



Risk assessment of investment projects by the Monte Carlo method using Oracle Crystal Ball

Elena Malyh



Risk is part of all our lives

TYPES OF RISK OF THE INVESTMENT PROJECT

discrete risks

(strategic decisions)

continuous risks

(risks fluctuations in market factors)



disc rete risk s	a high level of risk	Decision Tree model	Real options method
	low risk	The Discounted Cash Flow Method	Monte Carlo model
		low risk	a high level of risk
continuous risks			

How does Crystal Ball work?

Crystal Ball is an easy-to-use simulation program that helps to analyze the risks and uncertainties associated with Microsoft Excel spreadsheet models.



ClearView Project

Costs (in millions U.S. dollars):

Development Cost of ClearView to Date	10,00
Testing Costs	4,00
Marketing Costs	16,00
Total Costs	30,00

Drug Test (sample of 100 patients):

Patients Cured	100
----------------	-----

Market Study (in millions U.S. dollars):

Persons in U.S. with Nearsightedness Today	40,00
Growth Rate of Nearsightedness	0,02
Persons with Nearsightedness After One Year	40,80

Gross Profit on Dosages Sold:

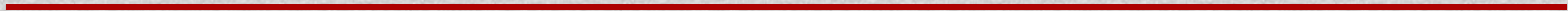
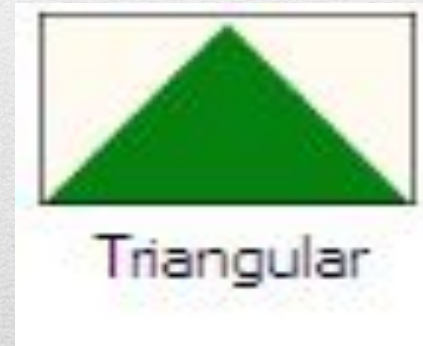
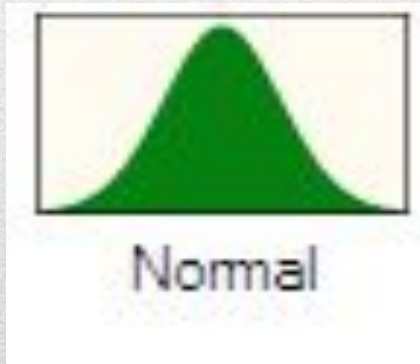
Market Penetration	0,08
Profit Per Customer In Dollars	12,00
Gross Profit if Approved (MM)	39,20

Net Profit (MM)

9,20

Identifying Uncertainty and Defining Assumptions

There are many types of distribution,
but the most used are normal and triangular distribution



	A	B	C	E
1	ClearView Project			
2				
3	Costs (in millions):			
4	Development Cost of ClearView to Date		\$10.0	
5	Testing Costs		\$4.0	
6	Marketing Costs		\$16.0	
7	Total Costs		\$30.0	
8				
9	Drug Test (sample of 100 patients):			
10				
11				
12				
13	Market	<div style="border: 1px solid black; padding: 5px;"> <div style="background-color: #0056b3; color: white; padding: 2px;">Define Forecast: Cell C23 ✕</div> <div style="padding: 5px;"> Name: <input style="width: 80%;" type="text" value="Net Profit (MM)"/> 🇺🇸 ▼ Units: <input style="width: 80%;" type="text"/> 🇺🇸 </div> <div style="text-align: right; padding-top: 10px;"> <input type="button" value="OK"/> <input type="button" value="Cancel"/> <input type="button" value="Help"/> </div> </div>		
14				
15				
16				
17				
18	Gross Profit on Dosages Sold:			
19	Market Penetration		8.00%	
20	Profit Per Customer in Dollars		\$12.00	
21	Gross Profit if Approved (MM)		\$39.2	
22				
23	Net Profit (MM)		\$9.2	

	A	B	C	E	F	G
1	ClearView Project					
2						
3	Costs (in millions):					
4		Development Cost of ClearView to Date	\$10.0			
5		Testing Costs	\$4.0			
6		Marketing Costs	\$16.0			

