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The Effect of Sustainability on Retail Values, Rents, and Investment Performance: European Evidence

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Abstract This paper is the first to focus on the effects of sustainability on the investment performance of a European retail portfolio comprising 128 properties in the Netherlands and extends the existing range of studies on the office and residential sectors in the United States. As the data sample is an existing fund portfolio, all attributes of the properties are known. Environmental sustainability is measured by the Dutch energy label, which compares with ENERGY STAR in the U.S. Through OLS regressions, we examine whether a sustainability premium exists. We find that green retail properties have a significantly higher income return of 0.52%, while, counterintuitively, non-green retail properties appear to have significantly higher rents and values. After controlling for various factors, however, the sustainability effects become insignificant. This contradicts some of the findings in the office and residential sectors. We attribute this to the importance of traditional retail location theory factors, which continue to dominate returns.

The attention institutional investors pay to the environmental performance of real estate investment portfolios is increasing. This is understandable in view of estimations that buildings are responsible for approximately 30% of the CO_2 emissions worldwide and 40% of global energy consumption (UNEP, 2009). This makes the sector vulnerable to increases in the prices of energy, and could impact future investment returns negatively. Consequently, the built environment also has substantial potential to contribute to a decrease in CO_2 emissions (Enkvist, Naucler, and Rosander, 2007). Therefore, it is essential for governments to include the real estate sector in plans to decrease global CO_2 emissions and diminish the use of natural resources. The United Nations has already suggested an active tax policy to their member states, making energy-efficient properties more attractive and energy-inefficient properties less attractive (UNEP, 2009).

Further to this notion, the impact of sustainability on investment returns has been the topic of a stream of literature. Several researchers find that sustainable office and residential properties have higher rents and values (e.g., Eichholtz, Kok, and Quigley, 2010; Kahn and Kok, 2012). However, there is very limited research available on the effect of sustainability on the total shareholder returns of properties. The absence of this evidence makes it hard for investors to justify (large) investments to make their properties more sustainable (INREV, 2010). The issue is compounded by the fact that studies are on office and residential properties, typically based on U.S. data.

In this paper, we explore the effect of sustainability on the investment performance of retail properties. Furthermore, we extend the range of papers with European evidence. We focus on the effects of sustainability on the investment performance of a portfolio of 128 retail properties in the Netherlands, covering the performance of the properties between 2007 and 2011. As the data sample is taken from an existing fund portfolio, all attributes of the properties are known, allowing us to analyze performance differential to a very high degree. The properties in the sample are diverse in age and type. The oldest asset in the study was built in 1820 and the study covers high street retail, neighborhood centers, and shopping malls.

The paper is structured as follows: the next section covers the literature review about the effect of sustainability on investment performance. The main sustainability labels are covered in the second section. In the third section, the data and methodology of this study are explained. The fourth section covers the study findings and the fifth section is the conclusion.

Literature Review

Finance literature on the impact of sustainability on real estate can be divided into a stream on the performance of individual properties and another on the performance of portfolios and/or funds. The literature provides insight on useful control variables we implement in our model.

Property Level Performance Literature

Several studies have been done on the effects of sustainability and the performance of individual properties, generally offices. Most studies focus on the effects of sustainability on the rent of the properties analyzed. Some studies have also examined the occupancy rates and the value of offices, although less evidence is available and fewer transactions take place. Exhibit 1 shows the results from these studies.

All studies on the American office sector find a premium on the rents, values, and/or occupancy rate for sustainable buildings in comparison to buildings without a sustainable certification like ENERGY STAR or LEED. All studies share the CoStar database as their principal datasource. Variations in the results can be attributed to data selection (i.e., the size of the sample, the control variables, and the timespan of the data). Some of the earlier studies find relatively large differences in sales prices (e.g., Fuerst and McAllister, 2009); however, the groups of green and non-green properties show large differences in age, size, and/or vacancy level.

Eichholtz, Kok, and Quigley (2010) look at performance and take into account a large number of control variables. The authors control for factors such as age,

