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

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ERES Bucharest 2014

AGENDA

Probability: CLASSICAL, STATISTICAL, SUBJECTIVE

HEURISTICS in estimation process

example

Applying the Easyfit software to estimate subjective probability distribution based on the percentiles specified by an expert

1. Classical (mathematical) definition of probability

P.S. Laplace

If an experiment can produced 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:

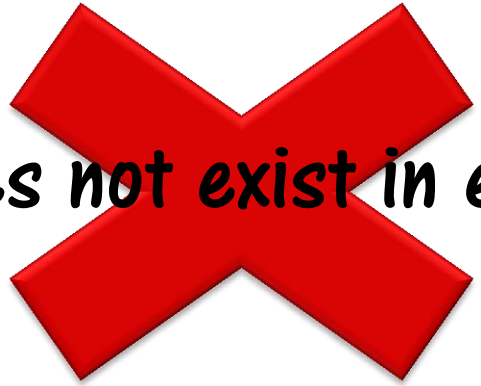
$$P(A) = \frac{\text{Number of outcomes favorable to } A}{\text{Number of possible outcomes}} = \frac{n}{N}$$


21 2 25 17 34
19 4 15 32 0 26 3 35 12 28
36 11 30 8 23 10 5 24 16

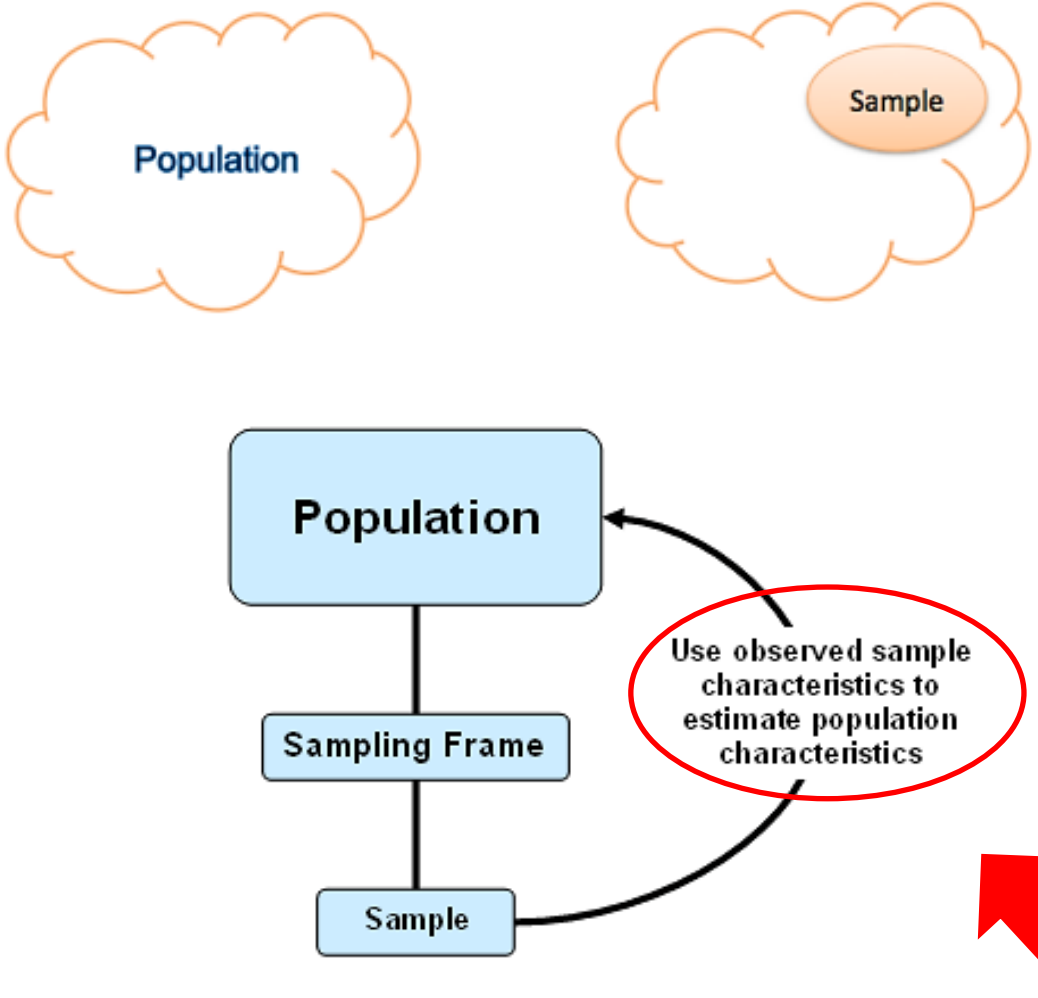

84 42 51 22 48
86 3 81 36
15 33 32 13 49

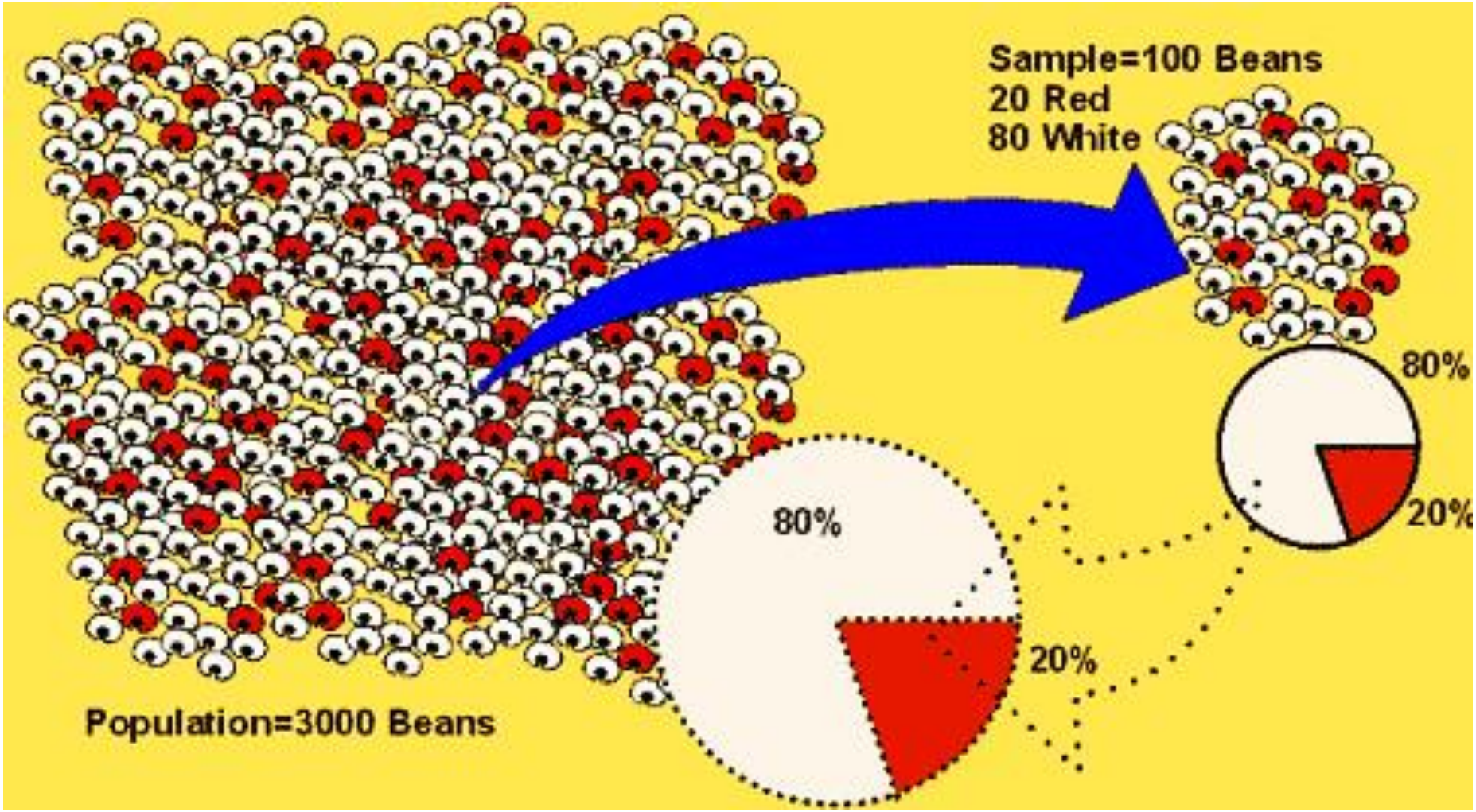
Classical probability