Define Assumption: Cell C6

Edit View Parameters Preferences Help

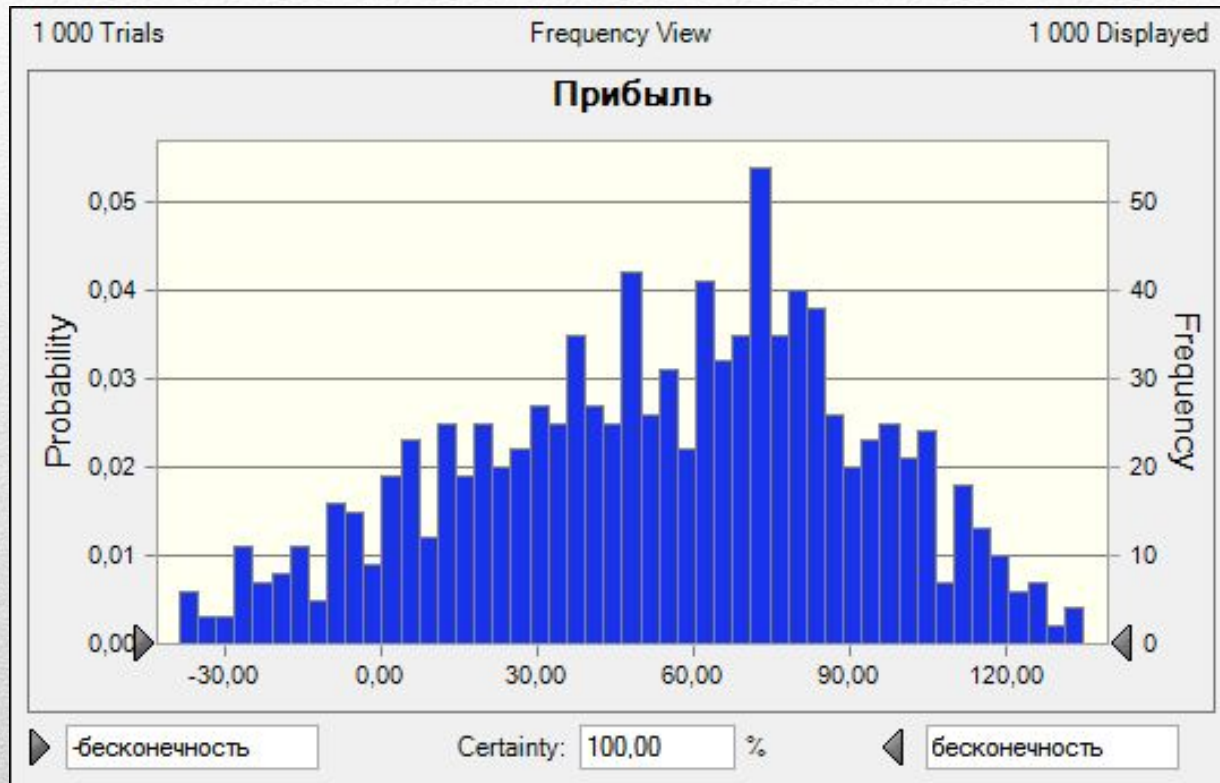
Name: Marketing Costs

Triangular Distribution

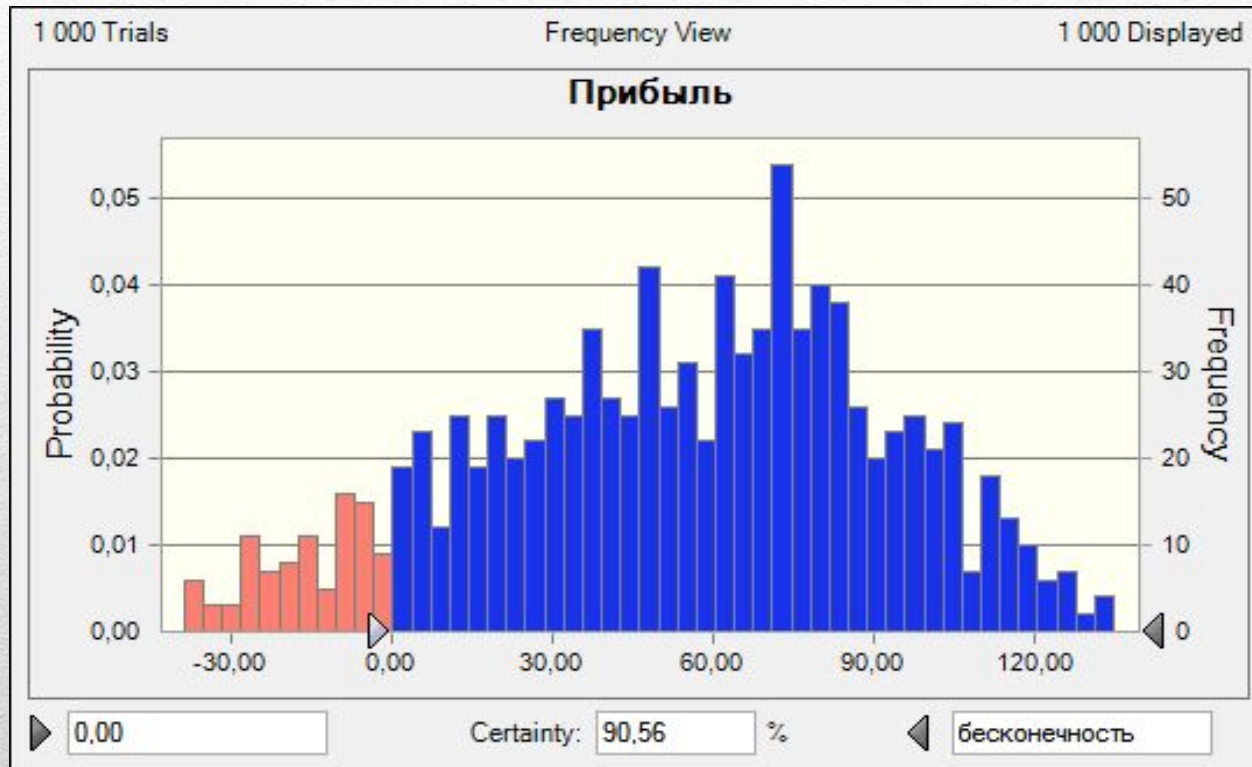
Minimum: \$14.0 Likeliest: \$16.0 Maximum: \$19.0

