Real estate valuation
Real estate economics

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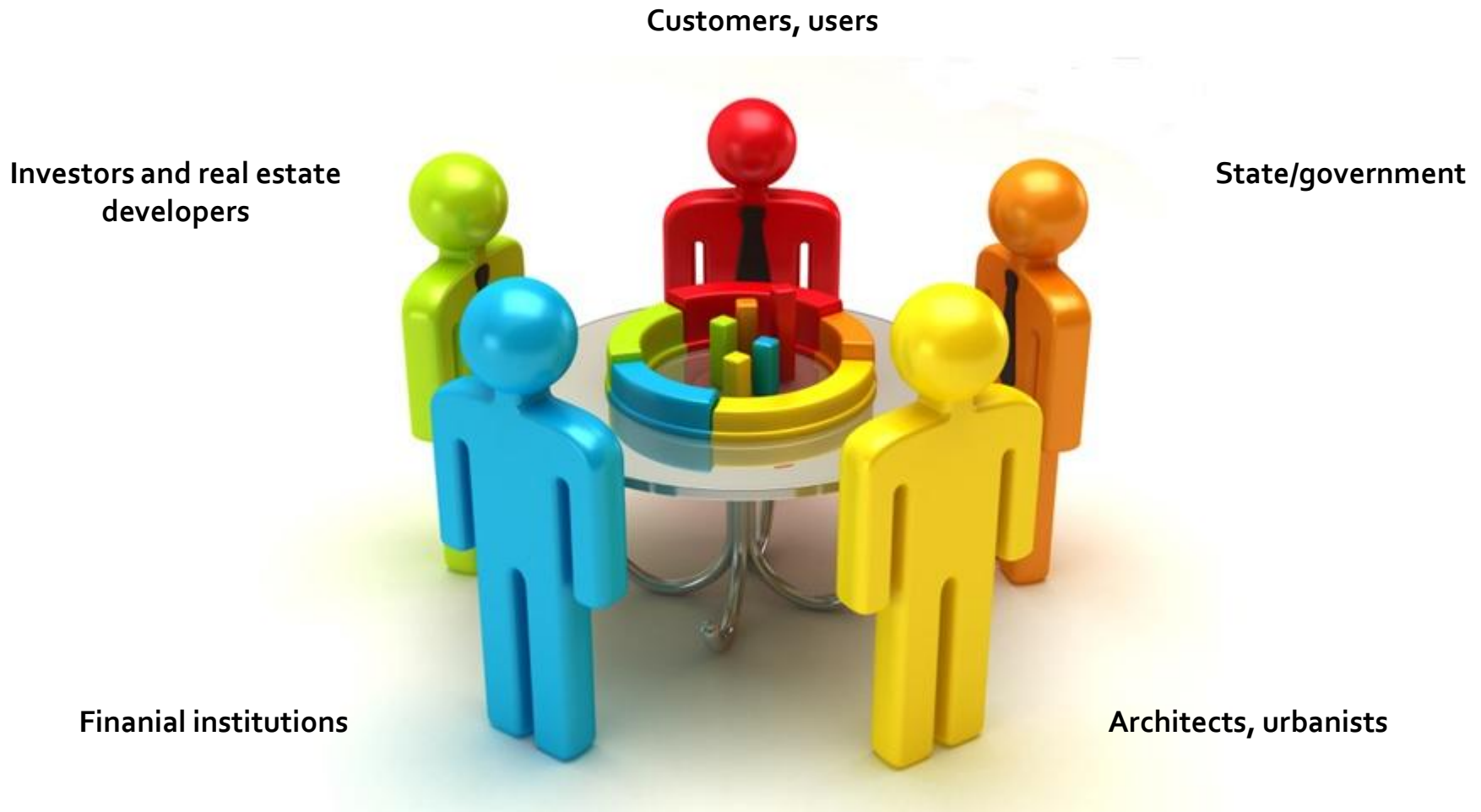2015. 03. 25.

Agenda

- Importance of real estate valuation

- Valuation methods
  - Traditional methods
  - Advanced methods

- Hedonic research – Budapest residential RE market

Agenda

- **Importance of real estate valuation**

- Valuation methods
  - Traditional methods
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- Hedonic research – Budapest residential RE market

Real estate development is important for several stakeholders

Customers, users

Investors and real estate developers

State/government

Finanial institutions

Architects, urbanists

Home-ownership rate is lower in the developed countries

Country	Home-ownership rate	Country	Home-ownership rate
Bulgaria	97%	Portugal	73%
Romania	96%	Czech Republic	72%
Lituania	95%	Italy	72%
Macedonia	95%	Luxembourg	71%
Singapore	90%	United Kingdom	71%
China	90%	Israel	71%
Lithuania	89%	Australia	69%
Slovakia	89%	Canada	68%
Hungary	87%	Belgium	67%
Nepal	85%	Finland	67%
Russia	85%	Cyprus	66%
Latvia	84%	US	65%
Mexico	84%	EU average	65%
Estonia	83%	New Zeland	65%
Spain	83%	Sweden	62%
Iceland	83%	Japan	60%
Oman	83%	Turkey	60%
Iran	81%	Denmark	58%
Slovenia	80%	France	58%
Ireland	77%	Poland	58%
Malta	77%	Netherlands	56%
Norway	77%	South Korea	54%
Brazil	74%	Austria	52%
Greece	73%	Germany	46%

Note: Approximate figures from different surveys
Source: Wikipedia

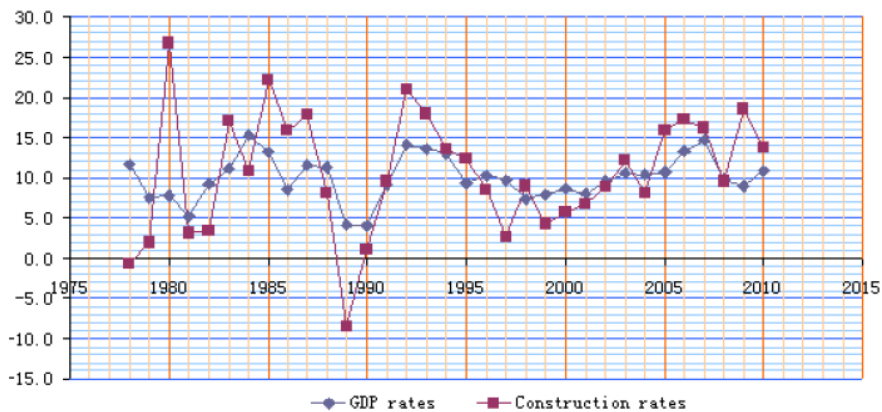# Tight correlation between GDP and construction growth rate