Exhibit 1 | Overview of Source Data

Study	Database	Country	Period	Control Buildings	Sample	Rent Premium	Sales Premium	Occupancy Premium
Office Sector								
Miller, Spivey, and Florence (2008)	CoStar	U.S.	2003–2007	>2,000	643 ENERGY STAR	8%	6%	2%–4%
					LEED		10%	2%–4%
Fuerst and McAllister (2009)	CoStar	U.S.		10,000	1291 ENERGY STAR	6%	31%	3%
		U.S.			292 LEED	6%	35%	8%
Fuerst and McAllister (2011)	CoStar	U.S.		15,000	834 ENERGY STAR	4%	26%	3%
		U.S.			197 LEED	5%	25%	8%
Miller (2010)	CoStar	U.S.	2008–2010	378	12 ENERGY STAR	—	—	(4%–5%)
		U.S.			5 LEED	12%	15%	
Wiley, Benefield, and Johnson (2010)	CoStar	U.S.	2008	7,308	ENERGY STAR	7%–9%		
		U.S.		1,151	LEED	16%–18%		
Eichholtz, Kok, and Quigley (2010)	CoStar	U.S.	2007	8,105	ENERGY STAR	3%	16%–17%	
		U.S.			LEED	5%	16%–17%	
Eichholtz, Kok, and Quigley (2011)	CoStar	U.S.	2009			2%–7%	13%	3%
		U.S.				6%	11%	3%
Reichardt, Fuerst, Rottke, and Zietz (2012)	CoStar	U.S.	2000–2010	7,140	ENERGY STAR	3%–7%		
					LEED	3%–4%		
Chegut, Eichholtz, and Kok (2011)	CoStar	U.K.	2000–2009	1,104	67 BREEAM	21%		
				1,953	70 BREEAM		26%	
Kok and Jennen (2011)		NL		1,100	Energy Labels	7%		
Residential Sector								
Brounen and Kok (2011)				145,325	31,993 energy labels		4%	
Aroul and Hansz (2012)				14,922	7,180 green buildings		2%–4%	
Kok and Kahn (2012)				1,600,000	4,321 green labels		9%	
Property Investment Funds					Outperformance on	Fund	Asset	Level
Eichholtz, Kok, and Yonder (2011)		U.S.		128 funds	ENERGY STAR	0%	1%	
					LEED	0%	2%	

Note: This table provides an overview of the studies on the impact of sustainability on performance studies published to date with their key findings.

building size, and building quality. The distinguishing feature in their paper is their control for location: not in a city or submarket, but within a range of 0.2 square miles. In addition, they control for the service sector employment increase in the area and for the amenities near the offices. This research shows that even after implementation of thorough controls, the sustainability premium for offices still remains and is statistically highly significant.

In Europe, the first study about the connection between property performance and BREEAM rated buildings in the United Kingdom was done by Chegut, Eichholtz, and Kok (2011). They find a relatively high premium (a 21% higher rent and 26% higher value) for sustainable offices in the U.K. This premium exists after extensive controlling for location (on ZIP Code level and by distance to a public transportation station), rental unit size, age, storage, amenities, and renovation. The sample is relatively small though, introducing a sample bias, as the best buildings typically are the ones that are labeled first.

Kok and Jennen (2011) compared 1,100 rent transactions of Dutch office properties with the Energy Performance Certificates. Energy Performance Certificates comparable to the ENERGY STAR ratings, but with labels ranging from G (energy inefficient) to A++ (very energy efficient), calculated based on an underlying energy index. They controlled for location (based on the ZIP Code, distance to the nearest train station and the nearest highway ramp), age, size, and the "walk score," being the distance to a varied set of neighborhood amenities. The sustainability premium varied per year: the highest rent premium of 6.5% for green properties was in 2010, in which year the rentals for "non-green" declined fast and the rentals for "green" buildings rose fast.

Although the studies consistently find a premium for sustainable offices, Eichholtz, Kok, and Quigley (2011) note that the building quality of green buildings is higher than for non-green buildings. For instance, the sample of rated buildings comprises 75% of Class A buildings, while the sample of control buildings only has 26% Class A buildings. Furthermore, green buildings are generally younger, larger in size, and have more favorable characteristics regarding location, transport, and amenities.

In the residential sector, the results of the three studies indicate that there is also a price premium for green residential properties. The premium can be found in different continents, is highly significant in a large sample (1.6 million transactions), and holds in regression analysis (Kahn and Kok, 2012).

Fund Level Performance Literature

None of the prior studies focus on the investment returns of the properties. For investment funds as a broader sector, studies of the relation between their financial performance and sustainability level have been done for a long time. The 30 years of research shows mixed results, which is also found in large review studies. Griffin and Mahon (1997) and Margolis and Walsh (2001) conclude that there is no clear direction in the evidence, while Orlitzky, Schmidt, and Rynes (2003) conclude from a meta-analysis of 52 paper that there is a (small) positive relation between the sustainability level and the financial performance of a fund.

To date, only one study has examined the relation between sustainability and the returns of property companies. Eichholtz, Kok, and Yonder (2011) examined 128 real estate investment trusts (REITs) for the relation between the total return performance of real estate securities and the percentage of green assets in their portfolio. They do not find a higher fund return for funds with a greener portfolio, but on a property portfolio level, they do find that portfolios with a 1% higher percentage of green properties have an increased asset return of 0.5% for ENERGY STAR and 2% for LEED properties. Furthermore, the portfolio beta decreases 0.7%–1.0% when there are 1% more ENERGY STAR buildings in the portfolio and the portfolio beta decreases by 6%–7% if the share of LEED buildings in the portfolio increases by 1%.

In conclusion, all studies on property level collectively find a premium in valuation for sustainable real estate, although there is a long running discussion as to whether sustainability leads to a better investment performance. Findings also suggest that sustainable properties in general have a better location and a higher building quality than properties without a high sustainability level. However, some elements of a better location and a higher property quality could still be visible in the financial characteristics of the building, since the quality of a location and building is determined by many elements, and it is very difficult to controls for all these elements.

