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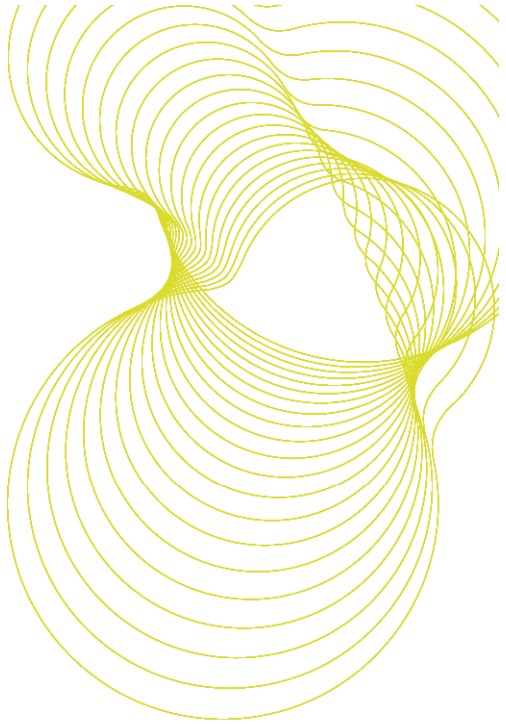

# Green Value

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# Summary

- US Study
  - Methodology
  - Results
- UK study

- Linking environmental to financial performance

# Doing Well by Doing Good?

- **An analysis of the financial performance of green office buildings in the USA**
- 30 March 2009
- Piet Eichholtz and Nils Kok of the University of Maastricht and John Quigley of the University of California, Berkeley

# US study: economic effect of “green” label

## *U.S. property sector offers laboratory*

1. Match

   LEED and Energystar rated offices

   to

   Costar database

2. Define nearby clusters containing a “green” building and one or more non-green office buildings

3. Investigate rents and market values for these paired samples

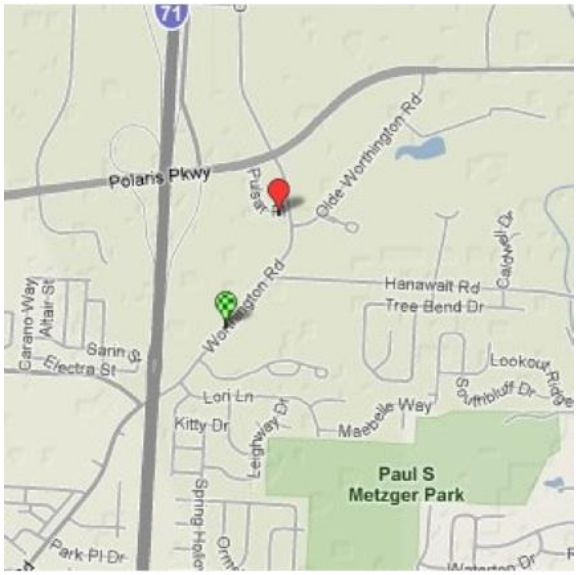
# Clusters of green and control buildings

*Minimum of one control building per cluster*

## Chicago, IL


## Houston, TX


## Columbus, OH



# Descriptives: green sample vs. control sample

*Green buildings are larger, younger and…less risky*

| Sample Size | | Green Buildings 694 | | Control Sample 7,488 | |
|---|---|---|---|---|---|
| | | *mean* | *st.dev.* | *mean* | *st.dev.* |
| Rent | (dollars/sq. ft.) | 29.80 | (13.05) | 28.16 | (15.77) |
| Net Rent Contract | (percent) | 5.76 | (23.32) | 3.15 | (17.47) |
| Size | (thousands sq. ft.) | 324.08 | (288.92) | 218.69 | (293.69) |
| Occupancy Rate | (percent) | 88.99 | (13.19) | 81.35 | (22.74) |
| Stories | (number) | 15.31 | (13.26) | 13.07 | (12.10) |
| Age | (years) | 23.75 | (15.75) | 49.44 | (32.50) |
| Building Class | A | 79.39 | (40.48) | 34.94 | (47.68) |
| | B | 19.45 | (39.61) | 48.78 | (49.99) |
| | C | 1.15 | (10.68) | 16.28 | (36.92) |
| On-Site Amenities | (percent) | 71.76 | (45.05) | 49.22 | (50.00) |
| Renovated Bldg. | (percent) | 21.04 | (40.79) | 38.50 | (48.66) |