Figure 2. A Comparison of Chinese Construction Growth Rate with GDP since 1978.
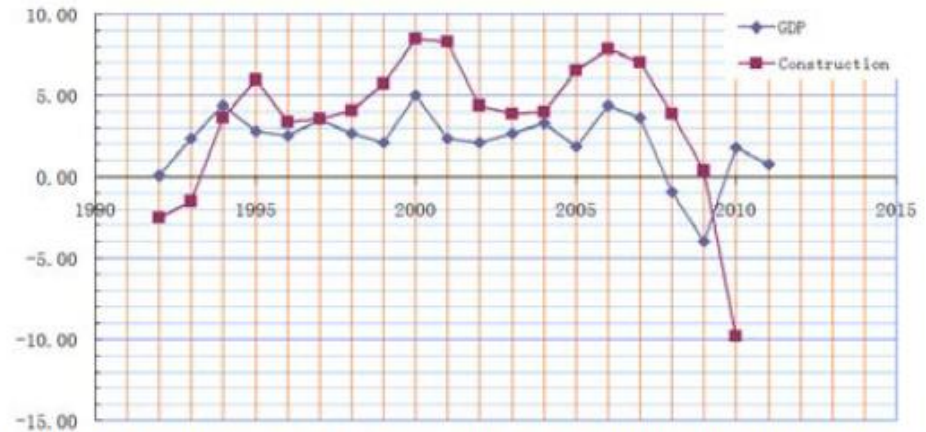
Figure 4. A Comparison of UK Construction Growth Rate with GDP since 1991.

Source: Jiang Qifa (2013) - Analysis on the Relationship between GDP and Construction Based on the Data of UK and China

High leverage results higher ROE

	Low leverage	High leverage
Cost of development	100	100
Loan	30	50
Own equity	70	50
Leverage ratio	100/70=1,428	100/50=2
Profit of project	15	15
Interest rate	5%	5%
Interest payable	30*5%=1,5	50*5%=2,5
Profit after interest payment	15-1,5=13,5	15-2,5=12,5
Return on Equity (ROE)	13,5/70=**19,2%**	12,5/50=**25%**

If profit declines, high leverage results in high risk

	Low leverage	High leverage
Cost of development	100	100
Loan	30	50
Own equity	70	50
Leverage ratio	100/70=1,428	100/50=2
Profit of project	3	3
Interest rate	5%	5%
Interest payable	30*5%=1,5	50*5%=2,5
Profit after interest payment	3-1,5=1,5	3-2,5=0,5
Return on Equity (ROE)	1,5/70=2,14%	0,5/50=1%

Developers' main target should be to create value in the real estate market

The work of developers is to find the best solutions among the constraints,…

- In developers' constraints are:
    - budget,
    - deadline,
    - regulation,
    - building materials,
    - environment,
    - etc.

- Good developers create the most valuable real estate among the given constraints

…but how do we know if our solution is the best?

- Users are happy to live/pass time there
- Meet the functional requirements
- Aesthetic outlook
- Sustainable
- Environmentally friendly
- Profitable operation
- Etc…

To give value to the stakeholders

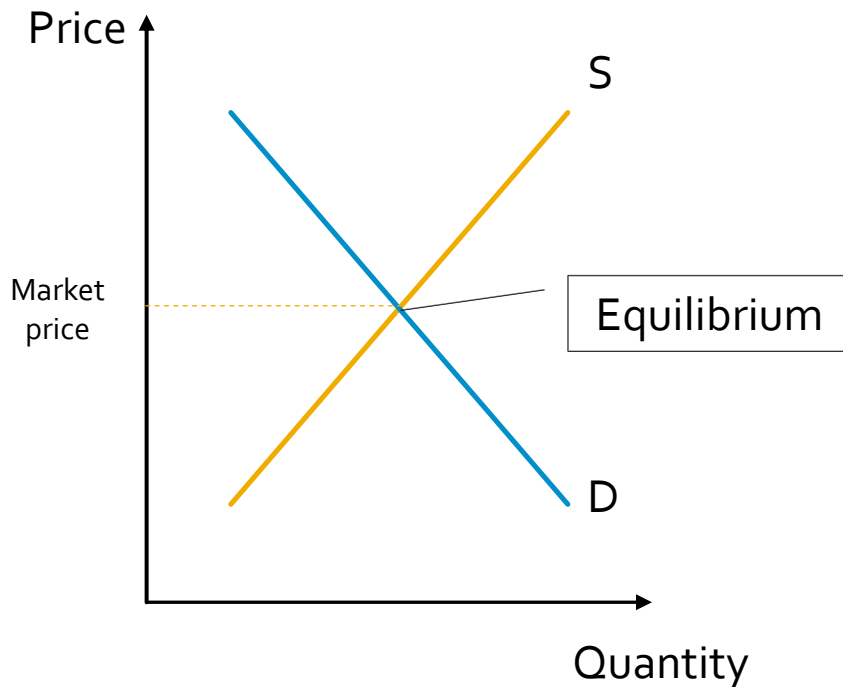**Real estate valuation helps to quantify the value for stakeholders**

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  - Traditional methods
  - Advanced methods

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Value is measured through the market price

Microeconomic approach

Supply and demand curve by Alfred Marshall

Valuation approach

"The estimated amount for which a property should exchange
- *on the date of valuation*
- *between a willing buyer and a*
- *willing seller*
- *in an arm's-length transaction (independent parties)*
- *after proper marketing*
- *wherein the parties had each acted knowledgeably, prudently and without compulsion."*

Source: RICS Red Book

Two types of valuation methods exist

Traditional valuation methods

- Simple techniques
- Valuation for individual real estate
- No sophisticated mathematical background needed

- Comparable method
- Cash flow method
- Cost method

Advanced valuation methods

- Advanced, complex techniques
- Generally used for mass appraisal
- Sophisticated, scientific approach (basic econometrics/statistics needed)

- Hedonic pricing method (regression)
- Artificial Neural Networks
- Spatial analysis method
- Fuzzy logic

Note: Based on Pagourtzi et al. (2003)