OK Cancel Enter Gallery Correlate... Help

Analyzing Simulation Results

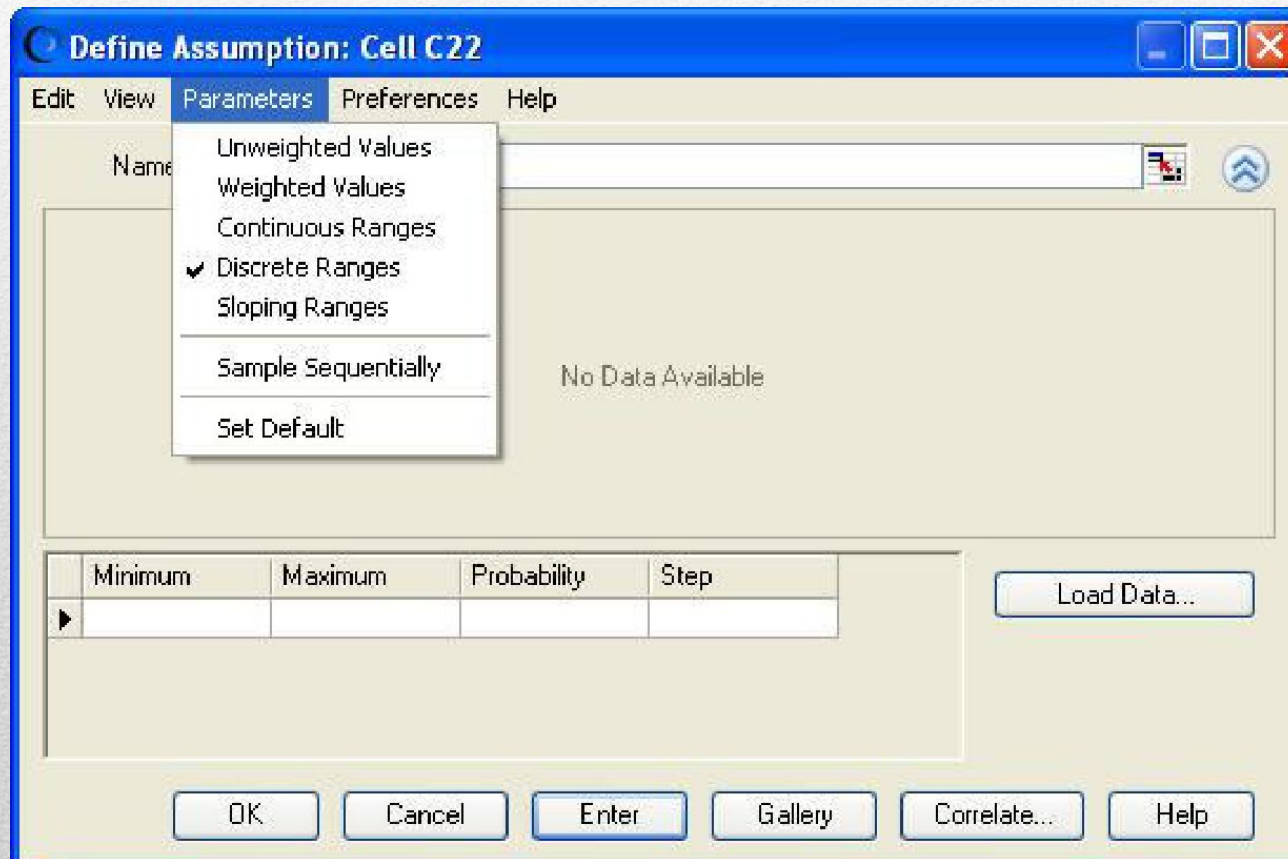


Analyzing Simulation Results

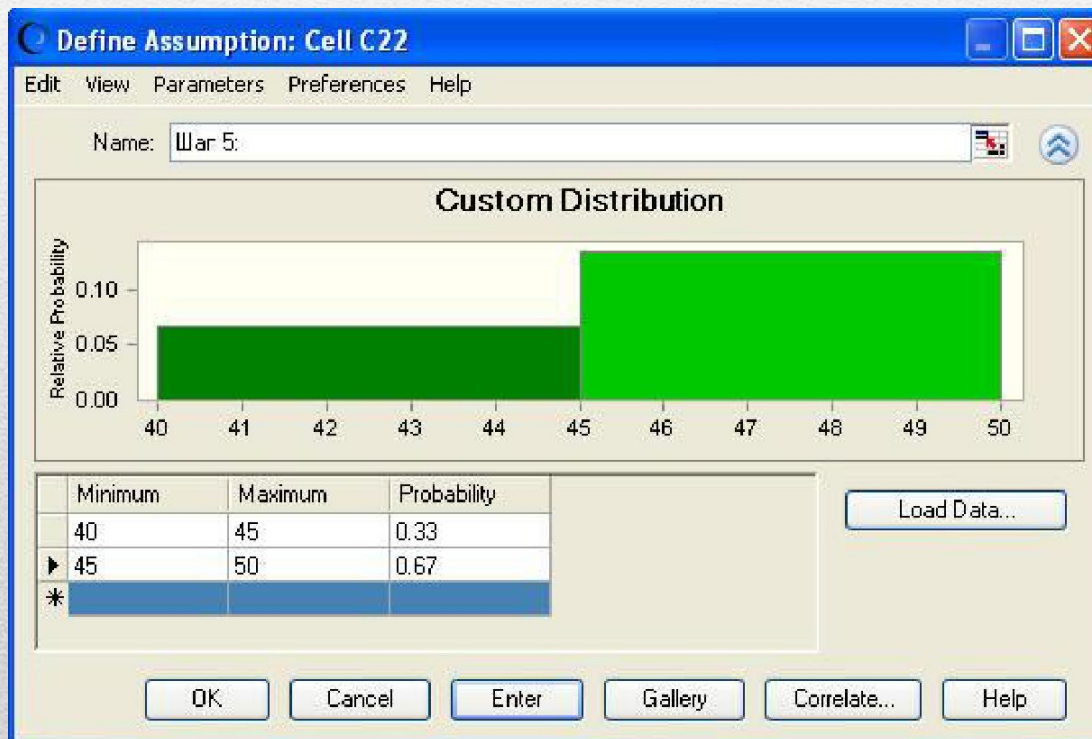


Trials	1 000	The number of trials
Mean	53,60	The sample mean value
Median	57,49	The argument value that divides the histogram of the probability density into two equal parts