# Methodology

## *Formulation generalizes the treatment of spatial variation*

- Methodology: standard valuation framework

(1) $$\log R_{in} = a + b_i X_i + \sum_{n=1}^{N} g_n c_n + d g_i + e_{in}$$

(2) $$\log R_{in} = a + b_i X_i + \sum_{n=1}^{N} g_n c_n + \sum_{n=1}^{N} d_n [c_n \cdot g_i] + e_{in}$$

R = asking rent, effective rent or transaction price (per sq.ft.)
X = vector of hedonic characteristics (e.g. age, size, quality, etc.)
g = dummy variable if building *i* has green label
c = dummy variable for location *n, alternatively:*

- *Location dummies for submarkets (e.g. Wheaton and Torto, 1994)*
- *Specific MSA or city (e.g. Webb and Fisher, 1996)*
- *GIS to specify distance to CBD, airport, etc. (Öven and Pekdemir, 2006)*

# Results (I): asking rent and green ratings

## *Green premium ranges from 2.8% – 3.5%*

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| Green Rating (1 = yes) | 0.035 | | 0.033 | 0.028 |
| | [0.009]*** | | [0.009]*** | [0.009]*** |
| Energy Star (1 = yes) | | 0.033 | | |
| | | [0.009]*** | | |
| LEED (1 = yes) | | 0.052 | | |
| | | [0.036] | | |
| Building Size (millions of sq. ft.) | 0.113 | 0.113 | 0.102 | 0.111 |
| | [0.019]*** | [0.019]*** | [0.019]*** | [0.021]*** |
| Fraction Occupied | 0.020 | 0.020 | 0.020 | 0.011 |
| | [0.016] | [0.016] | [0.016] | [0.016] |
| Building Class: | | | | |
| Class A (1 = yes) | 0.231 | 0.231 | 0.192 | 0.173 |
| | [0.012]*** | [0.012]*** | [0.014]*** | [0.015]*** |
| Class B (1 = yes) | 0.101 | 0.101 | 0.092 | 0.083 |
| | [0.011]*** | [0.011]*** | [0.011]*** | [0.011]*** |
| Net Contract (1 = yes) | -0.047 | -0.047 | -0.050 | -0.051 |
| | [0.013]*** | [0.013]*** | [0.013]*** | [0.013]*** |
| Employment Growth (fraction) | 0.608 | 0.608 | 0.613 | 0.609 |
| | [0.171]*** | [0.171]*** | [0.187]*** | [0.189]*** |
| Age: | | | | |
| < 10 years | | | 0.118 | 0.131 |
| | | | [0.016]*** | [0.017]*** |
| 10 – 20 years | | | 0.079 | 0.085 |
| | | | [0.014]*** | [0.014]*** |
| 20 – 30 years | | | 0.047 | 0.049 |
| | | | [0.013]*** | [0.013]*** |
| 30 – 40 years | | | 0.043 | 0.044 |

# Results (II): effective rent as dependent variable

*Green premium ranges from 6.4% – 10%*

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| Green Rating (1 = yes) | 0.100 | | 0.082 | 0.064 |
| | [0.016]*** | | [0.024]*** | [0.023]*** |
| Energy Star (1 = yes) | | 0.100 | | |
| | | [0.016]*** | | |
| LEED (1 = yes) | | 0.094 | | |
| | | [0.052]* | | |
| Building Size (millions of sq. ft.) | 0.261 | 0.261 | 0.235 | 0.189 |
| | [0.028]*** | [0.028]*** | [0.027]*** | [0.027]*** |
| Building Class: | | | | |
| Class A (1 = yes) | 0.408 | 0.408 | 0.340 | 0.229 |
| | [0.028]*** | [0.028]*** | [0.029]*** | [0.030]*** |
| Class B (1 = yes) | 0.226 | 0.226 | 0.203 | 0.152 |
| | [0.027]*** | [0.027]*** | [0.027]*** | [0.026]*** |
| Net Contract (1 = yes) | 0.015 | 0.014 | 0.010 | 0.009 |
| | [0.024] | [0.024] | [0.024] | [0.024] |
| Employment Growth (fraction) | 0.765 | 0.756 | 0.773 | 0.682 |
| | [0.312]** | [0.322]** | [0.293]** | [0.308]** |
| Age: | | | | |
| < 10 years | | | 0.134 | 0.177 |
| | | | [0.045]*** | [0.044]*** |
| 10 – 20 years | | | 0.141 | 0.146 |
| | | | [0.025]*** | [0.025]*** |
| 20 – 30 years | | | 0.113 | 0.112 |
| | | | [0.023]*** | [0.023]*** |
| 30 – 40 years | | | 0.097 | 0.090 |
| | | | [0.018]*** | [0.018]*** |
| Renovated (1 = yes) | | | 0.019 | 0.016 |
| | | | [0.018] | [0.018] |
| Stories: | | | | |
| Intermediate (1 = yes) | | | | 0.145 |
| | | | | [0.021]*** |

