



# Urban and real estate economics

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# Urban and real estate economics

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## Week 2

The effect of real estate attributes on  
the value of real estates

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# 1. Revision of the hedonic principle

# Comparative method

- Hedonic principle: the real estate is a total of a number of different characteristics.
- We decompose the value of the real estate into characteristics ("value correction factors") and assess them separately.
- Characteristics: technical features and state of real estates, legal status, quality of neighbourhood.

# Meaning of coefficients

Partial effect:

- With other coefficients given, what effect does a one-unit increase have?
- How can the coefficient of rooms be interpreted in case both floor area and the number of rooms are included in the regression?

# Twofold usage

- $R^2$  fitting indicator is important: can we determine the real estate price?
- In many cases it is less important than the coefficient significance levels that show the relation intensity.
- The indicator might not explain the variable completely but the relation is strong.



## 2. The role of green rating in the value of offices

# Green offices

- Can more rent be charged for certified green buildings?
- Piet Eichholtz, Nils Kok, John Quigley: *Doing Well by Doing Good? An Analysis of the Financial Performance of Green Buildings in the USA.*

[http://www.rics.org/site/scripts/download\\_info.aspx?fileID=5763&categoryID=523](http://www.rics.org/site/scripts/download_info.aspx?fileID=5763&categoryID=523)

# What difficulties emerge while measuring the premium?

What factors can distort the deviation of averages?

In which direction is the coefficient distorted if

- green offices are newer?
- green offices are situated in different regions?

Geographic distortion is filtered out by including buildings of similar regions in the sample.

(1a)

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

(1b)

$$\log R_{in} = \alpha + \beta_i X_i + \sum_{n=1}^N \gamma_n c_n + \sum_{n=1}^N \delta_n [c_n \cdot g_i] + \varepsilon_n$$

$X_i$ : hedonic characteristics of building  $i$  (control variables)

$c_n$ : dummy variable with a value of 1 if building  $i$  is located in cluster  $n$  and zero otherwise

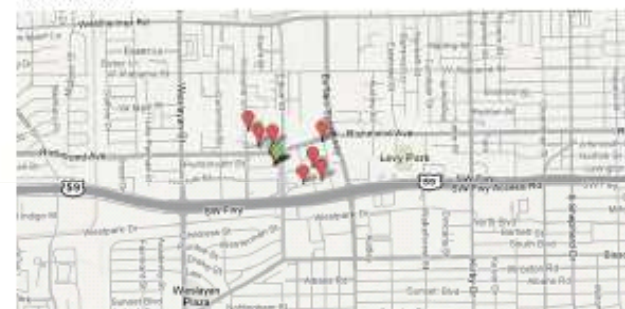
$g_i$ : dummy variable with a value of 1 if building  $i$  is green-rated

Figure 2 - Clusters of Green and Control Buildings

A. Chicago, IL



B. Houston, TX



C. Columbus, OH



The estimated rent premium for a green building is 3.5 percent.

Control variables:

- building class
- building age
- has the building been renovated?

**Table 2 Regression Results. Commercial Office Rents and Green Ratings**  
(dependent variable: logarithm of rent per square foot)