Valuation methods

Traditional valuation methods

- Comparable method
- Cash flow method
- Cost method

Advanced valuation methods

- Hedonic pricing method
- Artificial Neural Networks
- Spatial analysis method
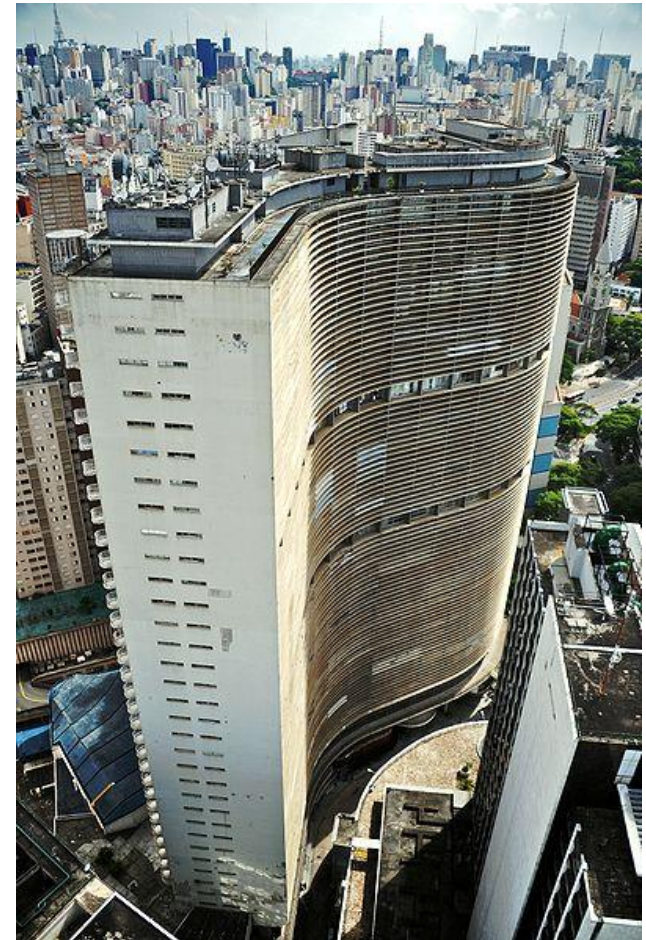- Fuzzy logic

What is the market value of the marked flat?

What is the name of the building?

Oscar Niemeyer: Edificio Copan

- 140-meter
- 38-story
- Site: 10572.80 square meters
- Construction started 1957, finished in 1966
- Largest floor area of any residential building in the world
- Copan: abbreviation of the developer (Companhia Pan-Americana de Hotéis e Turismo)

Oscar Niemeyer: Edificio Copan 1966, São Paulo

Oscar Niemeyer: Edificio Copan

- 1,160 apartments and 5,000 residents
- 100 employees to serve residents and to conduct maintenance
- Ground floor is home to 70 businesses and establishments including (since the 1990s) a church, a travel agency, a bookstore, and 4 restaurants
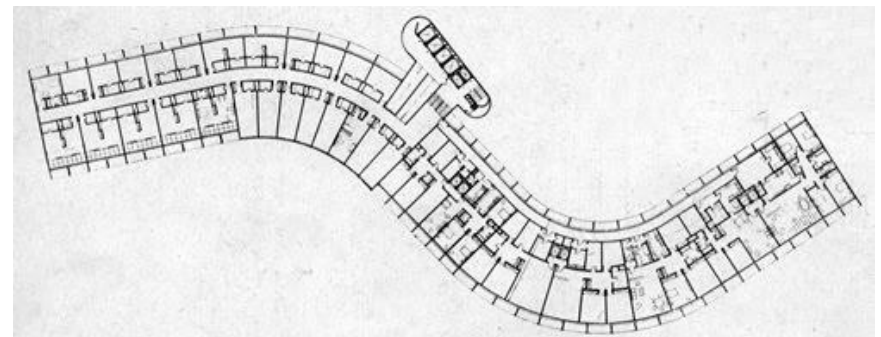
Oscar Niemeyer: Edificio Copan 1966, São Paulo

Comparable method compares subject real estate with coparable real estate to get the value

1. **Find comparable sales**
2. **Identify the differences between the subject and comparables' characteristics**
3. **Adjust the selling price of the subject**

Subject flat	Comparable flat	Differences
R$ xxx	R$350 000	
44 sqm	40 sqm	+10%
Kitchen furniture excluded	Kitchen furniture included	R$5000 – buy a kitchen furniture
-	New internal doors (2 pc)	R$1500 – change the doors
Plaster is falling down in the living room		R$500 – fix the plaster; paint

R$385 000 - R$7 000 =
R$378 000

Valuation methods

Traditional valuation methods

Advanced valuation methods

- Comparable method
- **Cash flow method**
- Cost method

- Hedonic pricing method
- Artificial Neural Networks
- Spatial analysis method
- Fuzzy logic

What is the market value this building?

What is the name of the building?

Jørn Utzon: Sydney Opera House

- Sydney Opera house
- Opened 1973. October
- Hosting over 1,800 performances each year attended by 1.2 million people
- More than seven million people visit the site each year
- 300,000 people participating annually in a guided tour of the facility
- UNESCO World Heritage Site on 28 June 2007
- Utzon received the Pritzker Prize, architecture's highest honor, in 2003
- Cost $102 million
- The original cost and scheduling estimates in 1957 projected a cost of £3,500,000 ($7 million) and completion date of 26 January 1963

