RISK ASSESSMENT OF REAL ESTATE INVESTMENT WITH THE USE OF SUBJECTIVE PROBABILITY

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AGENDA

Probability: CLASSICAL, STATISTICAL, SUBJECTIVE

HEURISTICS in estimation process

Applying the Easyfit software to estimate subjective probability distribution based on the percentiles specified by an expert
1. Classical (mathematical) definition of probability

If an experiment can produce \( N \) mutually exclusive and equally likely outcomes out of which \( n \) outcomes are favorable to the occurrence of event \( A \), then the probability of \( A \) is denoted by \( P(A) \) and is defined as the ratio \( (n/N) \). Thus the probability of \( A \) is given by:

\[
P(A) = \frac{\text{Number of outcomes favorable to } A}{\text{Number of possible outcomes}} = \frac{n}{N}
\]
Classical probability

Practically does not exist in economic activity
2. Statistical probability

- Population
- Sample
- Sampling Frame
- Use observed sample characteristics to estimate population characteristics
Sample=100 Beans
20 Red
80 White

Population=3000 Beans
If, during the multiple realizations of experiments, as a result of which we may obtain event A, the FREQUENCY of this event demonstrates a clear regularity, oscillating around a certain unknown number $p$, and if the variations of the frequency show a diminishing tendency with the increase in the amount of experiments, then the number $p$ is called the probability of event A.
Statistical probability

We can estimate in economic activity

CONDITION! an appropriate statistical sample
For risk assessment of real estate investment:

1. cities, big towns (large number of transaction)
2. typical properties
3. stable market condition

Yes!
FOR RISK ASSESSMENT of real estate investment:

1. small towns (little number of transaction)
2. atypical properties
3. high volatility of market condition

NO!
Classical and statistical probability

Objective probabilities

*2 different people defining the probability should give the same value*
Personal probability

Subjective probability

*value determined independently by 2 different people probably will vary*
3. SUBJECTIVE (PERSONAL) PROBABILITY

Subjective probability expresses the degree of someone’s belief of the possibility of an event or the degree of belief in the truth of the hypothesis or the judgement.
The expert describes his/her uncertainty about the various hypotheses, e.g., future value of 1m² of apartment.
If the expert is **convinced of the truth of a hypothesis**, the degree of belief should be reflected in assigning it a **HIGH PROBABILITY**.

If he/she is **not sure** then should assign probability more **EVENLY**.
SUBJECTIVE PROBABILITY

Is universal!

SMALL supply of information

LARGE supply of information
Subjective probability and behavioral economics

**Behavioral factors** may play an important role in risk assessment.
Cognitive and affective heuristics

HEURISTICS - simplified methods of inference and estimation.

D. Kahneman                   A. Tversky
Cognitive and affective heuristics

- anchoring and adjustment
- confirmation effect
- availability heuristics
- representativeness heuristic
- overconfidence error
- unrealistic optimism
Applying the Easyfit software to estimate subjective probability distribution based on the percentiles specified by experts
FUTURE SELLING PRICE

• An analyst in a real estate development company was asked to assess the risks associated with the possible selling price of $1m^2$ of apartment to be achieved in the future in a planned investment.

• The sales of the apartments had been planned for the years 2016/2017 so in different market conditions than the current ones (2014).

• investment was not a typical investment on the given local market,

• the analyst decided to ask for an expert opinion,
The AIM:

to determine the distribution of subjective probability.
• The analyst asked the expert to determine the probability, that the price will be located in specific price ranges.

• The expert could determine the ranges freely.
probabilities for

prices (PLN/1m2)
The analyst with the aid of the Easyfit package determined the best suited continuous probability density distributions.

The Easyfit package fixed 3 best suited distributions:
1) *Kumaraswamy* distribution,
2) *Johnson SB* distribution,
3) *Log – Pearson 3* distribution.
On the adoption of a **statistical significance of 0.1**, we can consider these distributions as **well-suited**.
After watching the graphs the expert stated that
none of the 3 distributions was adequate

He made more specific evaluations
The Easyfit was used once more.

The best suited distributions were:
1) Kumaraswamy distribution,
2) Johnson SB distribution.
Kumaraswamy distribution
Johnson SB distribution
On the adoption of a statistical significance of 0.05, we can consider these distributions as well-suited.

<table>
<thead>
<tr>
<th>#</th>
<th>Distribution</th>
<th>Kolmogorov Smirnov</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Statistic</td>
</tr>
<tr>
<td>1</td>
<td>Beta</td>
<td>0.090038023396739</td>
</tr>
<tr>
<td>2</td>
<td>Gen. Pareto</td>
<td>0.359154049086246</td>
</tr>
<tr>
<td>3</td>
<td>Johnson SB</td>
<td>0.054082626097958</td>
</tr>
<tr>
<td>4</td>
<td>Kumaraswamy</td>
<td>0.053166233124819</td>
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<tr>
<td>5</td>
<td>Log-Pearson 3</td>
<td>0.072751464859917</td>
</tr>
<tr>
<td>6</td>
<td>Pert</td>
<td>0.30203308292615</td>
</tr>
<tr>
<td>7</td>
<td>Phased Bi-Exponential</td>
<td>0.558123015782794</td>
</tr>
</tbody>
</table>
Finally the expert selected Kumaraswamy distribution.
The analyst can calculate (with the aid of Easyfit) the value of the selected risk measures.

1. The cumulative distribution function.
2. The quantiles.
Selected **risk measures** based on the distribution:

<table>
<thead>
<tr>
<th><strong>the chance</strong> that the selling price will <strong>not exceed</strong> 4700 PLN/m²</th>
<th>28%</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>the chance</strong> that the selling price will be <strong>higher than</strong> 5200 PLN/m²</td>
<td>31%</td>
</tr>
<tr>
<td><strong>the chance</strong> that the price will be located in the range between <strong>4900 PLN/m²</strong> and <strong>5300 PLN/m²</strong></td>
<td>36%</td>
</tr>
<tr>
<td><strong>the selling price</strong> at which the chances of the price <strong>not being lower</strong> than that price are <strong>80%</strong>.</td>
<td>4565 PLN/m²</td>
</tr>
</tbody>
</table>
Thank you for attention 😊