# So…what does it mean for investors?

*Dependent variable: sales price/sq.ft., 2004 – 2007 period*

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| Green Rating (1 = yes) | 0.168 | | 0.158 | 0.165 |
| | [0.051]*** | | [0.052]*** | [0.052]*** |
| Energy Star (1 = yes) | | 0.191 | | |
| | | [0.052]*** | | |
| LEED (1 = yes) | | 0.113 | | |
| | | [0.172] | | |
| Building Size (millions of sq. ft.) | 0.171 | 0.167 | 0.104 | 0.200 |
| | [0.090]* | [0.089]* | [0.089] | [0.108]* |
| Building Class: | | | | |
| Class A (1 = yes) | 0.164 | 0.161 | 0.032 | 0.104 |
| | [0.066]** | [0.066]** | [0.078] | [0.084] |
| Class B (1 = yes) | -0.188 | -0.187 | -0.216 | -0.184 |
| | [0.051]*** | [0.051]*** | [0.057]*** | [0.058]*** |
| Employment Growth (fraction) | -0.005 | -0.005 | -0.004 | -0.006 |
| | [0.004] | [0.004] | [0.005] | [0.005] |
| Age: | | | | |
| < 10 years | | | 0.201 | 0.207 |
| | | | [0.149] | [0.147] |
| 10 – 20 years | | | 0.196 | 0.224 |
| | | | [0.099]** | [0.100]** |
| 20 – 30 years | | | 0.248 | 0.276 |
| | | | [0.070]*** | [0.070]*** |
| 30 – 40 years | | | 0.226 | 0.251 |
| | | | [0.073]*** | [0.075]*** |
| Renovated (1 = yes) | | | -0.096 | -0.087 |
| | | | [0.046]** | [0.046]* |
| Stories: | | | | |
| High (1 = yes) | | | | -0.185 |
| | | | | [0.092]** |

# Conclusions and implications (I)

*Eco-investment real estate sector is not only 'doing good'*

- *Ceteris Paribus,* Green Buildings
  1. Have Higher Rents by 2-3%
  2. Have Higher Effective Rents by 6-9%
  3. Have Higher Selling Prices by 16-17%

- The average non-green building in the rental sample would be worth $5.1 M more if it were converted to green.

- The average non-green building sold in 2004-2007 would have been worth $5.9 M more if it had been converted to green.

# Conclusions and implications (II)

*Energy efficiency is priced in rents and values*

- Among green buildings, a 10 percent more efficient building rents for 3 percent more.
- One dollar of energy savings yields $18 of increased value – a cap rate of 5.5%.

**The increment to “green” building is not merely a labeling effect.**

# Current Progress of UK research

- Same approach being used
- Same academic team
- Additional level of analysis
- Two masters theses now subject to review
- Recommendations for further research

# Organisations involved

- Berkeley
- BRE Global
- IPD
- Maastricht University
- RICS

# Progress of UK research

- First research paper
  - 1400 office buildings with BREEAM ratings
  - Just over 100 with transaction data in IPD's database from 2007
  - <100 buildings included in final list for comparison

# Progress of UK research

- Second Research Paper
  - 1100 BREEAM rated buildings
  - 139 on RCA database (sales)
  - 214 buildings on CoStar database
  - Investigated impact different ratings and scores in each section

# Issues to be addressed from first paper

- Lack of industry provided data measures on building quality and financial information
- Limited number of assessed buildings (1400 office buildings)
- Piet Eichholtz essay http://www.breeam.org/page.jsp?id=224