Jørn Utzon: The Sydney Opera House - 1973

CF methodology gives a value for the building based on the revenues and costs using the Net Present Value
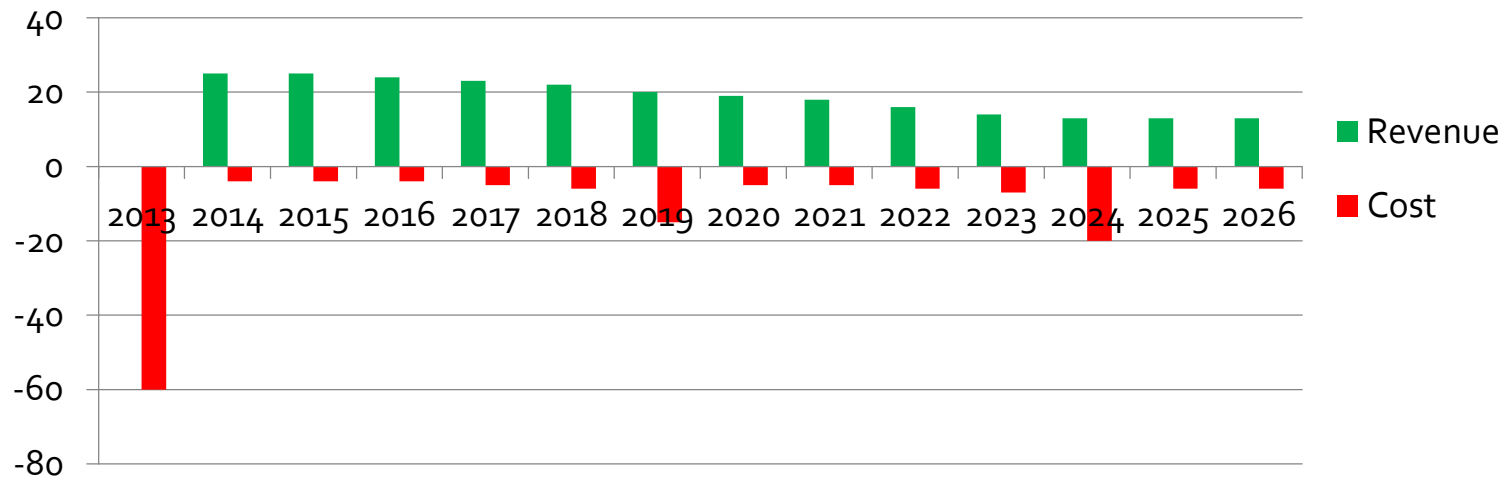
Net Present Value: $$NPV = -C_0 + \frac{C_1}{1+r} + \frac{C_2}{(1+r)^2} + ... + \frac{C_T}{(1+r)^T}$$

$- C_0 = Initial\ Investment$
$C = Cash\ Flow$
$r = Discount\ Rate$
$T = Time$

- The CF method says that the value of the building is equal with the CF it generates.
- Method is applicable for office buildings, cinema, theater, hotel, restaurants.
- Secondary/indirect CF effects should also be taken into consideration to be applicable for non profit generating functions. (museum, swimming pool, culture house)

4 steps to value buildings with the CF mehod

1. **HBU (highest and best use)**: define the operation of the building that is the most beneficial/generates most profit

2. **Estimation of CF – profit calculation**: collect all the CF elements (revenues & costs) that will occur during the operation of the building

3. **Analyze risks, define discount rate (opportunity cost of capital):** Analyze all the investments that have similar risk level and check their yield

4. **NPV calculation:** Use the NPV formula to calculate the present value of the CF

$$NPV = -C_0 + \frac{C_1}{1+r} + \frac{C_2}{(1+r)^2} + \dots + \frac{C_T}{(1+r)^T}$$

Higher risk results higher yield
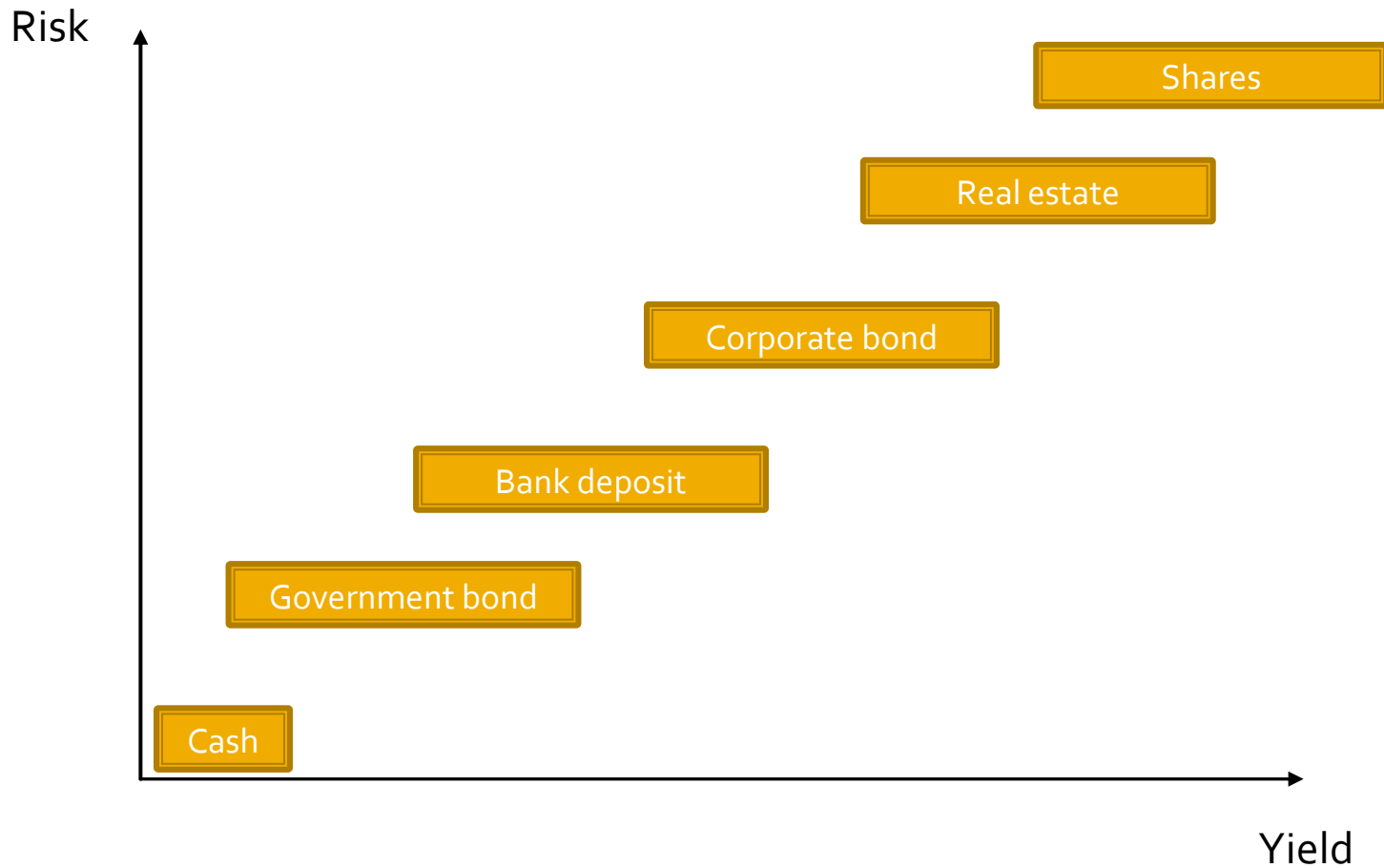
Example