Mode	---	The most frequently occurring value in the sample
Standard Deviation	37,55	The standard deviation
Variance	1 409,80	
Skewness	-0,2626	The "skewness" of the triangle < 0 left > 0 right
Kurtosis	2,39	"Slenderness" of the triangle 3,4 normal
Coeff. of Variability	0,7005	Standard deviation
Minimum	-38,92	The minimum value
Maximum	134,74	The maximum value
Range Width	173,66	Range width
Mean Std. Error	1,19	Standard error

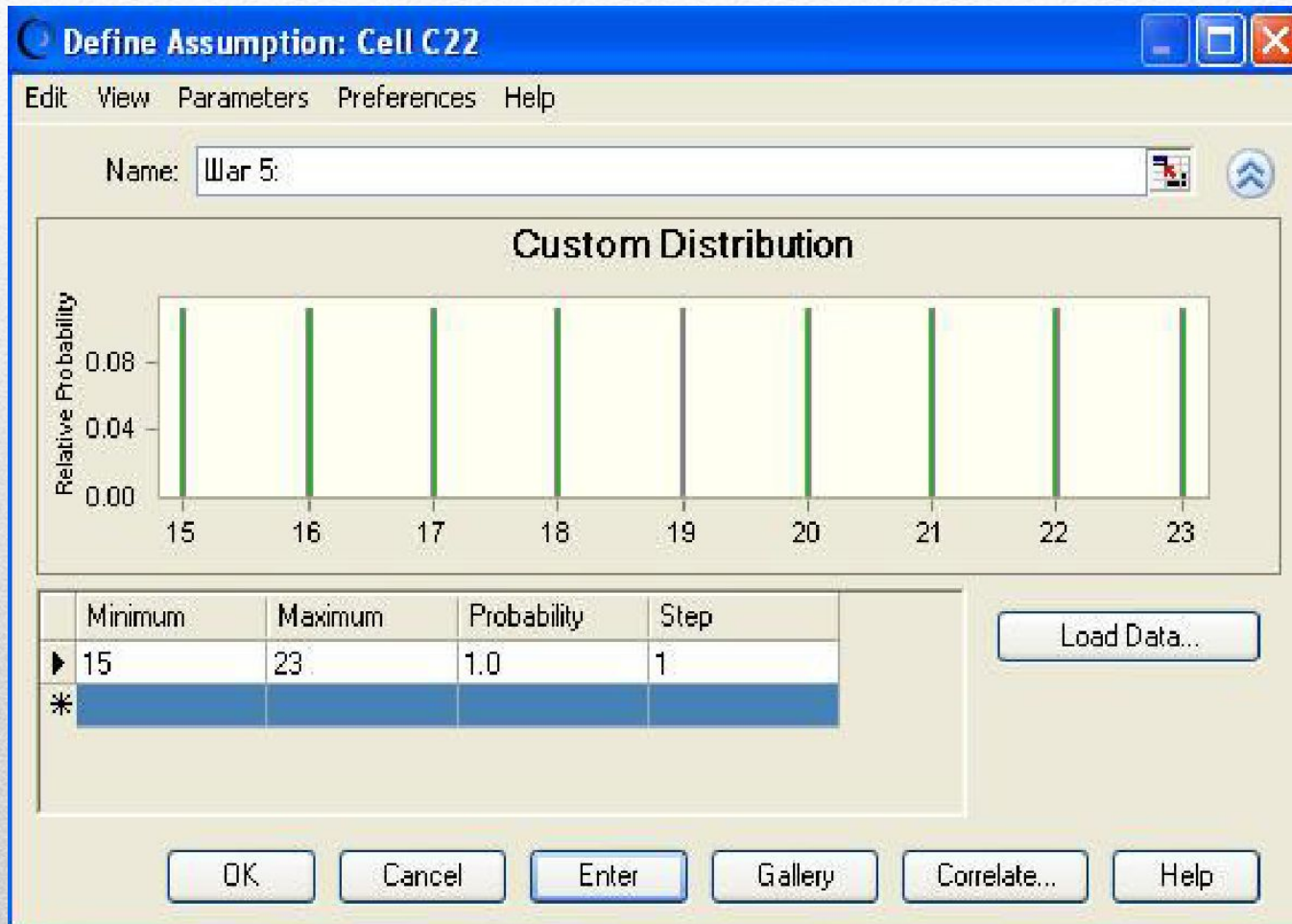
When you specify this type of distribution, you must specify a set of parameters that may vary depending on the amount of information available.



