

# The Swiss Housing Markt Rewards more than Energy Efficiency

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## Main research questions and methodology

- ▶ Question 1: Which sustainable building attributes (additional to the classical building attributes) are rewarded financially by the Swiss housing market?
- ▶ Question 2: Has the pricing of these sustainable building attributes changed compared to earlier studies?
- ▶ Methodology: Hedonic pricing model

## Previous studies for Switzerland

- ▶ Salvi, M., Horehajova, A. and Müri, R. (2008).  
"Minergie macht sich bezahlt" .[WWW page].  
URL <http://www.ccrs.uzh.ch/dam/jcr:00000000-7f73-6db1-ffff-ffff9d913cae/minergie2008.pdf>.
- ▶ Salvi, M., Horehajova, A. and Müri, R. (2010).  
"Der Minergie-Boom unter der Lupe". [WWW page].  
URL <https://www.minergie.ch/media/zkb-ccrs-minergie-boom-unter-der-lupe.pdf>.
- ▶ Rappl, I., Bröhl, A. and Müri-Leupp, R. (2011)  
"Ruhe Bitte! Wie Lage und Umweltqualität die Schweizer Mieten bestimmen". Zürich: ZKB.
- ▶ Feige, A., Mcallister, P. and Wallbaum H. (2013)  
"Rental price and sustainability ratings: which sustainability criteria are really paying back?". Construction Management and Economics 31 (4), p. 322-334.

# Real estate data

## Characterisation

- ▶ Real estate portfolio with 191 properties
- ▶ Property owner: 2 Swiss institutional investors
- ▶ Type of use: predominantly multi-family buildings (185) , few mixed-use (4) and sales buildings (2)
- ▶ Real-estate attributes analysed: locational- and building-specific attributes, sustainability attributes and financial indicators
- ▶ Sources: REIDA (locational building and specific attributes, financial indicators), CCRS (sustainability attributes i.e. ESI-indicators)
- ▶ Period of survey: 2013-2015

# The buildings' sustainability attributes

## The Economic Sustainability Indicator as a building's sustainability rating

- ▶ ESI-Indicator: Real estate rating consisting of 43 sustainability (e.g. economic, environmental, social) attributes being relevant for a real-estate's long-term value
- ▶ Measuring unit: Ordinal rating ranging between -1 (building is subject to maximal depreciation risk) and +1 (building is subject to minimal risk)
- ▶ Source: developed by CCRS (see Meins, E. and Sager, D. (2015). "Sustainability and risk". Journal of European Real Estate Research, Vol. 8 iss 1, p. 66-84).

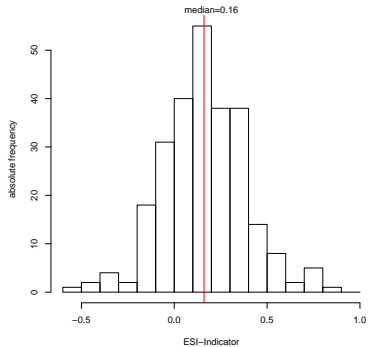
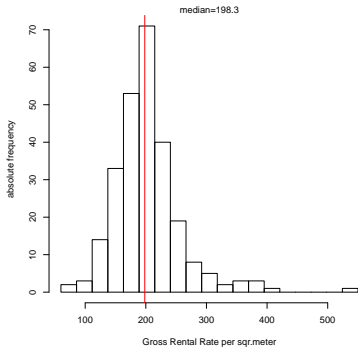
# The buildings' sustainability attributes

## The ESI-Indicator's five criteria

<b>The Sustainability criteria of the ESI-Indicator</b>
<b>1. Flexibility and polyvalence</b>
1.1 Flexibility to use
1.2 Adaptability to users
<b>2. Resource consumption and greenhouse gases</b>
2.1 Energy and greenhouse gases
2.2 Water
2.3 Building material
<b>3. Location and mobility</b>
3.1 Public transport
3.2 Non-motorized traffic
3.3 Location
<b>4. Safety and security</b>
4.1 Location regarding natural hazards
4.2 Building safety and security measures
<b>5. Health and comfort</b>
5.1 Inside air quality
5.2 Noise exposure
5.3 Sufficient natural light
5.4 Radon (ionizing)
5.5 Construction materials and inherited pollution