Data and Methodology

In general, the methods to assess the sustainability level of properties can be divided in two categories: the first category focuses on solely on energy, such as the ENERGY STAR label in the U.S. and the Energy Performance Certificate (EPC) or energy label in Europe. The second category of sustainability assessment methods focuses on aspects such as water, waste, materials, pollution, and management, next to energy usage. LEED and BREEAM are well-known labels in this category.

In the U.S., ENERGY STAR and LEED are most prevalent. In the U.S., almost 32,000 buildings have been rated with the LEED sustainability assessment method as of April 2012 (USGBC, 2012). In Europe, BREEAM is very prevalent in the U.K. and has been used for the sustainability assessments of almost 200,000 buildings. Outside the U.K., only around 300 buildings have been certified with BREEAM (BRE, 2013).

The European Performance on Buildings Directive (EPBD) has led to the proliferation of Energy Performance Certificates in Europe. The 2003 directive is aimed at the reduction of energy consumption of buildings, in view of the reduction of CO_2 emissions and the dependence on fossil fuels. Over time, energy certificates will become mandatory whenever a property is transacted, and will therefore over time become a large source of data.

Since the EPBD obliges European countries to generate Energy Performance Certificates (also called energy labels) for all properties, energy labels are the

Exhibit 2 | Energy Label Categories and the Corresponding Energy Indices

Energy Label	A++	A+	A	B	C	D	E	F	G
Energy Index	0.00–0.51	0.51–0.70	0.71–1.05	1.06–1.15	1.16–1.30	1.31–1.45	1.46–1.60	1.61–1.75	>1.76

most common measure of sustainability in Europe outside the U.K. For instance, almost 2,000,000 energy labels have been issued in the Netherlands. Although most of these labels have been issued for residential dwellings, approximately 10,000 energy labels have been issued for commercial buildings, of which roughly 1,900 are for retail properties (AgentschapNL, 2011). Therefore, the energy label is the most widely available sustainability label currently in use in the Netherlands.

The energy label consists of several categories, ranging from A++ to G in which A++ is very energy efficient and G is very energy inefficient. Every energy label category corresponds with an interval range of Energy Index scores. These interval ranges are not constant, as Exhibit 2 shows; therefore, the relationship between the energy index and energy labels is not linear. Therefore, the Energy Index has been used in the calculations and the energy label categories only to make a distinction between the ''green'' and ''non-green'' categories. The Energy Index score is calculated by a formula that takes several energy efficiency measures of the property into account, such as the thickness of the isolation, the type of material used in the walls, the total surface of the glass, etc. The *higher* the Energy Index, the more energy *in*efficient a property is (Exhibit 2).

For the energy label, the green categories are defined as the A++ to C categories with an Energy Index below 1.30 and the non-green categories are the D to G labels, with an Energy Index >1.30. The U.S. ENERGY STAR label is given to properties that belong to top 25% on energy efficiency and is roughly comparable with properties with an A++ to A label.

We draw data from a dataset of retail properties managed by CBRE Global Investors in the Netherlands for the period 2007–2011. The dataset consists of 128 retail properties, which entails the entire portfolio of retail properties managed by CBRE in the Netherlands. The properties are held in four funds, with a strategy to hold the assets for a long term (greater than five years). Properties that have been acquired, sold or redeveloped in the study period have not been included in this study, as full period information is not available.

As the data sample consists of an existing fund portfolio, all attributes of the properties are available. The properties are diverse in age and type. The oldest property was built in 1820, whereas the youngest was developed in 2007; the study covers retail properties in the main streets of city centers, as well as neighborhood centers and shopping malls. General information of the 128 properties (address, property type, type of center, age, size, number of leases) is drawn from the property characteristics database of CBRE Global Investors. The rents are extracted from the CBRE Global Investors database and are the actual gross rents. In this way, the data are more accurate than the frequently used market rent data, since negotiation results and incentives have been included.

Property values have been derived from valuations made by external national and international appraisers. Every property is valued quarterly by two independent appraisers, who jointly appraise the property, in accordance with the Royal Institute of Chartered Surveyors (RICS) standards.[1] Rental and market values of all properties are as per year-end 2011. A transaction price database providing energy labels is not available.

Total return, income return, operating costs, and vacancy rates for 116 properties are all annualized figures and have been extracted from the Investment Property Databank (IPD) database. IPD uses a consistent method to calculate the performance characteristics for all properties. The returns on 12 properties not in the IPD benchmark have been calculated using the same method.

As the first large investor in the Netherlands, CBRE Global Investors has certified all of its retail properties with an energy label. The energy labels of the properties in the research sample have been matched with their performance characteristics during the study period between 2007 and 2011. Some properties have multiple parts and a separate label for each part has been made. For these properties, a consolidated label has been calculated, based on the sizes of the specific parts of the property. In total, 195 energy labels have been designated to the properties in the research sample and the consolidation of the 195 labels has led to 128 labels at the property level.