The definition of custom continuous distribution




The definition of a discrete custom distribution



The definition of a custom distribution based on available data

	A	B	C	D	E	F
1	Value	Value2	Prob.	Step	(Type)	
2	10	20	0.2		Continuous Range	
3	20	30	0.1		Continuous Range	
4	40	50	0.3		Continuous Range	
5	60	80	0.3	1	Discrete Range	
6	90		0.05		Single Value	
7	100		0.05		Single Value	
8						

Load Data

Location of data: 

Link

Keep linked to spreadsheet

Static reference

Dynamic reference

Existing distribution



Replace

Append

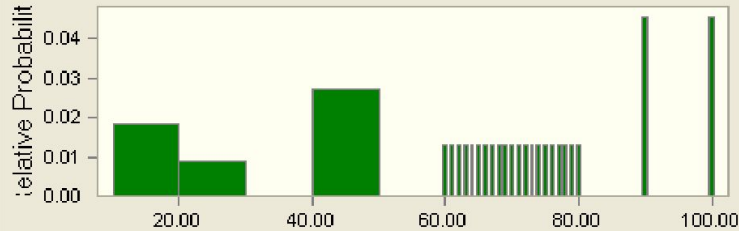
Probabilities are cumulative

Define Assumption: Cell B9

Edit View Parameters Preferences Help

Name:  

Custom Distribution



Minimum	Maximum	Probability	Step
▶ 10.00	20.00	0.2	
20.00	30.00	0.1	
40.00	50.00	0.3	
60.00	80.00	0.3	1.00
90.00		0.05	
100.00		0.05	