	(1)	(2)	(3)	(4)	(5)
Green Rating (1 = yes)	0.035 [0.009]***		0.033 [0.009]***	0.028 [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 [0.019]***	0.113 [0.019]***	0.102 [0.019]***	0.111 [0.021]***	0.111 [0.023]***
Fraction Occupied	0.020 [0.016]	0.020 [0.016]	0.020 [0.016]	0.011 [0.016]	0.004 [0.017]
<b>Building Class:</b>					
Class A (1 = yes)	0.231 [0.012]***	0.231 [0.012]***	0.192 [0.014]***	0.173 [0.015]***	0.173 [0.017]***
Class B (1 = yes)	0.101 [0.011]***	0.101 [0.011]***	0.092 [0.011]***	0.083 [0.011]***	0.082 [0.012]***
Net Contract (1 = yes)	-0.047 [0.013]***	-0.047 [0.013]***	-0.050 [0.013]***	-0.051 [0.013]***	-0.057 [0.014]***
Employment Growth (fraction)	0.608 [0.171]***	0.608 [0.171]***	0.613 [0.187]***	0.609 [0.189]***	0.874 [0.054]***
<b>Age:</b>					
< 10 years			0.118 [0.016]***	0.131 [0.017]***	0.132 [0.019]***
10 – 20 years			0.079 [0.014]***	0.085 [0.014]***	0.083 [0.015]***
20 – 30 years			0.047 [0.013]***	0.049 [0.013]***	0.049 [0.014]***
30 – 40 years			0.043 [0.011]***	0.044 [0.011]***	0.044 [0.012]***
Renovated (1 = yes)			-0.008 [0.009]	-0.008 [0.009]	-0.010 [0.010]
<b>Stories:</b>					
Intermediate (1 = yes)				0.009 [0.009]	0.008 [0.010]
High (1 = yes)				-0.029 [0.014]**	-0.032 [0.016]**
Amenities (1 = yes)				0.047 [0.007]***	0.054 [0.008]***
Constant	2.741 [0.113]***	2.742 [0.114]***	2.718 [0.126]***	2.725 [0.127]***	2.564 [0.022]***
Sample Size	8182	8182	8182	8182	8182
R <sup>2</sup>	0.71	0.71	0.72	0.72	0.74
Adj R <sup>2</sup>	0.69	0.69	0.69	0.69	0.68

Notes:

Each regression also includes 694 dummy variables, one for each locational cluster. Regression (5) also includes an additional 694 dummy variables, one for each green building in the sample.

Standard errors are in brackets. Significance at the 0.10, 0.05, and 0.01 levels are indicated by \*, \*\*, and \*\*\*, respectively.

# What results in the premium of green offices?

- Energy utilization might be more efficient.
- The employees of such buildings might work more productively.
- Companies might move into a green office in consideration of CSR.

# What results in the premium of green offices?

Three experts compiled a study (see link below) in which they explain where the premium arises from.

Piet Eichholtz, Nils Kok, John Quigley: Why Do Companies Rent Green? Real Property and Corporate Social Responsibility.

[http://www.rics.org/site/scripts/download\\_info.aspx?fileID=5071&categoryID=523](http://www.rics.org/site/scripts/download_info.aspx?fileID=5071&categoryID=523)

They concluded that the savings through lower overhead costs is a good explanation for the variation.

# 3. Calculation of house price index



# Timeliness of data

- The time of house price observation is also an attribute.
- How can its coefficient be interpreted?
- What effect does the timeliness have on house prices: house price index.

# House price indices

- Only the price of traded dwellings is shown.
- The change in average prices might display the aggregated price change distorted as dwellings with various attributes are traded:
  - different size – smaller or larger,
  - different quality – better quality: newly built,
  - no transactions at all.

# No identical dwellings are traded all the time

Dwelling stock:

Panel	Custom-designed
	20,000 USD
10,000 USD	20,000 USD
	20,000 USD
10,000 USD	20,000 USD

# Year 1 and Year 2

Panel	Custom-designed
	20,000 USD
10,000 USD	20,000 USD
	20,000 USD
10,000 USD	20,000 USD

Panel	Custom-designed
	20,000 USD
10,000 USD	20,000 USD
	20,000 USD
10,000 USD	20,000 USD

# House price index

- In case of “naive” calculations where merely the means are considered:

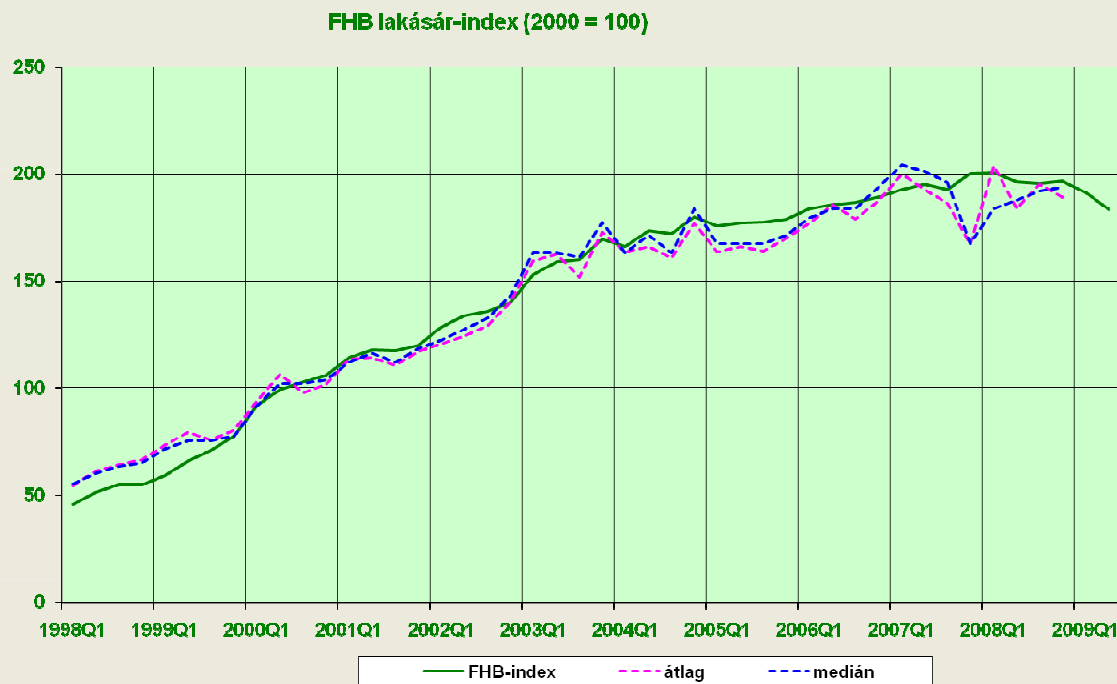
$$[(2 \cdot 10 + 4 \cdot 20) / 6] / [(2 \cdot 10 + 1 \cdot 20) / 3] = 1.25, \text{ i.e. a 25-percent price increase is measured.}$$

- In case the composition effect is considered and the weights of panel and custom-designed dwellings are kept fixed :

$$[(\mathbf{2/6} \cdot 10 + \mathbf{4/6} \cdot 20)] / [(\mathbf{2/6} \cdot 10 + \mathbf{4/6} \cdot 20)] = 1, \text{ i.e. no price increase is measured.}$$

# Comparison of methods

The index, which is based on hedonic methodology and designed to be able to handle composition effect, measures short-run changes more accurately.



# Notable house price indices

- **USA: Case – Shiller**

<http://www.standardandpoors.com/indices/sp-case-shiller-home-price-indices/en/us/?indexId=spusa-cashpidff--p-us---->

- **UK: Nationwide**

<http://www.nationwide.co.uk/hpi/>

- **UK: Halifax**

[http://www.lloydsbankinggroup.com/media1/economic\\_insight/halifax\\_house\\_price\\_index\\_page.asp](http://www.lloydsbankinggroup.com/media1/economic_insight/halifax_house_price_index_page.asp)

- **Hungary: FHB House Price Index**

[www.fhbindex.hu](http://www.fhbindex.hu)

# Curriculum

- Denise DiPasquale–William C. Wheaton [1996]: *Urban Economics and Real Estate Markets*. Chapter 4.
- Piet Eichholtz, Nils Kok, John Quigley: *Doing Well by Doing Good? An Analysis of the Financial Performance of Green Buildings in the USA. RICS Research Report*. March 2009.



# Further readings

- Piet Eichholtz, Nils Kok, John Quigley [2009]: Why Do Companies Rent Green? Real Property and Corporate Social Responsibility. *RICS Research Report*. November 2009.
- Meese, Richard A. . Nancy E. Wallace [1997]: The Construction of Residential Housing Price Indices: A Comparison of Repeat-Sales, Hedonic-Regression and Hybrid Approaches. *Journal of Real Estate Finance and Economics* 14, pp. 51-73.
- *FHB Index Methodological Description*. 2009.