Innax and Search are the market leaders in issuing energy labels in the Netherlands and made the energy labels for these properties. Both companies are certified to issue energy labels as independent certifiers, under supervision by the Dutch government.

In establishing the labels, actual information regarding the building structure is used. Data on tenant installations and lighting is standardized, ensuring comparability. Of each labeled property, several attributes are used as controls. The size of each property has been corrected for the amount of space on the several floors of a property, since the rent and value of a property is significantly different on each floor. The control factors per floor are averages. In accordance with various sources regarding the Dutch situation, standard percentages have been applied (see Bolt, 1995, 2003; Mols, 2006; SCN, 2012). The percentages are provided in Exhibit 3.

Information about the number of inhabitants living in the area near the retail property (the catchment area) and the size of the overall center is extracted from the Locatus database. Locatus is a Dutch research firm that has a database of all the retail properties in the Netherlands and contains information about the location, size, tenant, retail type, and the catchment area of each property. The size of the total center is defined as the sum of the sales area of all retail properties in a specific center. The catchment area of a retail property has been calculated by combining the type of center the property lies within and the number of inhabitants with a range of 2, 5 or 10 kilometers, as indicated by Locatus. For properties in

Exhibit 3 | Value Correction Percentages for Retail Space by Floor

Floor	−2	−1	0	1	2	3	5	6
Percentage	10%	25%	100%	30%	15%	10%	10%	10%

Notes: The table provides the correction percentages that have been used to standardize the surface area of each property depending on its structure. The correction factors applied are standard percentages that stem from literature.

large and medium city centers, the number of inhabitants within a range of 10 kilometers is used. For properties in urban district centers and small city centers, the inhabitants within a range of 5 kilometers is used. For neighborhood centers, the number of inhabitants within a range of 2 kilometers is used. To determine whether a retail property falls in a large, medium or small center, the categorization as used by the IPD is followed.

These data are analyzed in two steps. First, to see whether there are statistical differences between "green" properties and "non-green" properties, the groups have been compared using a *t*-test for the normally distributed variables and a Mann-Whitney test for the not-normally distributed variables. Second, the differences between the green and non-green properties have been examined with a multiple OLS regression analysis.

The general formula of the regression analysis is of the following form:

$$\begin{aligned} R_i = {} & \alpha + \beta_1 \, ln\,(EI_{t0}) + \beta_2 \, CENTERTYPE_{t0} \\ & + \beta_3 \, ln\,(CENTERSIZE_{t0}) + \beta_4 \, ln\,(CATCHMENT_{t0}) \\ & + \beta_5 \, ln\,(PROPERTY\ SITE) + \beta_6 \, ln\,(LEASE\ SIZE_{t0}) \\ & + \beta_7 \, ln\,(AGE_{t0}) + \varepsilon. \end{aligned}$$

In which:

R_i = Total annualized period return on property *i*;
α = Constant;
$\beta_1 \ldots \beta_7$ = Regression coefficients;
EI_{t0} = The energy index value of property *i*;
$CENTERTYPE_{t0}$ = The type of center of property *i*;
$CENTERSIZE_{t0}$ = The size of the total center where property *i* is located, in square meters retail space;
$CATCHMENT_{t0}$ = The number of inhabitants in the catchment area of property *i*;
PROPERTY SIZE = The size of the center in square meters;
LEASE SIZE = The average amount of square meters per lease;

AGE = The age of the property in years; and
ε = Error term

The control variables are based on the general retail and land rent theories of Reilly (1931), Christaller (1933), Myrdal (1957), Nelson (1958), and Alonso (1964), combined with empirical evidence on the variables that influence retail sales, rents, and values, such as described in among others in the review article of Mejia and Benjamin (2002). Control variables were tested for normality through a Kolmogorov-Smirnov test. On those variables that were not normally distributed, a natural log transformation was applied. The regression model progressively introduces the control variables. The order of the variables is based on the highest expected influence based on the literature review. Control variables that did not have a significant effect on the performance driver were removed from the model. The data were checked for multicollinearity, heteroscedasticity, dependent errors, non-linear relationships, not normally distributed residuals, and outliers that strongly influence the gradient of the regression line.

Empirical Results

In this section we look at the performance of green and non-green properties and relate these to various explanatory variables. This allows us to verify the extent to which the findings arise from difference in energy labels, or whether they can be attributed to other factors. The differences between the green and non-green properties are shown in Exhibit 4.

We find an insignificant total return difference of green properties of 0.60% versus the total return of non-green properties. The income return difference is highly significant and amounts to 0.52%. Counterintuitively, the rents and values of green properties are *lower* than the rents and values of non-green properties (both significant at the 99% confidence level). Another surprising finding is that green properties have a *higher* vacancy than non-green properties, at a 95% confidence level. For operating costs, there is no significant difference. The characteristics of green and non-green properties also differ. The non-green properties in the portfolio are on average 25 years older than the green properties. Furthermore, the green properties are on average three times larger than the non-green properties and there is also a size difference in the average unit size of green properties, although to a lesser extent. Furthermore, non-green properties are located in larger cities than green properties.