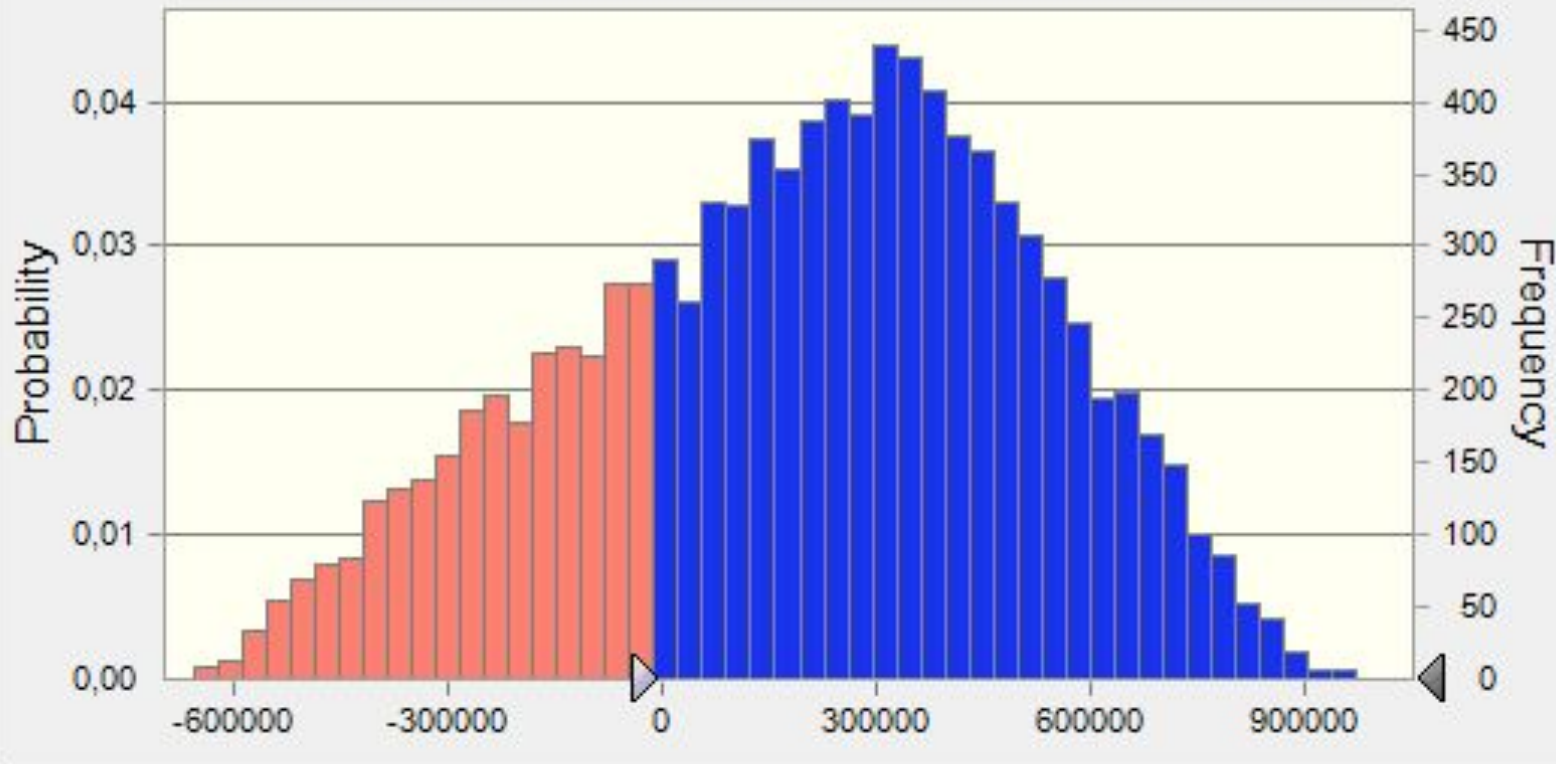
	0 year	1 year	2 year	3 year
Price		6	6,05	6,1
The number of sold		802000	967000	1132000
Revenue		4812000	5850350	6905200
Cost, % of sales	55%			
The cost		2646600	3217693	3797860
Gross profit		2165400	2632658	3107340
Transaction costs		324810	394899	466101
Net income before taxes		1840590	2237759	2641239
Taxes (32%)		588989	716083	845196
Initial investment	-3400000			
Net income		1251601	1521676	1796043
NPV	344796			