# Ongoing work

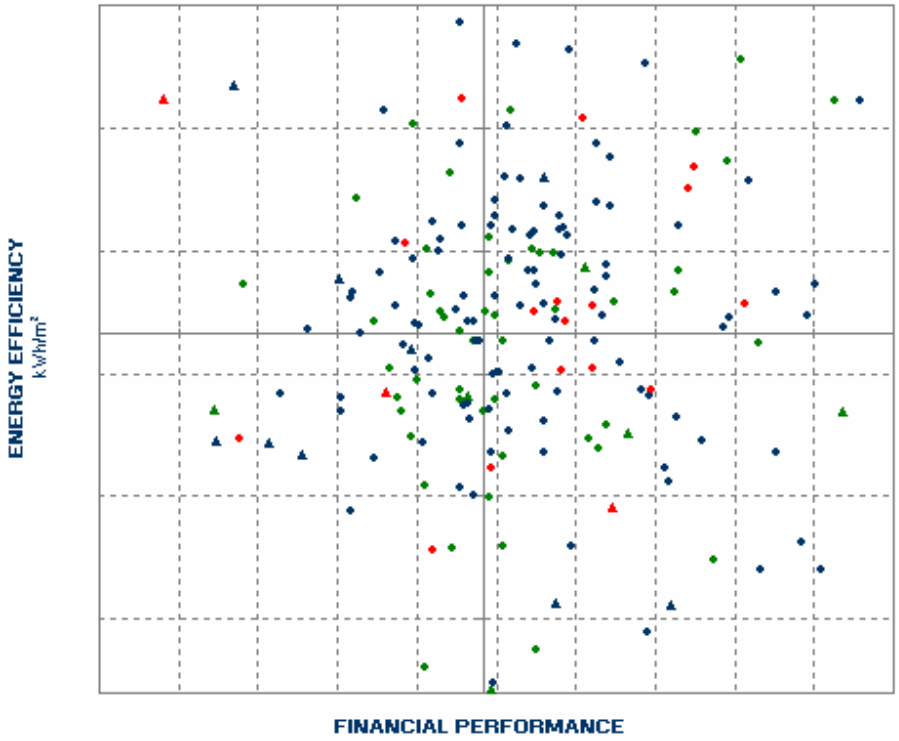
- Thorough academic review of second paper
- Gather underlying information on quality
- Incorporating additional control factors

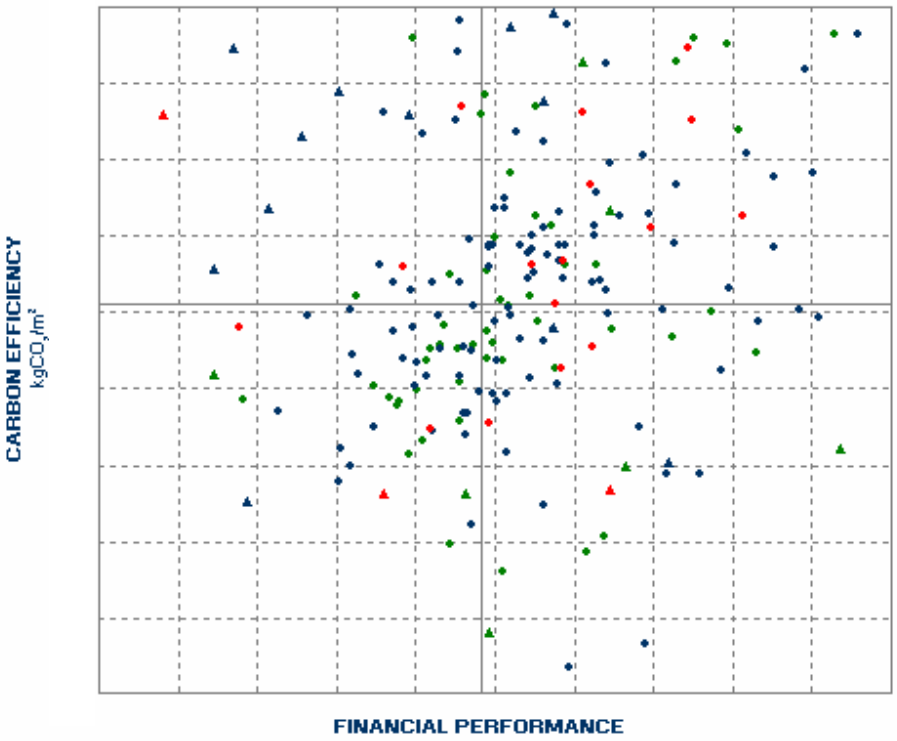
- BRE is introducing other products
  - to facilitate data gathering and future research
  - Introduce an international standard to be able to compare across borders

# Recommendations for Future Research

- Common Office Quality Indicator
- Demonstrating benefits to occupiers
  - Cost savings – energy, maintenance
  - Impact on productivity
- Demonstrating other benefits to investors
  - Investment risk management
- Link between environmental and financial performance

# Environmental Performance vs Financial Performance



# Pathways to a Low-Carbon Portfolio