# Descriptive statistics of real-estate portfolio

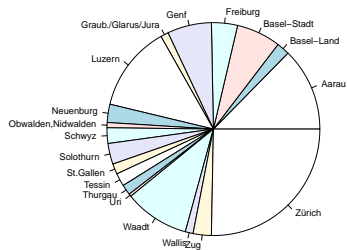
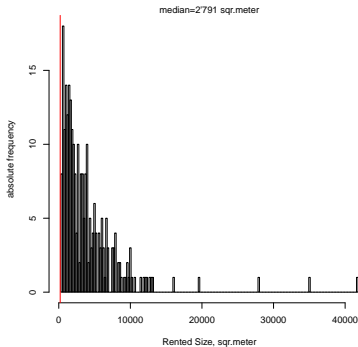
## Histogram of gross rental income (CHF) and ESI-Indicator (ordinal index)





# Descriptive statistics of real-estate portfolio

## Histogram of building size and location



## Model specification

### The log-linear hedonic rent model

. Log-linear hedonic rent model:

$$\begin{aligned} \log(\text{RentalIncome}_i) = & \text{FixedEffectUseType}_i + \beta_1 * \log(\text{Space}_i) \\ & + \beta_2 * \log(\text{BuildingAge}_i) + \beta_3 * \text{MacroLocation}_i \\ & + \beta_4 * \text{MicroLocation}_i + \beta_5 * \text{RentalIncomeLossRate}_i \\ & + \beta_6 * \text{ESI} - \text{Indicator}(s)_i + \epsilon_i \end{aligned}$$

Definition of variables:

- ▶ RentalIncome: Gross / net rental income (in CHF per square meter and per year, net of operating costs at the tenants expense)
- ▶ Space: Rented size (in square meter)
- ▶ Building Age: building age in years
- ▶ Macro/MicroLocation: (ordinal) location rating (below average, average, above average within Switzerland and Swiss regions, res.)
- ▶ RentalIncomeLossRate: Rental income lost due to vacancies (in percent)

# Log-linear hedonic gross rent model

Model with log(Gross Rental Income per square meter) as left-hand side variable

	Model with ESI criteria			Model with ESI-Indicator		
	Estimate	t-value	Pr(> t )	Estimate	t-value*	Pr(> t )
FixedEffectOffice	0.14 <sup>c</sup>	1.83	0.07	0.21	2.98	0.0
FixedEffectSales	-0.08	-0.58	0.56	0.02	0.17	0.86
log(RentedSize)	-0.05 <sup>a</sup>	-2.75	0.01	-0.048 <sup>a</sup>	-2.68	0.01
log(BuildingAge)	-0.10 <sup>a</sup>	-4.14	0.00	-0.068 <sup>a</sup>	-3.09	0.00
MacroRating (above average)	0.14 <sup>a</sup>	2.87	0.00	0.02	1.49	0.14
MicroRating (above average)	0.02 <sup>a</sup>	1.55	0.12	0.18 <sup>a</sup>	3.63	0.00
RentalIncomeLossRate	-0.01 <sup>a</sup>	-5.58	0.00	-0.006 <sup>a</sup>	-5.92	0.00
<b>ESIIndicator</b>	-	-	-	0.08	1.25	0.21
<b>Flexibility</b>	-0.07 <sup>c</sup>	1.67	0.09	-	-	-
<b>ResourceConsumption</b>	-0.04	-0.95	0.34	-	-	-
<b>Location</b>	<b>0.08<sup>a</sup></b>	3.02	0.00	-	-	-
<b>Safety</b>	0.02	1.07	0.28	-	-	-
<b>HealthComfort</b>	<b>0.12<sup>a</sup></b>	2.49	0.01	-	-	-
<i>R</i> <sup>2</sup>	0.40			0.35		
Num. of Obs.	191			195		
Method	OLS			OLS		

Notes: a:  $Pr < 0.01$ , b:  $Pr < 0.05$ , c:  $Pr < 0.1$ ;