10 000 Trials

Frequency View

10 000 Displayed

NPV

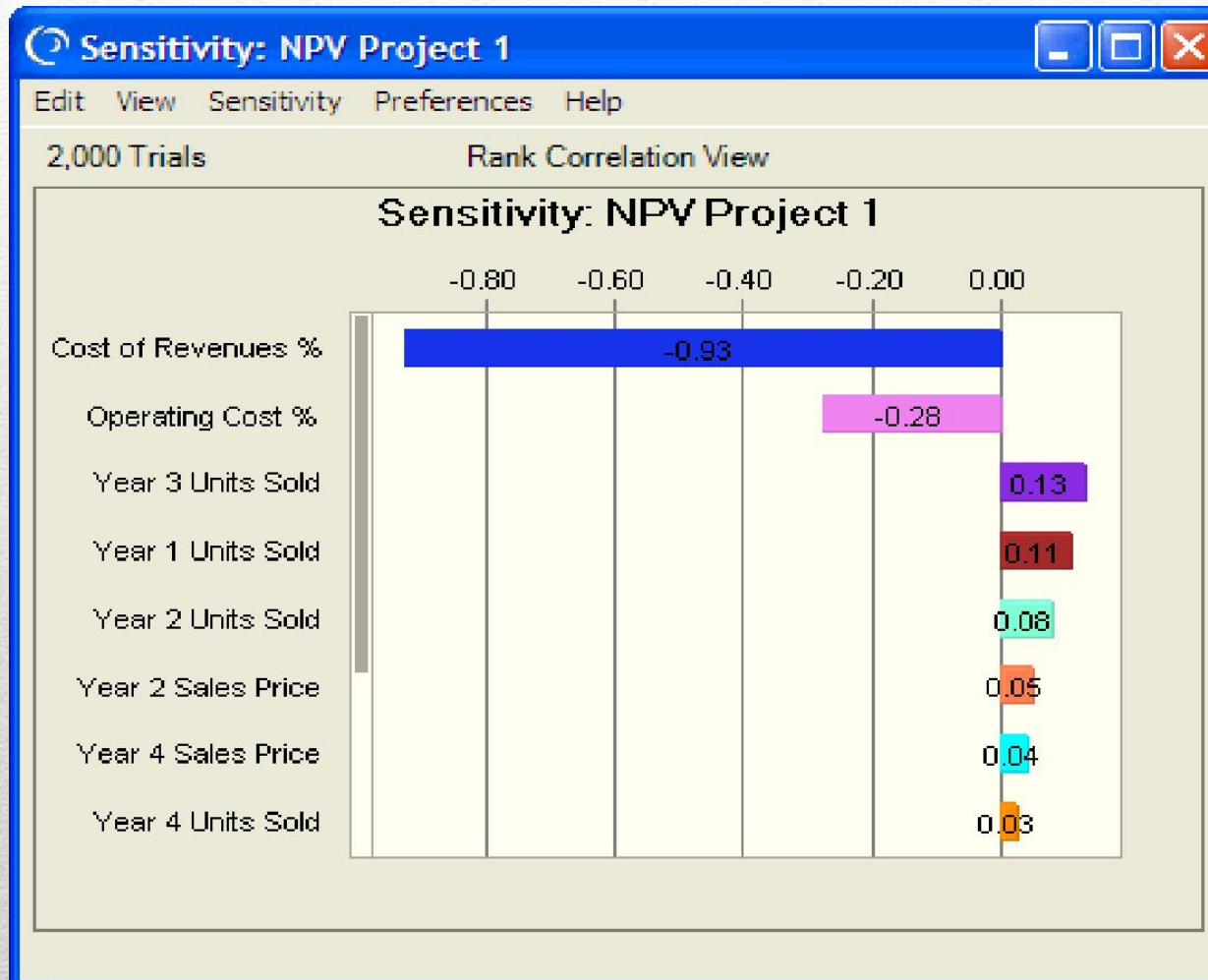


▶ 0

Certainty: 72,24 %

◀ бесконечность

DIAGRAM OF SENSITIVITY





**THANK YOU FOR YOUR
ATTENTION**