Sample question	Annual revenues	Annual costs

Sample question
- Hotel of 100 rooms in Budapest
- 70% average usage
- EUR 49/room/night net revenue
- Operates 365 days/year
- HR costs: 25 employees with average gross cost of EUR 1500/month/employee
- FM costs: EUR 400 000/year
- Other costs: EUR 200 000/year
- Calculate with perpetuity
- Expected yield for similar investments is 10%

Annual revenues
- 100 rooms * 70% * EUR49 * 365 days = ~**EUR 1 250 000**

Annual costs

HR:
25 Employees * EUR 1500 salary * 12 months = **EUR 450 000**

FM:
EUR 400 000

Other:
EUR 200 000

Total: EUR 1 050 000

Annual profit is EUR 200 000 with 10% discount rate perpetuity results:
200 000 / 10% = **EUR 2M** market value

Valuation methods

Traditional valuation methods

Advanced valuation methods

- Comparable method
- Cash flow method
- **Cost method**

- Hedonic pricing method
- Artificial Neural Networks
- Spatial analysis method
- Fuzzy logic

Cost method, the last resort

- The cost method is applicable, when:
  - In case there are no comparable real estate nearby
  - The generated CF can not be easily defined

- Define the cost of the construction, creation of the building, deducting the damages and amortization

- Could also be used as a control for the previous methods (Comparable, CF)

- Applicable for special buildings: special residential buildings, industrial buildings, factories, not finished constructions, etc...

- This method represent least the market value, as the usage is supported as a last resort

3 steps to use to get value with cost method

Cost method:

1. Define the land value
- Use comparable or CF method

2. Define the re-construction costs
- All the cost to create the same utility function including all related costs

3. Calculate the amortization value[1]
- Urban brick buildings   60-90 years
- Urban not brick   40-70 years
- Suburban housing   50-80 years
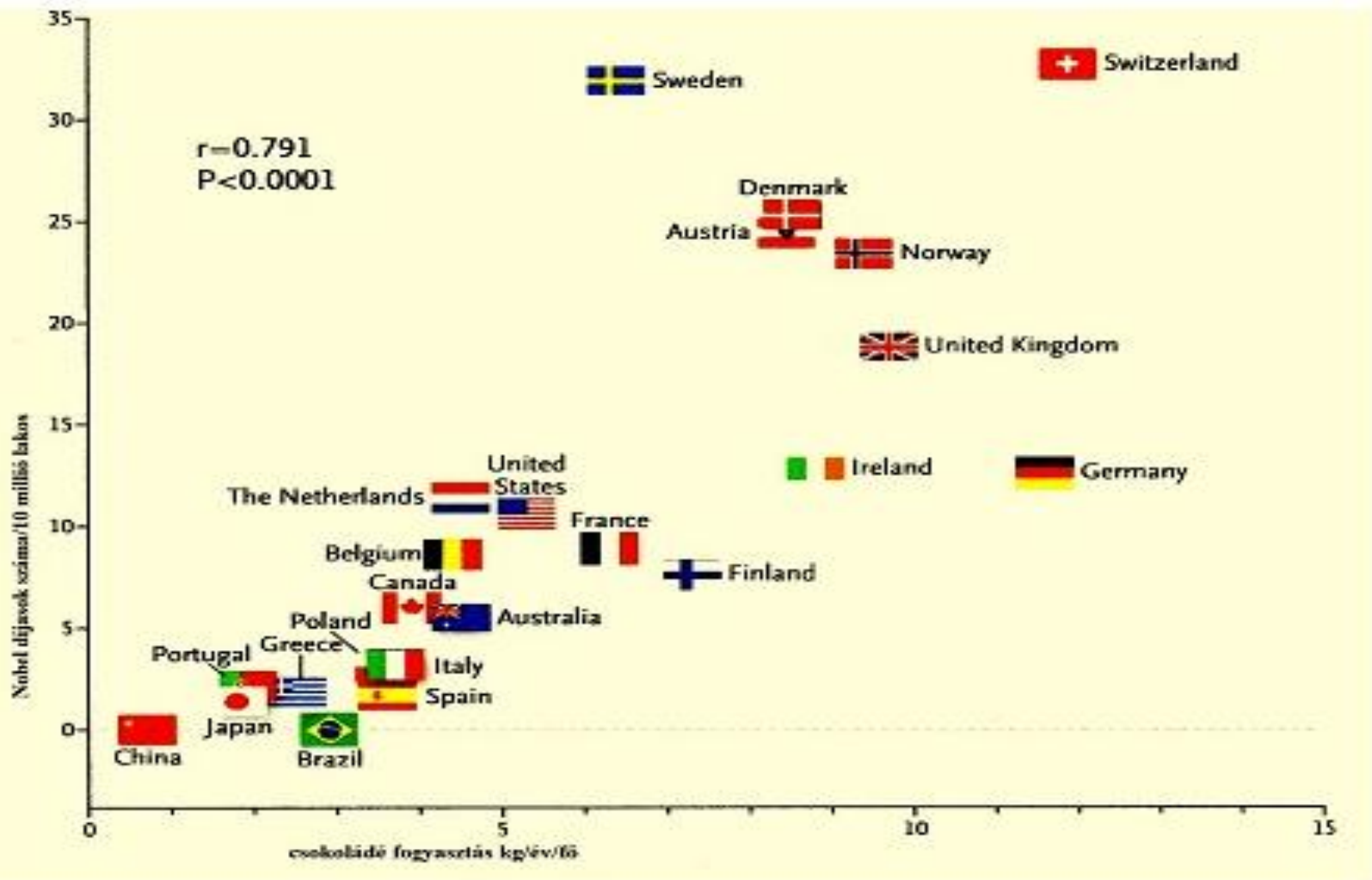- Industrial and agricultural   20-50 years

1. Figures are proposed by Hungarian regulation

Valuation methods

Traditional valuation methods

- Comparable method
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Advanced valuation methods

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Hedonic regression is focusing on the value components