Practically does not exist in economic activity



2. Statistical probability




Sample=100 Beans
20 Red
80 White
80%
20%
80%
20%
Population=3000 Beans

Statistical probability

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:

❶ cities, big towns (large number of transaction)

❷ typical properties

❸ stable market condition

YES!

FOR RISK ASSESSMENT of real estate investment:

❶ small towns (little number of transaction)

❷ atypical properties

❸ 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

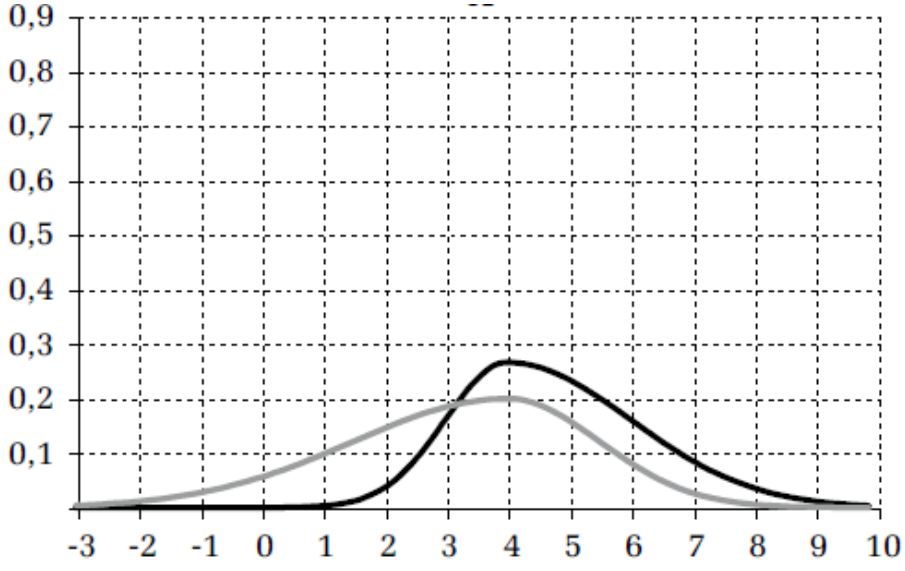
Subjective probability

value determined independently by 2 different people probably will vary

3. SUBJECTIVE (PERSONAL) PROBABILITY

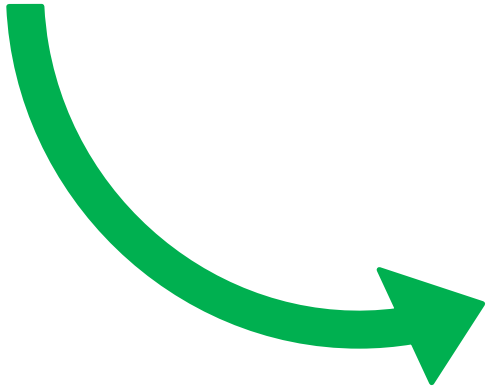
Subjective probability expresses the degree of someone's belief of the possibility of an event or the degree of belief in the truth of the hypothesis or the judgement.

