Inc.	2008	2008	3.05%	0.76%	3.82%
SL Green Realty Corp.	2008	2008	31.94%	4.17%	12.50%
Sovran Self Storage, Inc.			0.00%		
Strategic Hotels & Resorts, Inc.		2008	7.14%		7.14%
Sun Communities, Inc.			0.00%		
Sunstone Hotel Investors, Inc.		2005	0.00%		11.76%

Supertel Hospitality, Inc.			0.00%		
Tanger Factory Outlet Centers, Inc.	2010		6.06%	3.03%	
Taubman Centers, Inc.			30.43%		
Terreno Realty Corporation			0.00%		
UDR, Inc.			0.00%		
UMH Properties, Inc.	2010		42.86%	5.71%	
Universal Health Realty Income Trust			0.00%		
Urstadt Biddle Properties Inc.			0.00%		
U-Store-It Trust		2009	0.00%		0.55%
Ventas, Inc.		2010	0.17%		0.66%
Vornado Realty Trust	2005	2004	20.08%	3.28%	11.48%
Washington Real Estate Investment Trust		2008	7.06%		12.94%
Weingarten Realty Investors		2002	0.26%		3.13%
Weyerhaeuser Company					
Whitestone REIT		2005	0.00%		2.63%
Winthrop Realty Trust		2008	0		4.65%