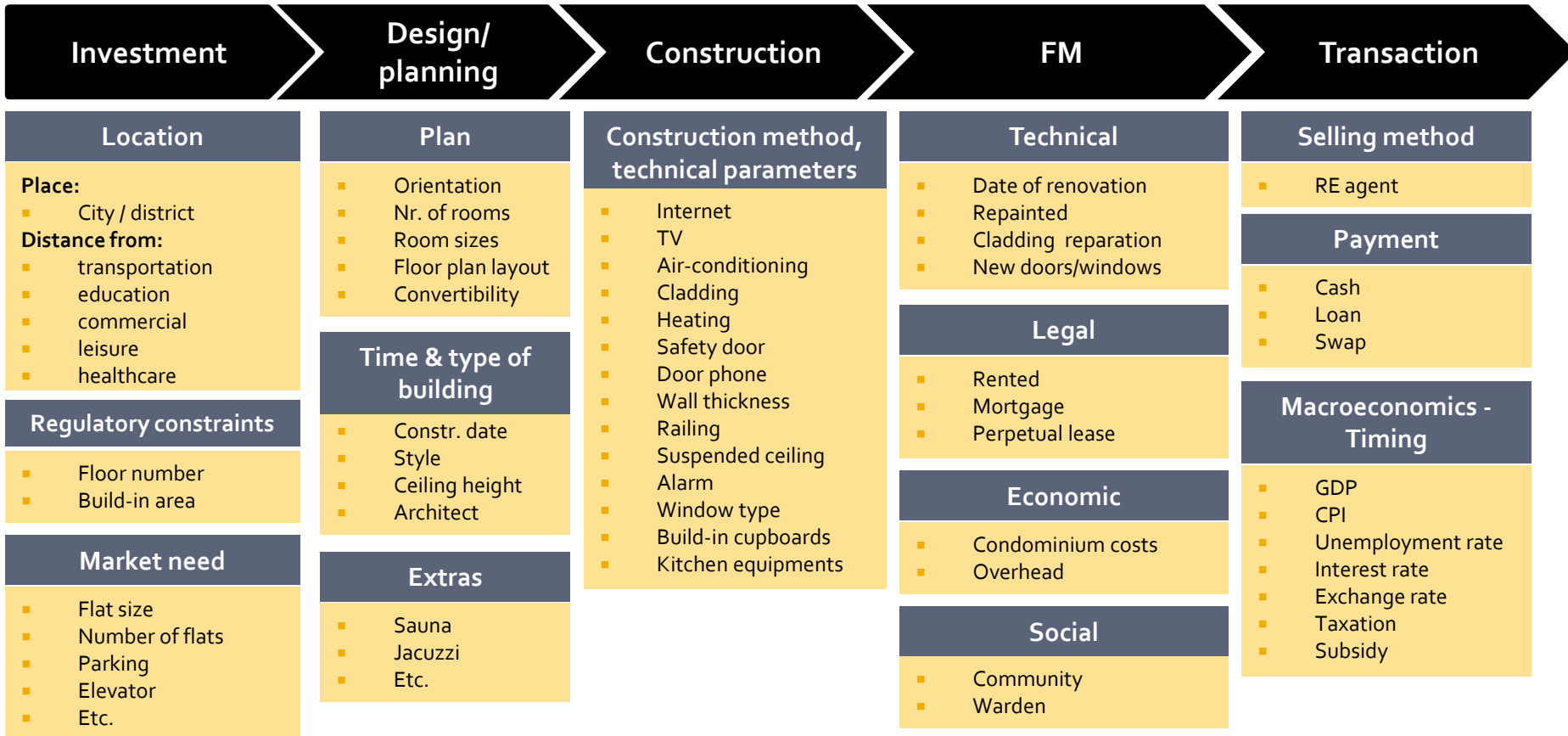## High correlation between housing characteristic and price

Price (M HUF)

Area (m²)
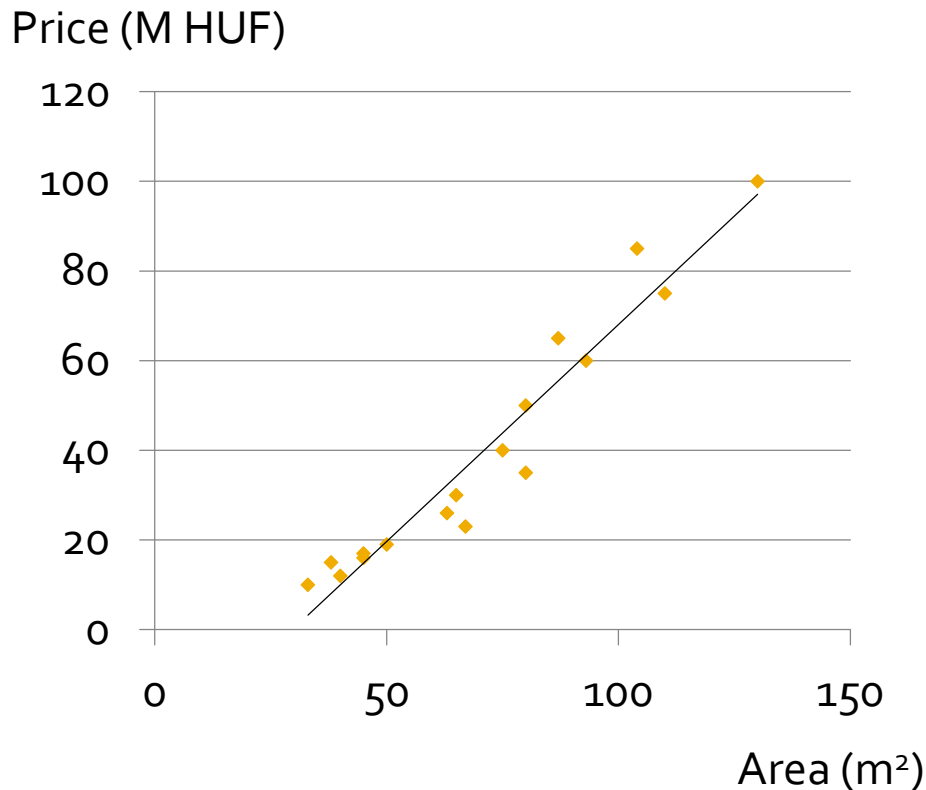
Hedonic regression

- Real estate value is determined by its characteristics

- Characteristics should be valuated separately

- Value of real estate is the sum of the components' value

Several characteristics can influence price
Grouped by the real estate life-cycle

Investment	Design/planning	Construction	FM	Transaction

Location
Place:
- City / district

Distance from:
- transportation
- education
- commercial
- leisure
- healthcare

Regulatory constraints
- Floor number
- Build-in area

Market need
- Flat size
- Number of flats
- Parking
- Elevator
- Etc.

Plan
- Orientation
- Nr. of rooms
- Room sizes
- Floor plan layout
- Convertibility

Time & type of building
- Constr. date
- Style
- Ceiling height
- Architect

Extras
- Sauna
- Jacuzzi
- Etc.