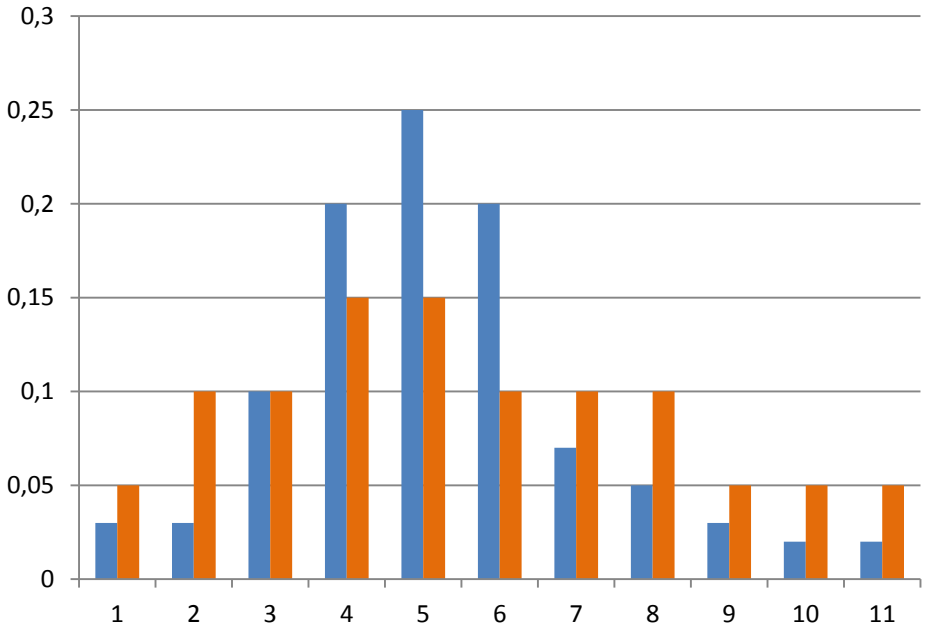
The expert describes his/her uncertainty about the various hypotheses eg. future value of 1m² of apartment.



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!

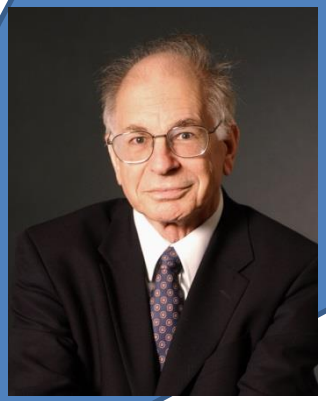
SMALL supply of information

Subjective probability and behavioral economics

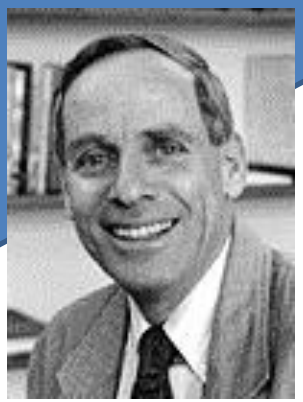
Behavioral factors may play an important role in risk assessment.

Cognitive and affective heuristics

HEURISTICS - simplified methods of inference and estimation.



D. Kahneman



A. Tversky

Cognitive and affective heuristics

- ⇨ anchoring and adjustement
- ⇨ 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

THE EXAMPLE

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).

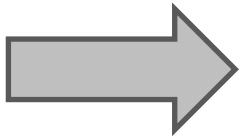
- investment was not a typical investment on the given local market,
- the analyst decided to ask for an **expert opinion**,

The AIM:

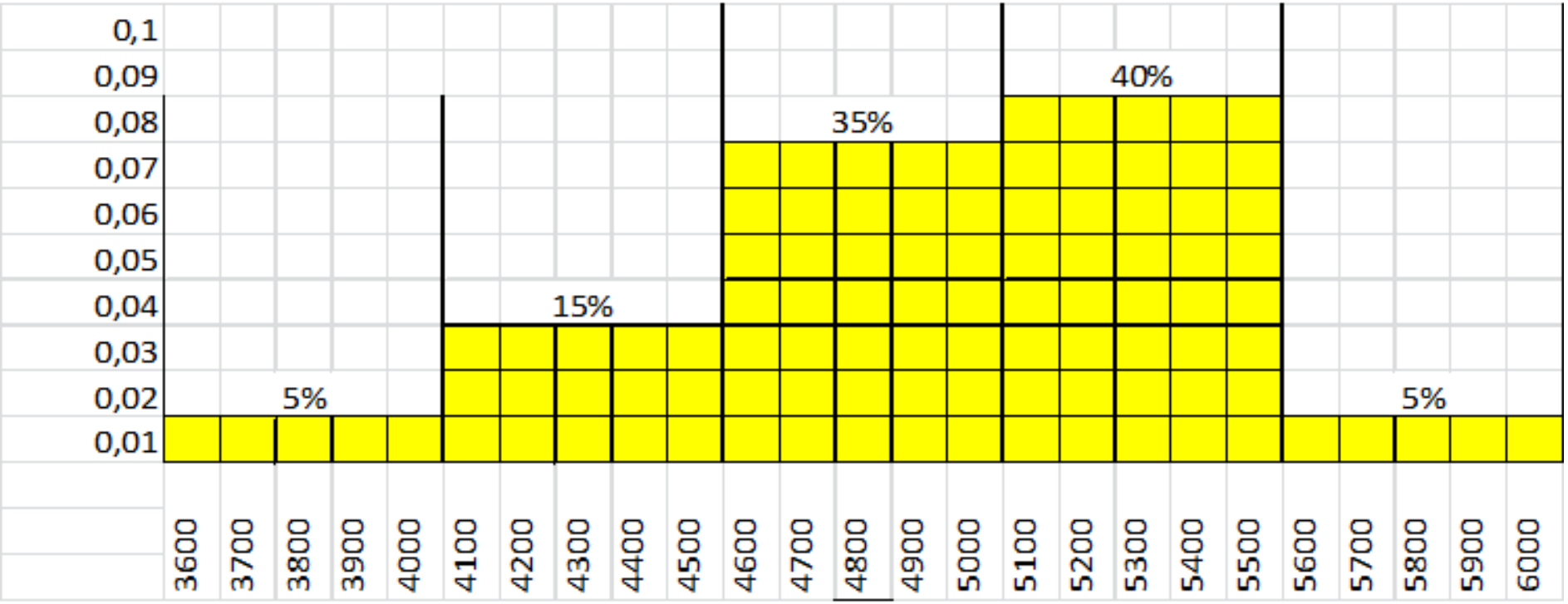
to determine the distribution of subjective probability.