To see whether these differences are interconnected, the partial correlation between the characteristics is calculated. Exhibit 5 presents the results. The results indicate that only the age of the property and the size of the total center have a partial correlation with the Energy Index.

The fact that green properties are younger can be explained due to the evolution in building codes, in which energy efficiency requirements have become more stringent and new materials have been introduced (e.g., for insulation). The fact that non-green properties are more prevalent in larger centers is quite remarkable,

Exhibit 4 | Descriptive Statistics

		N	Mean	Median	Std. Dev.	Sign. Diff.	Standardized *t*
Energy labels							
Energy index	Green	88	1.01	1.02	0.19	Yes[b]	−9.049***
	Non-green	40	1.67	1.57	0.35		
Performance Drivers							
Total return 2007–2011 (%)	Green	68	7.75	7.69	2.05	No[a]	1.348
	Non-green	33	7.15	6.96	1.91		
Income return 2007–2011 (%)	Green	68	6.22	6.37	0.67	Yes[a]	3.750***
	Non-green	31	5.70	5.71	0.57		
Rent per adjusted m^2	Green	87	€303	€226	€201	Yes[b]	−3.369***
	Non-green	39	€430	€380	€237		
Value per adjusted m^2	Green	87	€4,678	€3,397	€3,656	Yes[b]	−3.478***
	Non-green	38	€7,225	€6,145	€5,117		
Vacancy level 2007–2011 (%)	Green	71	1.04	0.00	2.16	Yes[b]	2.121**
	Non-green	32	0.32	0.00	0.76		
Operating costs 2007–2011 (%)	Green	88	10.58	10.21	3.85	No[b]	0.548
	Non-green	40	10.83	9.29	5.38		

Exhibit 4 | (continued)

Descriptive Statistics

		N	Mean	Median	Std. Dev.	Sign. Diff.	Standardized *t*
Control Variables							
Age (years)	Green	88	31	23	29	Yes[b]	−5.116***
	Non-green	40	56	48	30		
Adjusted property size (m²)	Green	88	4,961	2,840	5,892	Yes[b]	4.277***
	Non-green	40	1,592	571	2,041		
Average m² per lease	Green	88	1,141	371	2,008	Yes[b]	2.020**
	Non-green	40	826	275	1,924		
Center size	Green	88	40,850	28,925	48,267	Yes[b]	−3.651***
	Non-green	40	63,922	49,424	55,060		
Catchment area	Green	88	167,821	122,442	185,282	No[b]	0
	Non-green	40	171,770	156,335	190,236		

Notes: This table presents descriptive statistics on the dataset, dividing the results in "Green" and "Non-green" energy labels. The return statistics are five year averages from the base date. Reported values are as per year-end 2011.

[a] Based on a *t*-test.

[b] Mann-Whitney test.

*Significant at the 10% level.

**Significant at the 5% level.

***Significant at the 1% level.

Exhibit 5 | Correlations between the Energy Index and the Control Variables

Correlation to Energy Index	ln (size of the total center)	ln (age)	ln (adjusted property size)	ln (average m^2 per lease)
Zero-order correlation	0.37***	0.44***	(0.50)***	(0.16)
Partial correlation	0.28***	0.18**	(0.13)	(0.02)

Notes:
** Significant at the 5% level.
*** Significant at the 1% level.

since the location is not a component in the Energy Index calculation. This could be caused by that fact that properties in the center of larger cities have a shop front that has more open space, so that more consumers can go in and out, but more energy is needed for heating.

Regression Analysis on Returns

In Exhibit 6, we first look at total return (Panel A). The 0.60% higher total return of green properties was not significant to start with. Within the context of the regression analysis, this relation remains insignificant. The partial correlation between the Energy Index and the total return shifts from −0.08 in the first to +0.09 in the fifth model. The influence of the Energy Index on total return is also very low, with a standardized beta of 0.09 in the last model. The dominance of value fluctuations is apparent from the regressions. Total returns are not explained by the factors used. The adjusted R^2 remains low in all cases, reaching 0.22 in the last model.

The income return (Exhibit 6, Panel B) removes the valuation movements from the equation and leads to a far better model fit. The *t*-test shows that green and non-green properties initially show a significantly different income return (at the 99% level). This is supported by the regression analysis. When in model 4 property size is added as an explanatory variable, this relation disappears. In model 6, where age is added, the relation between the energy index and income return becomes even more insignificant ($P = 0.855$). The partial correlation also decreases from −0.41 in Panel A to +0.01 in model 6. This leads us to conclude that the higher income return is not due to the better energy label in itself, but due to the fact that properties with a green label are located in smaller centers (which is in line with the general retail theories), have a larger size, and are younger.