Construction method, technical parameters
- Internet
- TV
- Air-conditioning
- Cladding
- Heating
- Safety door
- Door phone
- Wall thickness
- Railing
- Suspended ceiling
- Alarm
- Window type
- Build-in cupboards
- Kitchen equipments

Technical
- Date of renovation
- Repainted
- Cladding reparation
- New doors/windows

Legal
- Rented
- Mortgage
- Perpetual lease

Economic
- Condominium costs
- Overhead

Social
- Community
- Warden

Selling method
- RE agent

Payment
- Cash
- Loan
- Swap

Macroeconomics - Timing
- GDP
- CPI
- Unemployment rate
- Interest rate
- Exchange rate
- Taxation
- Subsidy

Example
- Calculate the value of a flat of 80 sqm having an alarm system, given the following transactions in the neighborhood.

	1.	2.	3.	Subject
Transaction price (HUF)	20M	20M	18M	?? M
Area	70 sqm	80 sqm	60 sqm	80 sqm
Alarm	Yes	No	No	Yes

$$Price = b_0 + b_1 * area + b_2 * alarm\ system\ (0/1)$$

- The difference between the 2nd and 3rd flat is just the area. The value of 1 sqm is :
  $$(20-18)/(80-60)= HUF\ 0,1\ M/sqm$$
- Based on this the 10 sqm difference between the 1st and 2nd flat results in 1M HUF. This is compensated by the Alarm system, thus the value of the alarm system is 1M HUF.
- Thus the subject flat with 80 sqm and alarm system is 20+1=21 M

With regression:
- $Price = b_0 + b_1 * area + b_2 * alarm\ system\ (0/1)$ + error term
- $P= 12 + 0,1 * area + 1 * alarm\ system\ (0/1)$ + error term

P – Price
Area – Area in sqm
D_metro(km) - Distance from metro station in km
Alarm sys:0/1 – Existence of alarm system 1-yes, 0-no

H_district:0/1 – District heating 1-yes; 0-no
H_central:0/1 – Existence of central heating
e – error term

$$P = \beta_0 + \beta_1 * Area + \beta_2 * D\_metro(km) + \beta_3 * Alarm\ sys:0/1 + \beta_4 * H\_district:0/1 + \beta_5 * H\_central:0/1 + e$$

$$
\begin{bmatrix} 30 \\ 40 \\ 35 \\ 23 \\ 65 \\ 34 \\ 34 \end{bmatrix}
= \beta_0 + \beta_1 * \begin{bmatrix} 60 \\ 82 \\ 78 \\ 45 \\ 110 \\ 67 \\ 94 \end{bmatrix}
+ \beta_2 * \begin{bmatrix} 1,2 \\ 3,1 \\ 0,7 \\ 6,1 \\ 0,6 \\ 2,3 \\ 4,2 \end{bmatrix}
+ \beta_3 * \begin{bmatrix} 0 \\ 0 \\ 0 \\ 1 \\ 1 \\ 0 \\ 1 \end{bmatrix}
+ \beta_4 * \begin{bmatrix} 1 \\ 0 \\ 1 \\ 1 \\ 0 \\ 0 \\ 0 \end{bmatrix}
+ \beta_5 * \begin{bmatrix} 0 \\ 0 \\ 0 \\ 0 \\ 1 \\ 0 \\ 1 \end{bmatrix}
+ e_i
$$

Regression finds values for all β , to have the smallest values for $\sum e_i^2$

$$P = 3,1 + 0,45 * \textbf{Area} + 0,01 * \textbf{D\_metro(km)} + 1,2 * \textbf{Alarm sys:0/1} + 2,2 * \textbf{H\_district:0/1} + 3,2 * \textbf{H\_central:0/1}$$

By putting the characteristics of the subject RE to the function, the price can be determined!!

Note: Regression result's figures are only for explanation, not based on approprieate calculation

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# Supply prices from internet were used

Panel or brick

- Value of panel building is significantly less than non-panels

Floor

- Not significant for the whole sample

- Only significant for panel buildings (10-story buildings)

- The higher the flat is, the less value it has

- Potential breakdown of elevators

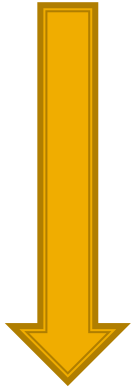- 1 storey means -1% in value, but possible correlation with panorama to compensate effect
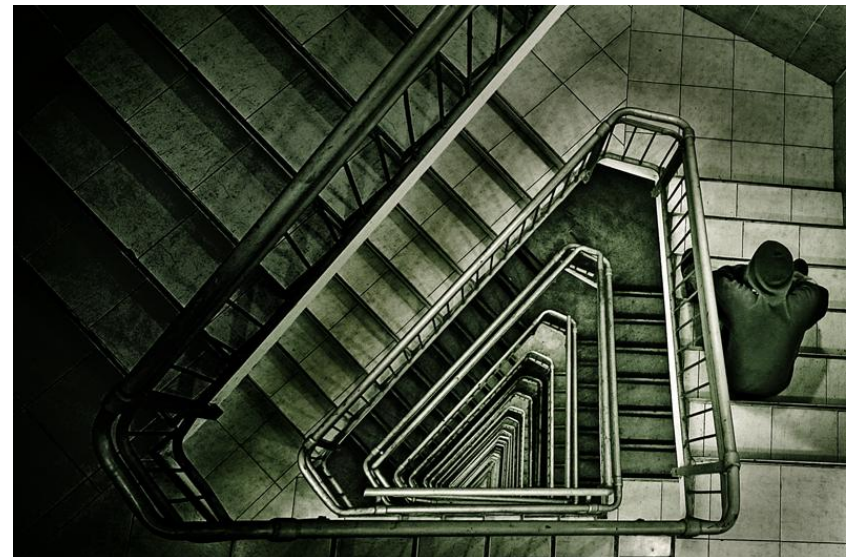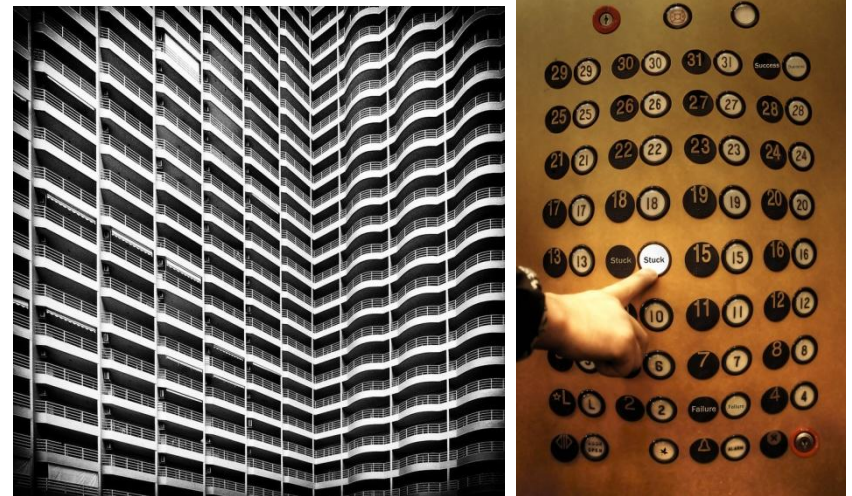
Balcony