- 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.



probability

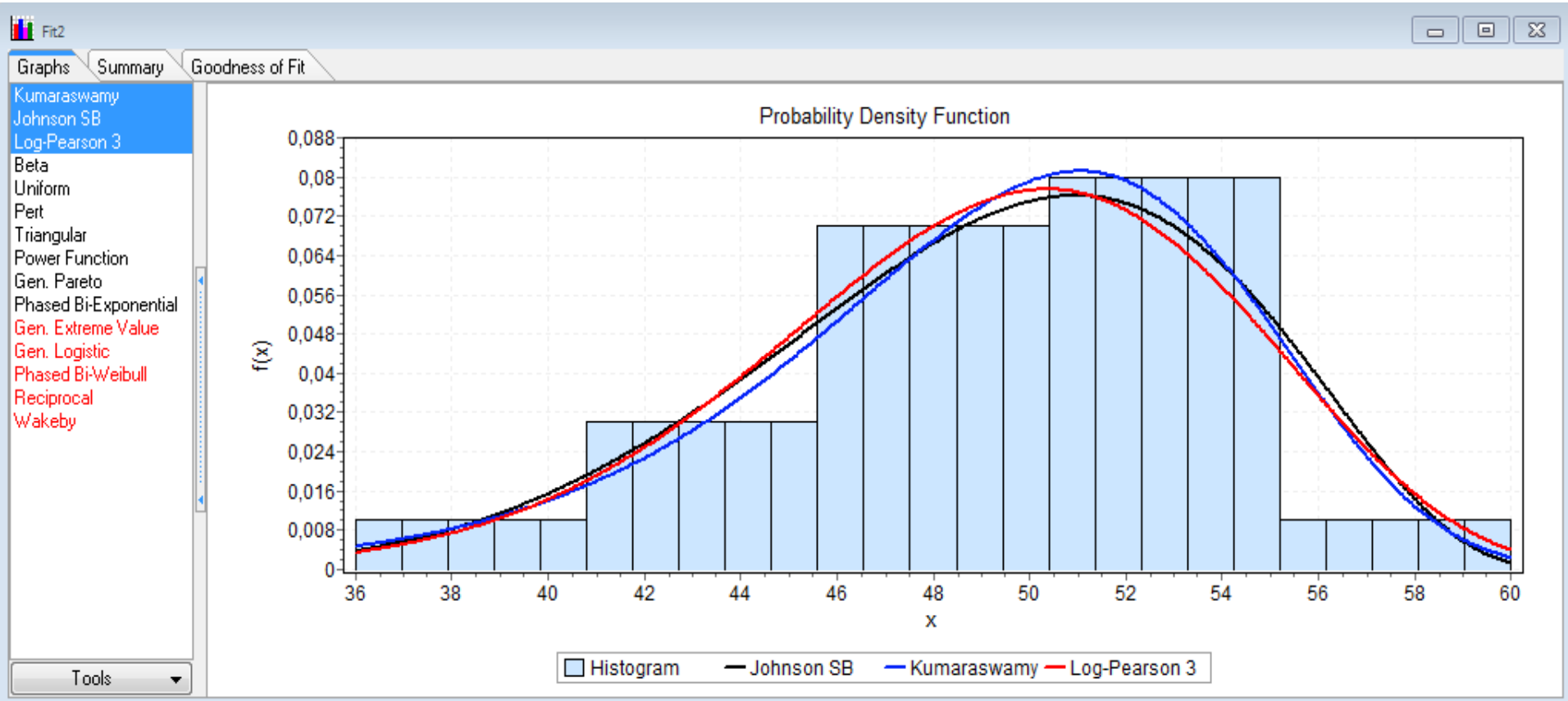


Prices (PLN/1m2)

The analyst with the **aid of the Easyfit package** determined the best suited continuous probability density distributions.