Regression Analysis on Rents and Values

We now turn to rents and values. Exhibit 7 shows that *non-green* properties had a *higher rent and value* than green properties. This can also be seen in the first

Exhibit 6 | Energy Label Impact on Variation in Total and Income Returns

Regression Model	1	2	3	4	5	6	
Variable Added	Energy Index	Location	Center Size	Catchment Area	Property Size	Age	Standardized Beta
Panel A: Total return							
Constant	7.653***	7.462***	11.105***	7.497***	3.454		
Energy Index	(0.573)	(0.851)	(0.433)	(0.225)	0.643		0.09
Dummy for large centers		3.032***	2.402***	2.097***	1.957***		0.33
ln (Center size)			(0.370)*	(0.569)**	(0.433)**		(0.25)
ln (Catchment area)				0.488**	0.426*		0.22
ln (Adjusted property size)					0.430***		0.35
Partial Correlation							
Energy Index with Total Return	(0.083)	(0.128)	(0.059)	(0.033)	0.094		
Model Fit							
R^2	0.007	0.096	0.126	0.167	0.264		
Adjusted R^2	(0.004)	(0.077)	(0.098)	(0.131)	(0.223)		

Exhibit 6 | (continued)

Energy Label Impact on Variation in Total and Income Returns

Regression Model	1	2	3	4	5	6	
Variable Added	Energy Index	Location	Center Size	Catchment Area	Property Size	Age	Standardized Beta
Panel B: Income return							
Constant	6.223***	6.301***	9.220***	7.328***	6.613***	7.386***	
Energy Index	(0.935)***	(0.806)***	(0.451)**	(0.086)	(0.097)	0.030	0.01
Dummy for large centers		(0.823)***	(0.342)*	(0.388)**	(0.451)***	(0.498)***	(0.24)
ln (Size of the total center)			(0.297)***	(0.247)***	(0.221)***	(0.204)***	(0.35)
ln (Adjusted property size)				0.182***	0.144***	0.101***	(0.24)
ln (Average m^2 per lease)					0.119***	0.120***	0.21
ln (Age)						(0.190)***	(0.21)
Partial Correlation							
Energy Index with Income Return	(0.41)	(0.39)	(0.25)	(0.05)	(0.06)	0.02	
Model Fit							
R^2	0.166	0.319	0.493	0.633	0.667	0.687	
Adj. R^2	0.157	0.305	0.477	0.617	0.648	0.666	
Change in Adj. R^2	0.157	0.148	0.172	0.140	0.031	0.018	

Notes: The table presents results on the regression models, subsequently adding variables in a stepwise regression. For each model we present the effect of the added variable on the coefficient for the energy label as well as the model fit. Panel A provides the results on the total return level, whereas panel B focuses on the income return component. Standardized betas are given for the fifth model. The sample size in Panel A is 96; the sample size in Panel B is 98.

*Significant at the 10% level.

**Significant at the 5% level.

***Significant at the 1% level.

Exhibit 7 | Energy Label Impact on Variation in Rent and Value

Regression Model	1	2	3	4	5	6	Standardized Beta
Variable Added	Energy Index	Location Dummy	Center Size	Catchment Area	Property Size	m^2 / Lease	Model 6
Panel A: Rent: ln(rent per adj. m^2)							
β-values							
Constant	5.517***	5.528***	3.022***	1.309***	2.469***	3.549***	
ln (Energy Index)	0.662***	0.400***	0.004	0.037	(0.140)	(0.125)	(0.06)
Dummy for large centers		0.813***	0.363***	0.176	0.193*	0.277***	0.15
Dummy for peripheral large retail		(0.737)***	−0.750***	(0.964)***	(0.741)***	(0.498)***	(0.24)
ln (Size of the total center)			0.259***	0.166***	0.145***	0.129***	0.26
ln (Catchment area)				0.233***	0.233***	0.206***	0.34
ln (Adjusted property size)					−0.127***	(0.100)***	(0.25)
ln (Average m^2 per lease)						(0.135)***	(0.25)
Partial Correlations							
Energy Index with Value per m^2	0.31	0.24	0.00	0.03	(0.11)	(0.11)	
Model Fit							
R^2	0.10	0.43	0.60	0.68	0.75	0.79	
Adj. R^2	0.09	0.42	0.59	0.67	0.74	0.78	
Change Adj. R^2	0.09	0.33	0.17	0.08	0.07	0.04	

Exhibit 7 | (continued)