## Log-linear hedonic net rent model

Model with log(Net Rental Income per square meter) as left-hand side variable

	Model with ESI criteria			Model with ESI-Indicator		
	Estimate	t-value*	Pr(> t )	Estimate	t-value*	Pr(> t )
FixedEffectOffice	0.12 <sup>a</sup>	1.60	0.11	0.20 <sup>a</sup>	2.65	0.00
FixedEffectSale	-0.25	-1.32	0.19	-0.06	-0.32	0.75
log(RentedSize)	-0.03	-1.68	0.19	-0.03	-1.51	0.13
log(BuildingAge)	-0.109 <sup>c</sup>	-1.68	0.09	-0.07 <sup>a</sup>	-2.94	0.00
MacroRating (above average)	0.11 <sup>c</sup>	1.90	0.06	0.16 <sup>a</sup>	2.77.4	0.00
MicroRating (above average)	0.04 <sup>b</sup>	2.08	0.02	0.03	2.77	0.13
RentalIncomeLossRate	-0.01 <sup>a</sup>	-5.76	0.00	-0.008 <sup>a</sup>	-4.74	0.0
<b>ESIIndicator</b>	-	-	-	0.04	0.58	0.56
<b>Flexibility</b>	-0.05	-1.14	0.25	-	-	-
<b>ResourceConsumption</b>	-0.08 <sup>c</sup>	1.78	0.07	-	-	-
<b>Location</b>	0.07 <sup>b</sup>	2.25	0.00	-	-	-
<b>Safety</b>	0.03	1.47	0.14	-	-	-
<b>HealthComfort</b>	0.15 <sup>a</sup>	2.86	0.00	-	-	-
$R^2$	0.44			0.37		
Num. of Obs.	144			148		
Method	OLS			OLS		

Notes: a:  $Pr < 0.01$ , b:  $Pr < 0.05$ , c:  $Pr < 0.1$

# Analysing the resource consumption discount

## Composition of ESI-criteria "resource consumption"

- ▶ Main ESI-indicator of criteria "resource consumption": "thermal heat usage" (29 percent weight in ESI-Indicator)
- ▶ Definition of ESI-indicator "Thermal heat usage"

Indicator "Thermal heat usage"	Building code equivalent
-1	MuKE n 1992 not fulfilled
0	sia-code 380/1 fulfilled
0.5	Minergie-label fulfilled
+1	Minergie P-label fulfilled

source: Meins E. and Sager D. (2015)

## Measuring the energy efficiency premium

Model with  $\log(\text{Net Rental Income per } m^2)$  as left-hand side variable

	log model with ESI-indicators		
	Estimate	t-value*	Pr(> t )
FixedEffectOffice	0.13 <sup>a</sup>	1.67	0.1
FixedEffectSale	-0.25	-1.36	0.18
log(RentedSize)	-0.03	-1.51	0.13
log(BuildingAge)	-0.11 <sup>a</sup>	-4.24	0.00
MacroRating (above average)	0.11 <sup>b</sup>	1.93	0.06
MicroRating (above average)	0.04 <sup>b</sup>	2.16	0.03
RentalIncomeLossRate	-0.007 <sup>a</sup>	-5.74	0.00
<b>Flexibility</b>	-0.06	1.26	0.20
<b>Thermal heat usage</b>	-0.10 <sup>b</sup>	-2.41	0.02
<b>Location</b>	0.07	2.37 <sup>b</sup>	0.02
<b>Safety</b>	0.03	1.36	0.17
<b>HealthComfort</b>	0.16 <sup>a</sup>	3.03	0.00
$R^2$	0.45		
Num. of Obs.	144		
Method	OLS		

Notes: a:  $Pr < 0.01$ , b:  $Pr < 0.05$ , c:  $Pr < 0.1$

## Conclusions

- ▶ Mostly rewarded sustainable building attributes: attributes subsumed under "health and comfort" i.e. inside air quality, low noise exposure, sufficient natural light
- ▶ Sustainable building attribute changing significantly compared to earlier studies: thermal heat usage (is priced now at a significant discount contrary to e.g. Salvi et al.(2008)) and Salvi et al. (2010)
- ▶ but: results are consistent with those of Feige et al. (2013)