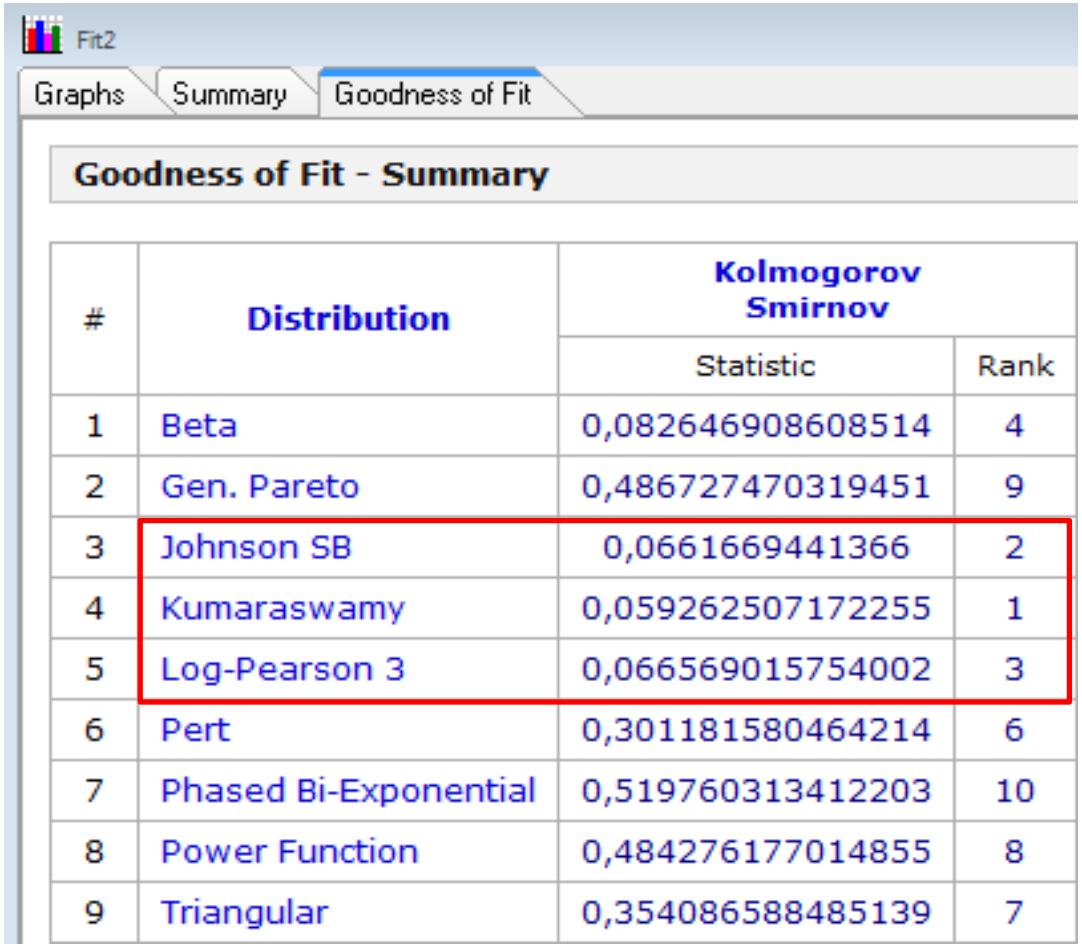
The Easyfit package fixed 3 best suited distributions:

1) Kumaraswamy distribution,
2) Johnson SB distribution,
3) Log – Pearson 3 distribution.


Fit2
Graphs
Summary
Goodness of Fit
Kumaraswamy
Johnson SB
Log-Pearson 3
Beta
Uniform
Pert
Triangular
Power Function
Gen. Pareto
Phased Bi-Exponential
Gen. Extreme Value
Gen. Logistic
Phased Bi-Weibull
Reciprocal
Wakeby
Tools
Probability Density Function
f(x)
0,088
0,08
0,072
0,064
0,056
0,048
0,04
0,032
0,024
0,016
0,008
0
36
38
40
42
44
46
48
50
52
54
56
58
60
x
Histogram
Johnson SB
Kumaraswamy
Log-Pearson 3


Histogram
Johnson SB
Kumaraswamy
Log-Pearson 3

On the adoption of a statistical significance of 0,1, we can consider these distributions as well-suited.