Energy Label Impact on Variation in Rent and Value

Regression Model	1	2	3	4	5	6	Standardized Beta
Variable Added	Energy Index	Location Dummy	Center Size	Catchment Area	Property Size	m^2 / Lease	Model 6
Panel B: Value: ln(value per adj. m^2)							
β-values							
Constant	8.191***	8.193***	5.429***	3.501***	4.886***	5.986***	
ln (Energy Index)	0.804***	0.495**	0.062	0.101	(0.110)	(0.094)	(0.04)
Dummy for large centers		1.000***	0.502***	0.288**	0.298**	0.381***	0.18
Dummy for peripheral large retail		(0.812)***	(0.827)***	(1.069)***	(0.801)***	(0.552)***	(0.23)
ln (Size of the total center)			0.286***	0.183***	0.146***	0.139****	0.25
ln (Catchment area)				0.261***	0.266***	0.239***	0.34
ln (Adjusted property size)					(0.156)***	(0.130)***	(0.28)
ln (Average m^2 per lease)						(0.137)***	(0.22)
Partial Correlations							
Energy Index with Rent per m^2	0.33	0.26	0.04	0.07	−0.08	(0.07)	
Model Fit							
R^2	0.11	0.46	0.61	0.69	0.77	0.80	
Adj. R^2	0.10	0.45	0.60	0.68	0.76	0.79	
Change Adj. R^2	0.10	0.35	0.16	0.08	0.08	0.03	

Notes: In the table we provide the results of the regression analyses on Rent (Panel A) and Value (Panel B), subsequently adding variables. For each model we present the effect of the added variable in a stepwise regression on the coefficient for the energy label as well as the model fit. Standardized betas are given for the sixth model. The sample size in Panel A is 125; the sample size in Panel B is 124.

*Significant at the 10% level.

**Significant at the 5% level.

***Significant at the 1% level.

model of the rent and value regression analyses. This significant relation disappears completely when in the third model the size of the total center is added. The partial correlation between the Energy Index and the rent and value even changes signs when the catchment area, property size, and size of the unit are added.

The regression models help us to explain the differences in rent and value to a large extent. Thus, we conclude that the energy label as such does not affect the rent and value in this portfolio of retail properties. The difference is caused by the fact that the non-green properties are located in larger centers, have a larger catchment area, and a smaller unit and property size than green properties.

The findings that properties in a larger center, with a larger catchment area, have higher rents (and values) are in line with the general retail theories of Reilly (1931), Christaller (1933), and Alonso (1964) and consistent with the literature (e.g., Hardin and Wolverton, 2000, 2001; Mejia and Benjamin, 2002). The finding that smaller properties have higher rents is also consistent with earlier reported results, such as Eppli and Benjamin (1994).

Regression Analysis on Operating Costs and Vacancies

In contradiction with the evidence in the literature for office properties, the Mann-Whitney test shows that the Energy Index in this sample of retail properties did not have any significant influence on the operating costs. Also in the regression analysis in Exhibit 8, this relation is insignificant. With a partial correlation of 0.12 in the last model, the relationship between the Energy Index and the operating costs is very weak. The operating costs for retail properties are influenced by the size of the units and the property, if a shopping center is covered, as well as the size of the city. The vacancy level influences operating costs highly: if the vacancy rate increases by 1%, the operating costs increase by 0.6%.

The Mann-Whitney test shows that green properties in the sample have a significantly higher vacancy rate than non-green properties. This effect can also be seen in the initial model of the regression analysis. The relation disappears completely in subsequent models, after the introduction of control variables. The β-value between the energy label and the vacancy level is also highly insignificant in the third panel. The partial correlation is already weak in the first model and stays weak.

The only variables that have a significant effect on the vacancy rate are the property size and the average unit size. These results show that larger properties have a higher vacancy rate and that properties with large units have lower vacancy rates. This can be explained since the larger properties with smaller retail units are mainly shopping centers, which have more vacancy on the higher floors of the shopping center. The large properties are mostly supermarkets and peripheral retail properties, which have relatively low vacancy rates in this sample. Since the average vacancy in the sample is only 0.82% and 66 of the 103 properties did not have any vacancy in the sample period between 2007 and 2011, the distribution of the vacancy has a high kurtosis. The residuals are not normally

Exhibit 8 | Regression Analysis of Operating Costs and Vacancy

Regression Model	1	2	3	4	5	6	Standardized Beta
Variable Added	Energy Index	Location Dummy	Property Size	m^2 / Lease	Retail Type	Vacancy	Model 6
Panel A: Operating costs							
β-values							
Constant	10.511***	10.345***	9.402**	16.851***	15.415***	14.797***	
Energy Index	1.075	0.699	0.979	0.751	1.523	1.591	0.11
Dummy for large city centers		1.813	1.839	2.284**	2.565**	2.786**	0.22
ln (Adjusted property size)			0.122	0.810***	0.988***	0.789***	0.29
ln (Average m^2 per lease)				(2.040)***	(2.089)***	(1.841)***	(0.51)
Dummy for standard units—covered					3.327**	3.732***	0.23
Average vacancy 2007–2011						0.579***	0.25
Change (%) in rent 2007–2011							
Energy Index with Operating Costs	0.07	0.05	0.06	0.05	0.11	0.12	
Model Fit							
R^2	0.05	0.02	0.03	0.28	0.32	0.37	
Adj. R^2	(0.01)	0.00	(0.00)	0.25	0.28	0.33	
Change Adj. R^2	(0.01)	0.01	(0.01)	0.25	0.03	0.05	