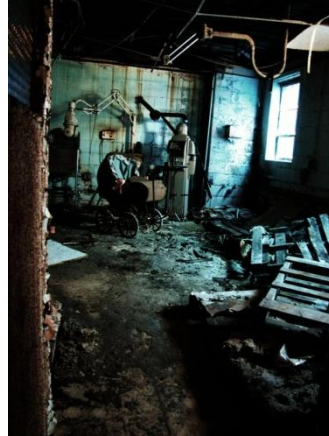- Existence of balcony results additional value to the house

Heating

- Convector
- Electro or Hera
- District
- Central heating
- Circulation
- Fain coil

Condition

- Bad
- Average
- Good
- Very good
- New

Panorama

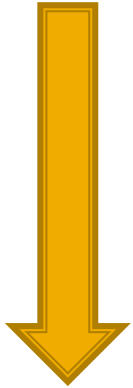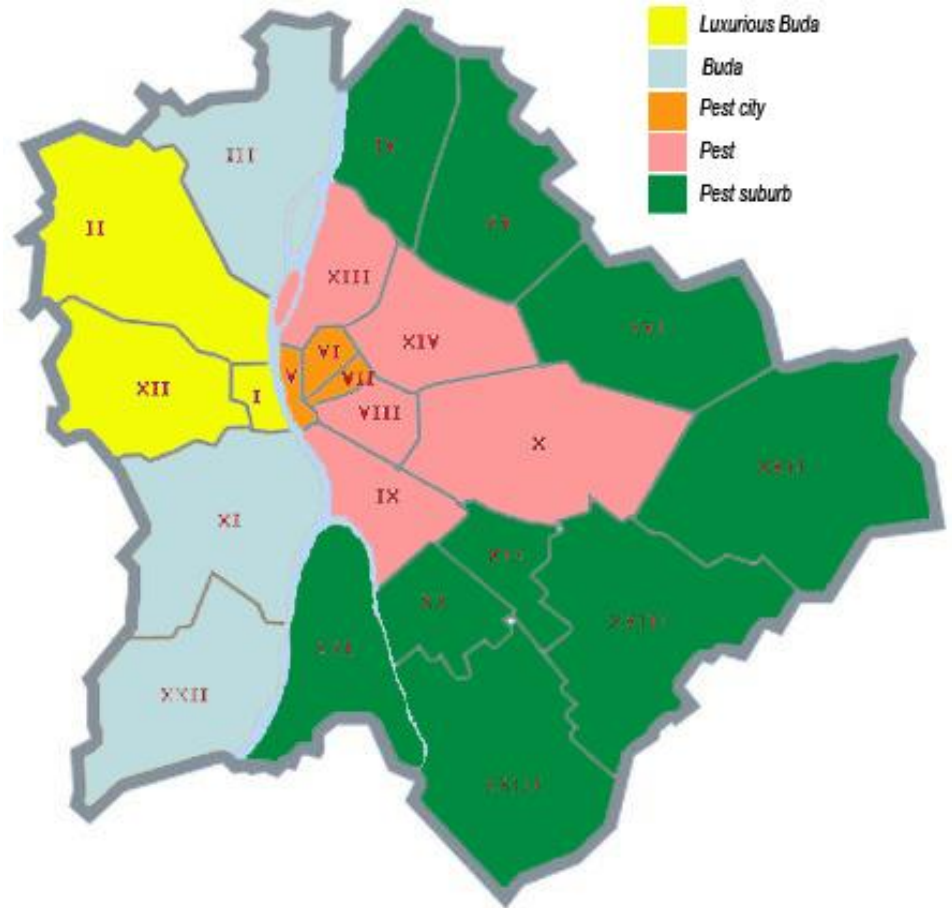- Panorama (~+13%)
- Garden (~+7%)
- Courtyard or street view

Parking

- Existence of a garage results in HUF 2,5M in value

Zone

- Luxurious Buda
- Pest city
- Buda
- Pest
- Pest suburb

Luxurious Buda
Buda
Pest city
Pest
Pest suburb

Airport

- The longest the distance from Liszt Ferenc Airport, the higher the value of the residential real estate

Cemetery

- People prefer not to live next to the cemeteries

Market

- But they do like to stay close to a market

Park

- Nearby parks are preferred

Stadium

- But nearby soccer stadiums are not

Trainstation

- Nor the trainstations

Results

$$\ln(Y) = \beta_0 + a_1 \cdot \ln(x_1) + a_2 \cdot \ln(x_2) + a_3 \cdot \ln(x_3) + \cdots + a_n \cdot \ln(x_n) + \beta_1 \cdot z_1 + \beta_2 \cdot z_2 + \beta_3 \cdot z_3 + \cdots + \beta_m \cdot z_m$$

- Positive coefficients means positive effect to the value

- 3 groups and total sample were observed: historic (392), panel (285), other (1129)

- R-squared of 85% means a good estimator equation

# How could the results of the research be used by the stakeholder?

Landlords and tenants (owners, users)

- Where to buy? How much is it worth if I sell? Worth renovation?

State/Government (owner, regulator (tax), etc.)

- Equation can be the base of property tax; Cost-benefit calculation for infrastructure development: park, subway, etc. As a secondary CF, property value might rise in the area
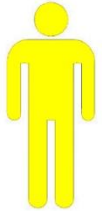
Architects, urbanists (design/create real estate, plan cities)

- Where to locate infrastructure, commercial area; leisure facilities, parks, etc...?; What are the characteristics that give value to owners

Financial institutions (financing, mortgage, insurance fee)

- Valuate real estate portfolio, when traditional methods not applicable.

Investors and real estate developers (potential business makers of the real estate sector)

- Where to locate residential housings? Create parking? Which heating to choose? ; Where to locate new infrastructure to avoid facing resistance (airport, market, etc.)

Thank you for your attention!