Fit2

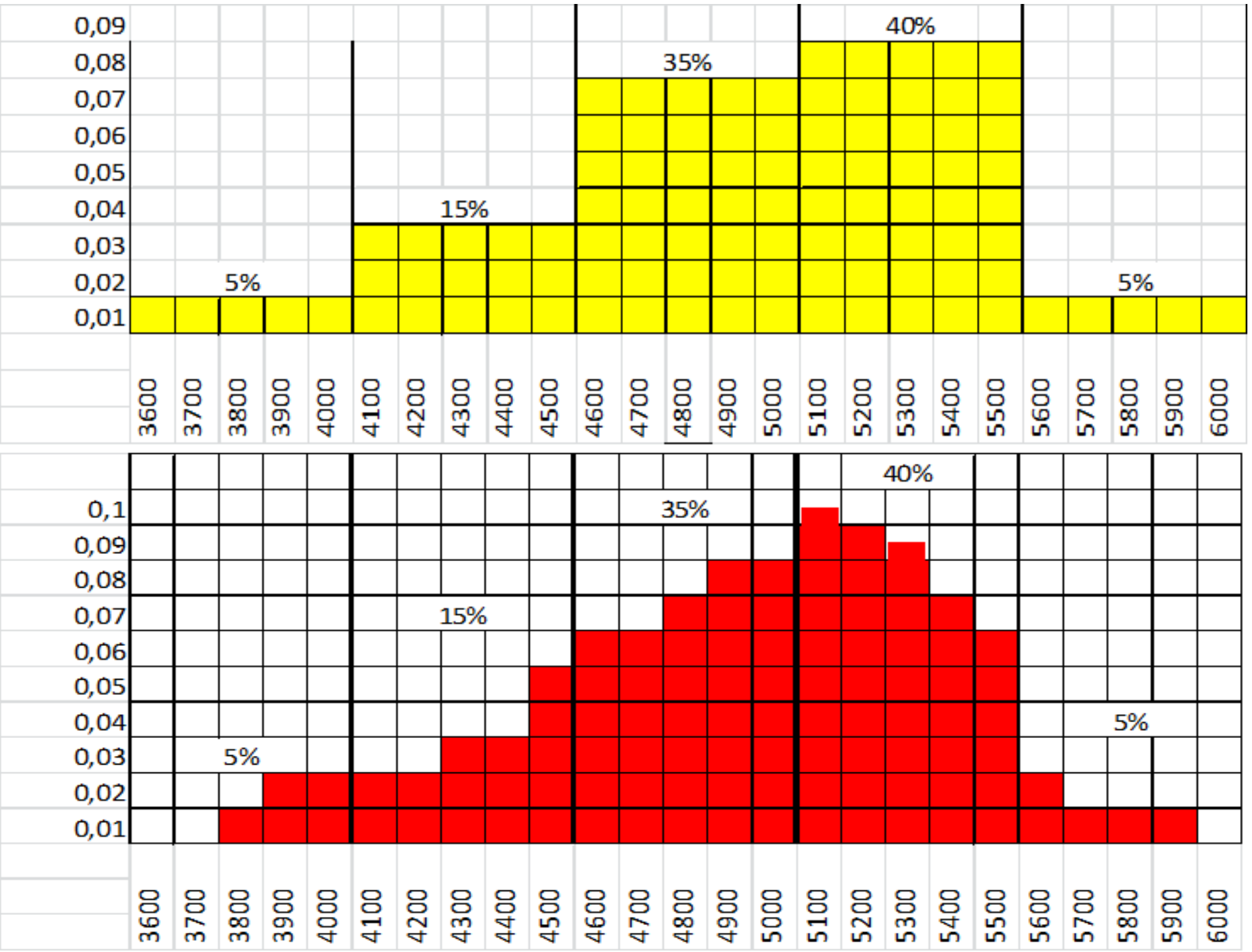
Graphs | Summary | Goodness of Fit

Goodness of Fit - Summary

#	Distribution	Kolmogorov Smirnov	
		Statistic	Rank
1	Beta	0,082646908608514	4
2	Gen. Pareto	0,486727470319451	9
3	Johnson SB	0,0661669441366	2
4	Kumaraswamy	0,059262507172255	1
5	Log-Pearson 3	0,066569015754002	3
6	Pert	0,301181580464214	6
7	Phased Bi-Exponential	0,519760313412203	10
8	Power Function	0,484276177014855	8
9	Triangular	0,354086588485139	7

After watching the graphs the expert stated that none of the 3 distributions was adequate

