



A Theory of Investment for Energy-Efficient Technologies

Part III

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Research Question

How do neighborhood characteristics relate to the number of certified energy-efficient commercial buildings?

Last Week:

- The Energy-Efficiency Gap
- Future Energy Savings v. Upfront Costs
- Still Focusing on Energy-Using Durables

Eichholtz, Piet, Nils Kok, and John M Quigley, “Doing well by doing good? Green office buildings,” *American Economic Review*, 2010, 100 (5), 2492–2509.

- Similar ideas, but much closer to my research question
- An extra incentive problem with buildings

Overview

Purpose Will firms pay more for green buildings? For what reasons?

Model Use a standard hedonic pricing model for office building rents

Method Identify green buildings and nearby non-green buildings, and estimate the model to find the predicted difference in rents

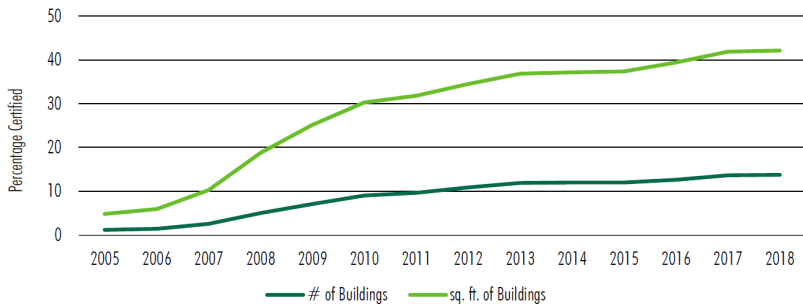
Results 3% premium on the rent per sq. ft.

Background

Adoption

The Scope of Commercial Green Buildings

FIGURE 1: CERTIFIED GREEN OFFICE SPACE – 30 LARGEST MARKETS (HOLTERMANS AND KOK, 2019)



Method



Data and Econometric Model

- Energy Star Program & LEED (Leadership in Energy and Environmental Design)
 - ▶ Two Largest Green Building Rating Programs
 - ▶ 694 Buildings
- CoStar
 - ▶ Commercial Real Estate Service
 - ▶ 7,411 Nearby Buildings

FIGURE 2: EXAMPLE CLUSTER IN CHICAGO



(Eichholtz et al., 2011)

Econometric Model

$$\log R_{in} = \alpha + \beta_i \mathbf{X}_i + \sum_{n=1}^N \gamma_n c_n + \delta g_i + \varepsilon_{in}$$

- i : Office Building
- n : Office Building Cluster
- R : Rent / Sq. ft. of Building i in Cluster n
- \mathbf{X}_i : Column Vector of Building Characteristics for i
- c_n : Dummy Variable for Cluster n
- g_i : Green Dummy Variable

Results



TABLE 1: REGRESSION RESULTS (EICHHOLTZ ET AL., 2010)

<i>Dependent Variable: Log Rent /sq.ft.</i>				
	(1)	(2)	(3)	(4)
Green rating (Yes = 1)	0.035 (0.009)		0.033 (0.009)	0.028 (0.009)
Energy Star (Yes = 1)		0.033 (0.009)		
LEED (Yes = 1)		0.052 (0.036)		
Building Size (millions of sq.ft.)	0.113 (0.019)	0.113 (0.019)	0.102 (0.019)	0.111 (0.021)
Age < 10 years (Yes = 1)			0.118 (0.016)	0.131 (0.017)
Amenities (Yes = 1)				0.047 (0.007)
Sample Size	8,105	8,105	8,105	8,105
R ²	0.72	0.72	0.72	0.72
Adj. R ²	0.69	0.69	0.69	0.69

Standard errors in parentheses

Implications

- Yes, firms will pay more for Green Buildings:
 - ▶ Rents 3% higher rents than control buildings
 - ▶ Sale price premium of 16% – but with low explanatory power ($R^2 = 0.45$)
- Green buildings earn proportionately smaller premiums at prime locations
- Limited but suggestive evidence of a “social premium”

Contribution to Project

- First paper we've seen about green buildings
- Certification premium solves the incentive problem
 - ▶ Without, why build green?
 - ▶ Importance of certification
- Green design as a rent determinant

Wiley, Jonathan A, Justin D Benefield, and Ken H Johnson,
“Green design and the market for commercial office space,” *The Journal of Real Estate Finance and Economics*, 2010, 41 (2),
228–243.

- Green design and *area characteristics* as rent determinants
- Their interaction will change the decision to build green buildings
- Preview of my own model

References

- Eichholtz, Piet MA, Nils Kok, and John M Quigley**, “Who rents green? Ecological responsiveness and corporate real estate,” *W09-4. Berkeley*, 2011.
- Eichholtz, Piet, Nils Kok, and John M Quigley**, “Doing well by doing good? Green office buildings,” *American Economic Review*, 2010, *100* (5), 2492–2509.
- Holtermans, Rogier and Nils Kok**, “US Green Building Adoption Index 2019,” *CBRE*, 2019.
- Wiley, Jonathan A, Justin D Benefield, and Ken H Johnson**, “Green design and the market for commercial office space,” *The Journal of Real Estate Finance and Economics*, 2010, *41* (2), 228–243.