Exhibit 8 | (continued)

Regression Analysis of Operating Costs and Vacancy

Regression Model	1	2	3	Standardized Beta
Variable Added	Energy Index	Property Size	m²/lease	Model 3
Panel B: Vacancy (2007–2011)				
β-values				
Constant	0.918**	(0.948)	0.642	
Energy Index	(0.521)	(0.036)	(0.020)	(0.00)
ln (Adjusted property size)		0.244*	0.395***	0.33
ln (Average m² per lease)			(0.440)***	(0.28)
Partial Correlation				
Energy Index with Vacancy 2007–2011	(0.083)	(0.005)	(0.003	
Model Fit				
R^2	0.01	0.04	0.11	
Adj. R^2	(0.00)	0.02	0.08	
Change Adj. R^2	(0.00)	0.03	0.06	

Notes: In this table, we provide the results of the regression analyses on Operating Costs (Panel A) and Vacancies (Panel B), subsequently adding variables. For each model we present the effect of the added variable on the coefficient for the energy label as well as the model fit. Standardized betas are given for the sixth model. The sample size in Panel A is 101; the sample size in Panel B is 102.

*Significant at the 10% level.

**Significant at the 5% level.

***Significant at the 1% level.

distributed and therefore not in line with the general assumptions of a linear regression analysis. This is in line with findings that the vacancy rate of retail properties is highly dependent on the exact location within a retail area (Myrdal, 1957) and the number of people passing by (Locatus, 2012), which has not been taken into account due to data availability issues.

Conclusion

The literature on the impact of sustainability on investor returns on real estate has largely focused on the office sector and on the U.S. As sector characteristics and the combination of geography and market structure (e.g., age of the properties) are likely to significantly influence the findings, we use a dataset focusing on the retail sector in the Netherlands. Using a unique dataset, we show that green properties have a significantly higher direct income return. Counterintuitively, non-green properties have significantly higher rents and values. However, when this is explored further in a regression analysis, we show that the significant differences are not caused by the energy labels, but by other factors influencing the performance of a retail property. The total return, vacancy rate, and operating costs also have no significant relation to the sustainability level of a property. Therefore, we do not find evidence of a sustainability premium for sustainable retail properties.

Since the Energy Index is significantly positively related to the age and size of the total retail area, non-green properties are generally older and more prevalent in the larger centers. In the Netherlands, these larger centers consist mainly of historical city-center high streets, which are highly valued by consumers and also have higher rents, values, and lower income returns than properties in other locations. Green properties are mostly modern shopping centers just off the high streets and neighborhood centers, with lower rent, values, and higher vacancy levels and returns. In addition, non-green properties are smaller and have smaller retail units than green properties, enhancing the rent and values. Therefore, the significant difference in rent, value, and income return of green and non-green properties is not caused by the energy label, but by the size and catchment area of the (city) center, the location, and the size of the property. The age of a retail property has not been found to have a significant influence on the rent and value, which can be explained by the fact that location has more impact on rent and value than age.

The main conclusion of this study contradicts the conclusions of studies on the office and residential sectors, which all find higher rents and values for sustainable properties. An explanation might be that sustainability has been incorporated more within the office and residential sectors than in the retail sector. Also, the sensitivity of value and income of retail properties to the traditional location factors seem to be more important than for offices.

These data shows that it is of pivotal importance to understand and examine the data. The more detailed the study is and the more refined the regression analysis method is, the smaller the difference between the green and non-green properties becomes. This study has a very focused and high quality data sample with a small measurement error. This may also be the reason why the relation between the performance and energy label has been assigned to other factors.

The finding of this study that the sustainability level has no significant influence on the return is in line with other studies on the returns of sustainable funds, as shown by Eichholtz, Kok, and Yonder (2012). Larger studies on the relation between sustainability or corporate social responsibility (CSR) and the returns of investment funds indicate mixed results. Many review studies also find no significant relation and Orlitzky, Schmidt, and Rynes, (2003) finds in their large meta-analysis only a small positive correlation between sustainability and financial performance.

Furthermore, the rent (and value) of a retail unit is mainly determined on the potential sales that a retailer can realize in a specific retail unit and at a specific location. Since the rent is only approximately 10% of the sales and the energy costs only 1% of the sales, the effect of lower energy costs on the total profit is limited. A retailer is probably more eager to invest in better lighting (which might use even more energy), so that the products are lit better, look more attractive, and sell better. When a higher profit can be made out of more sales, a retailer will accept higher energy costs.

The result of this study that retail properties have higher rents, higher values, and lower vacancy levels in larger retail areas is fully in line with the general retail theories of Reilly (1931), Christaller (1933), Myrdal (1957), Nelson (1958), and Alonso (1964), and with the published articles.

Endnote

[1] The RICS Valuation Standards can be found at www.rics.org/uk/knowledge/red-book/global-red-book-valuation-standards/.

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