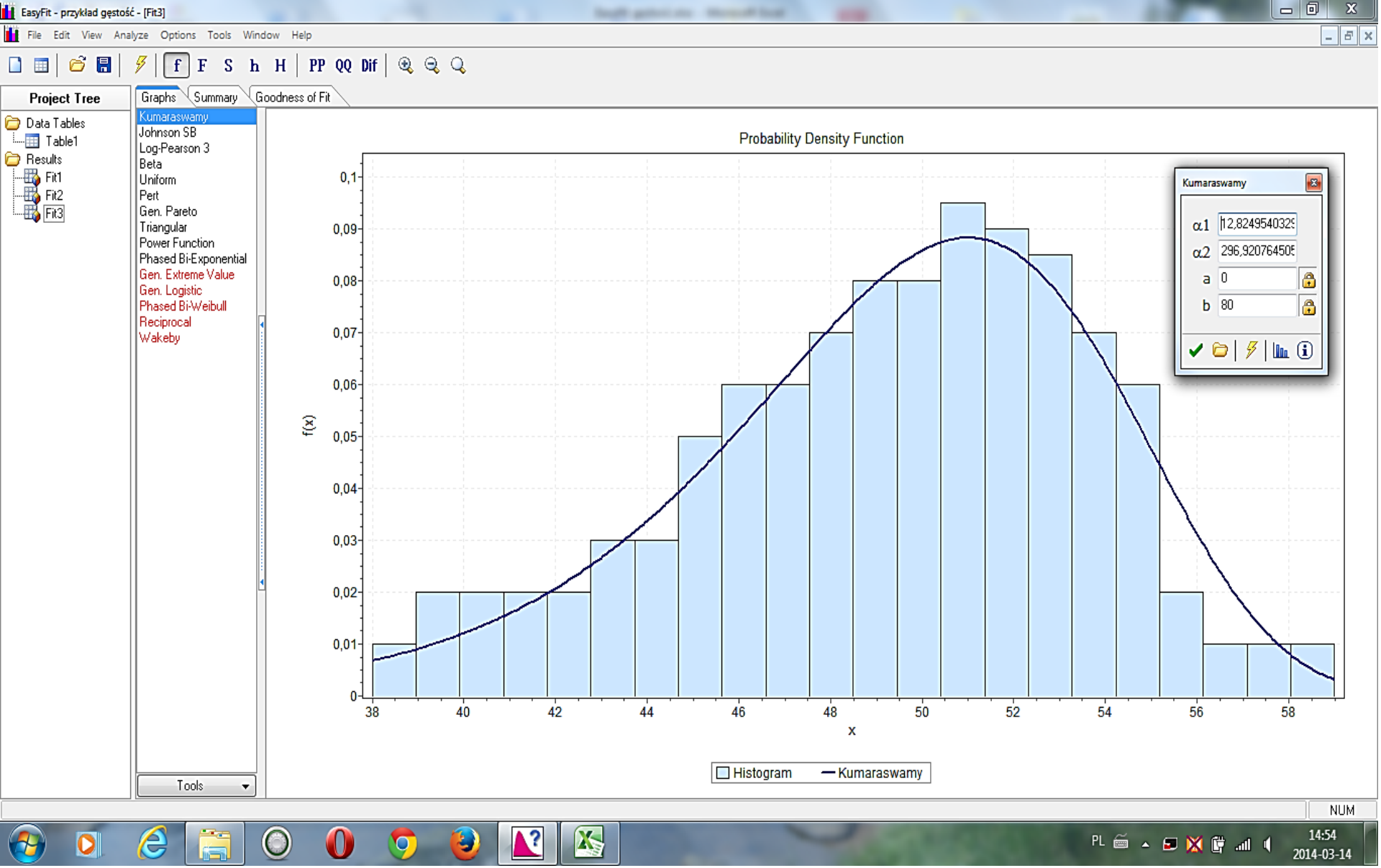
He made more specific evaluations


0,09
0,08
0,07
0,06
0,05
0,04
0,03
0,02
0,01
40%
35%
15%
5%
5%
3600
3700
3800
3900
4000
4100
4200
4300
4400
4500
4600
4700
4800
4900
5000
5100
5200
5300
5400
5500
5600
5700
5800
5900
6000
0,1
0,09
0,08
0,07
0,06
0,05
0,04
0,03
0,02
0,01
40%
35%
15%
5%
5%
3600
3700
3800
3900
4000
4100
4200
4300
4400
4500
4600
4700
4800
4900
5000
5100
5200
5300
5400
5500
5600
5700
5800
5900
6000

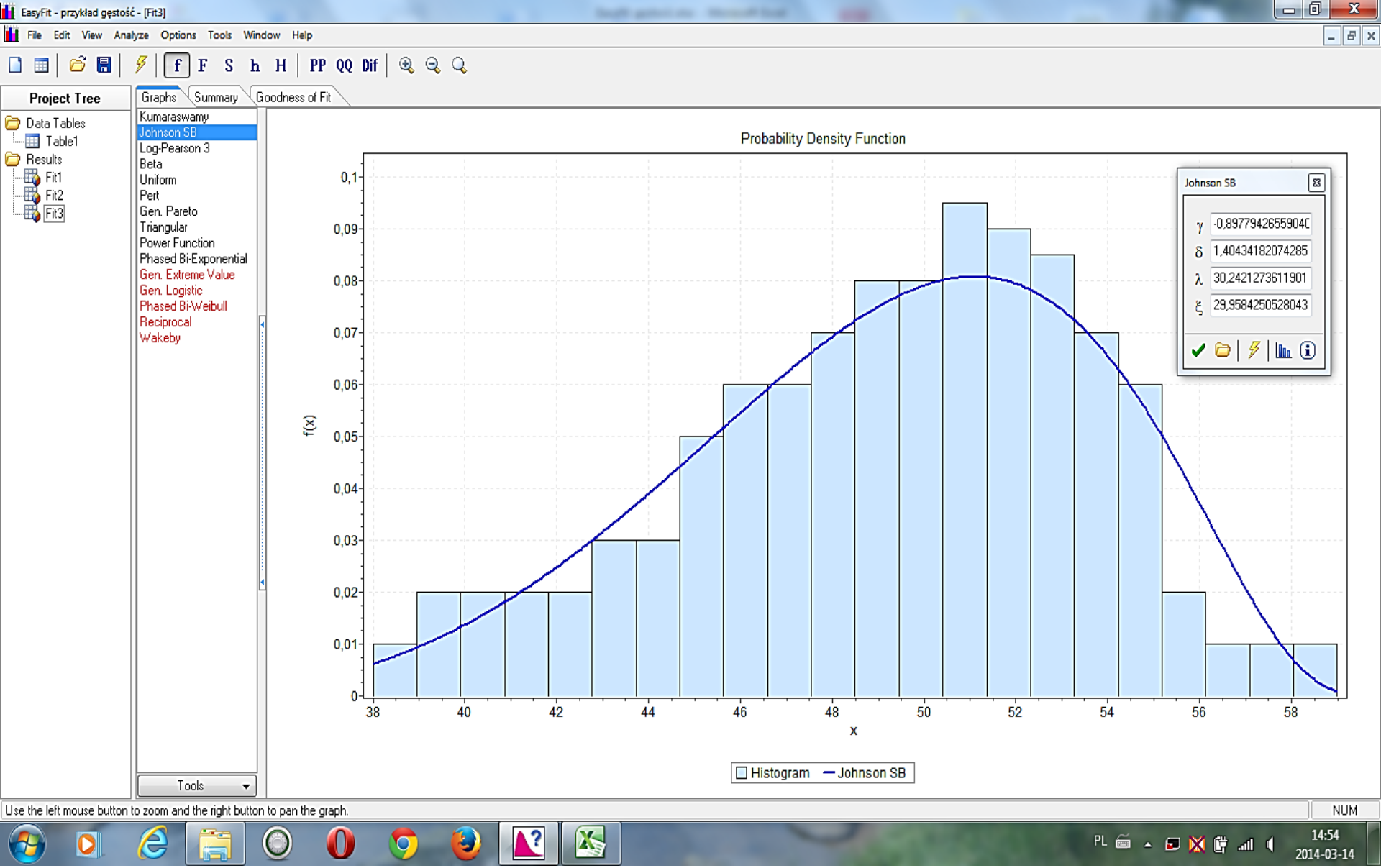
The Easyfit was used once more.

The best suited distributions were:

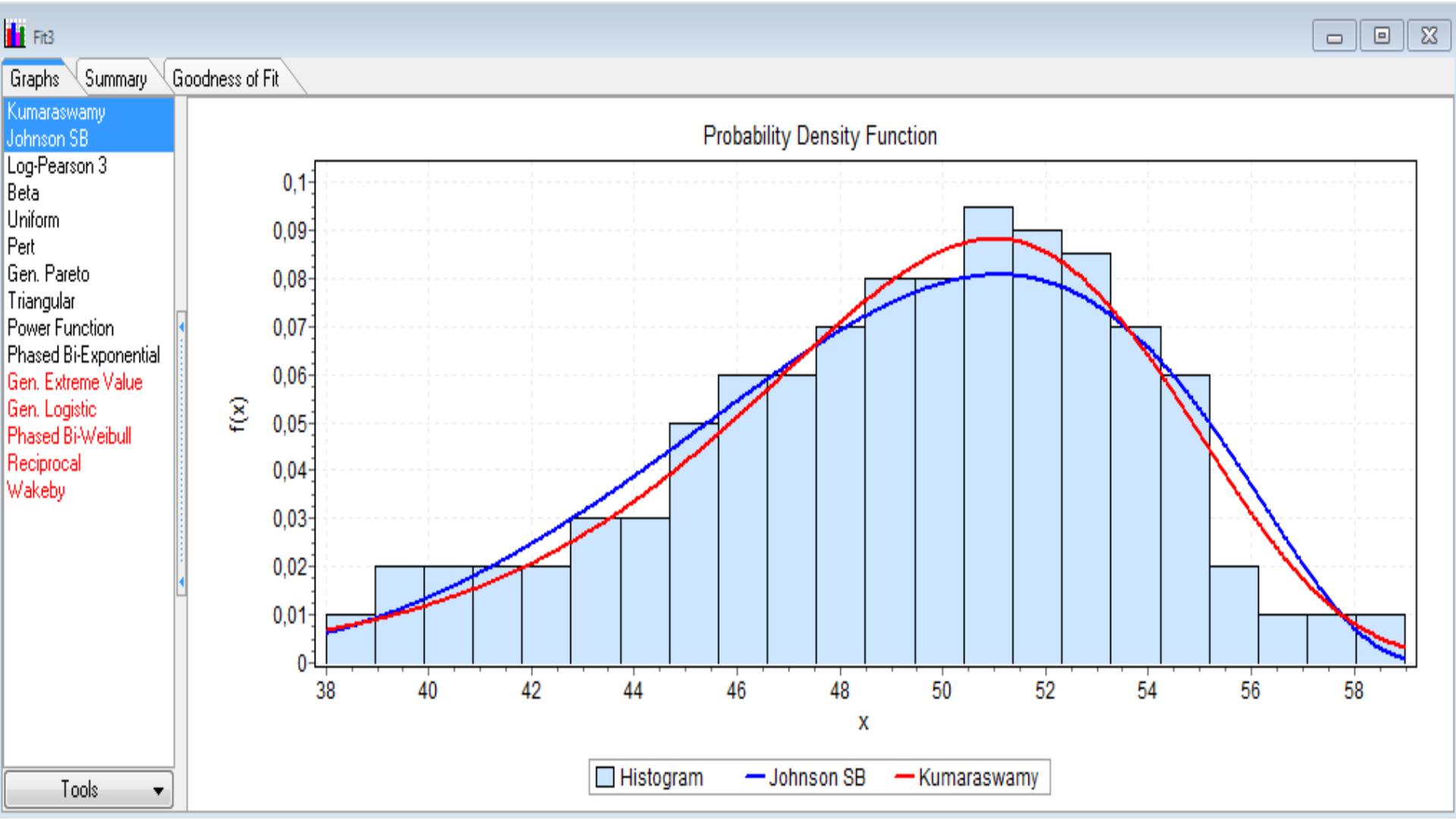
1) *Kumaraswamy* distribution,
2) *Johnson SB* distribution.



Kumaraswamy distribution



Johnson SB distribution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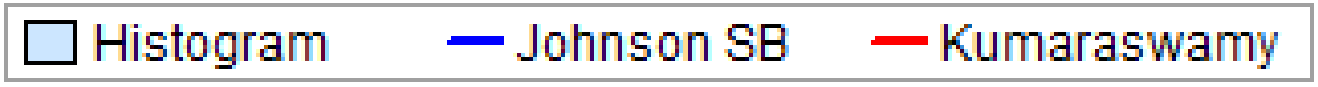
58
x
Histogram
Johnson SB
Kumaraswamy


Histogram
Johnson SB
Kumaraswamy

On the adoption of a statistical significance of 0,05, we can consider these distributions as well-suited.

Goodness of Fit - Summary

#	Distribution	Kolmogorov Smirnov	
		Statistic	Rank
1	Beta	0,090038023396739	4
2	Gen. Pareto	0,359154049086246	7
3	Johnson SB	0,054082626097958	2
4	Kumaraswamy	0,053166233124819	1
5	Log-Pearson 3	0,072751464859917	3
6	Pert	0,30203308292615	6
7	Phased Bi-Exponential	0,558123015782794	10

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:

the chance that the selling price will **not exceed 4700 PLN/m2**	**28%**
the chance that the selling price will be **higher than 5200 PLN/m2**	**31%**
the chance that the price will be located in the range between **4900 PLN/m2** and **5300 PLN/m2**	**36%**
the selling price at which the chances of the price **not being lower** than that price are **80%.**	**4565 PLN/m2**

Thank you for attention ☺