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Small Business Valuation with Use of Cash Flow Stochastic Modeling

FORMULATION OF THE PROBLEM

- * Value based management (VBM) is grounded on value maximization.
- * To conduct VBM concept one needs tools providing easy and fast value estimation, key value drivers detection and support in making decisions leading to company value gain.
- * The aim of this paper is to create a toolkit for fast prediction of company dynamics in case of different managerial decisions and to get risk estimations.

IMITATIONAL MODELING APPLICATION TECHNIQS ON FINITE-DIFFERENCE EQUATION BASIS

- * According to the chosen approach, a company is described as a vector, in which the components are financial parameters. Vector dynamics is described by employing finite-difference equations

$$A_t = F(A_{t-1})$$

- * There are no principal difficulties with realization of this approach, but the practical solution faces a number of issues:
 - * - Construction of a model
 - * - Determination of parameters
 - * - Analysis of forecast uncertainty

VECTOR COMPONENTS CAN BE DIVIDED IN THREE GROUPS

Internal

REV(t) – revenues from sales,
CGS(t) – cost of sales,
NWC(t) – net working capital,
FA(t) – fixed assets,
NET(t) – net profit,
E(t) – equity.

External
TAX(t) – taxes.

Managerial

D(t) – debt,
PAY(t) – annual payment,
DIV(t) – dividends.

Thoughtful description of business processes in the company.

Profit and Loss Statement

$$REV(t) = \frac{FA(t-1)}{a_7}$$

$$CGS(t) = a_1 REV(t) = \frac{a_1}{a_7} FA(t-1)$$

$$NWC(t-1) = a_6 * REV(t)$$

$$PAY(t) = D(1) * \left(a_2 + \frac{a_2}{(1+a_2)^{n-1}} \right)$$

$$TAX(t) = a_3 (REV(t) - CGS(t) - PAY(t))$$

$$NET(t) = REV(t) - CGS(t) - PAY(t) - TAX(t)$$

Parameters:

- * a_1 – cost (percentage of revenue),
- * a_2 – debt interest rate,
- * a_3 – tax rate,

Vector components:

- * $REV(t)$ – revenues from sales,
- * $CGS(t)$ – cost of sales,
- * $NWC(t)$ – net working capital,
- * $FA(t)$ – fixed assets,
- * $NET(t)$ – net profit,
- * $PAY(t)$ – annual payment,
- * $D(1)$ – debt at the start of the period,
- * $TAX(t)$ – taxes.

- * a_6 – coefficient that shows the ratio between revenue and net working capital,
- * a_7 – coefficient that shows the ratio between revenue and fixed assets.

Thoughtful description of business processes in the company.

Assets

$$FA(t) = FA(t - 1) + \text{deltaFA}(t)$$

$$NWC(t) = NWC(t - 1) + \text{deltaNWC}(t)$$

$$E(t) = FA(t) + NWC(t - 1) - D(t - 1)$$

$$\text{deltaFA}(t) = \frac{a_7}{a_6 + a_7} * (\text{NET}(t) - \text{DIV}(t))$$

$$\text{deltaNWC}(t) = \frac{a_6}{a_6 + a_7} * (\text{NET}(t) - \text{DIV}(t))$$

Vector components:

- * NET(t) – net profit,
- * NWC(t)– net working capital,
- * FA(t) – fixed assets,
- * DIV(t) – dividends,
- * E(t) – equity,
- * deltaFA(t) – change of fixed assets,

- * deltaNWC(t) - change of net working capital.

Parameters:

- * a_6 – coefficient that shows the ratio between revenue and net working capital,
- * a_7 – coefficient that shows the ratio between revenue and fixed assets.

Thoughtful description of business processes in the company.
What can be managed?

$$E(t = 1) = FA(t = 1) + NWC(t = 1)$$

$$D(t = 1) = a_8 * E(t = 1)$$

$$DIV(t) = a_5 * NET(t)$$

Vector components:

- * $NET(t)$ – net profit,
- * $DIV(t)$ – dividends,
- * $D(1)$ – debt at the start of the period,
- * $E(1)$ – equity at the start of the period.

Managerial parameters:

- * a_5 – the share of net profit that is distributed as dividends,
- * a_8 – a ratio between the amount of debt and the total equity of the company.

Business valuation

Cash flow can be determined with use of vector components

$$CF(t) = REV(t) - CGS(t) - PAY(t) - TAX(t) - \text{deltaNWC}(t) - \text{deltaFA}(t),$$

- * Present value of the company (PV) is determined with use of discounted cash flow method

$$PV = \sum_{t=1}^T \frac{CF(t)}{(1+r)^t} + \frac{FV}{(1+r)^T}$$

- * Where future value (FV, value by the end of forecast period) is calculated with use of Gordon formula

$$FV = \frac{CF(T)}{r - g}$$

- * Where
- * r – discount rate,
- * g – cash flow growth rate

SOFTWARE IMPLEMENTATION.

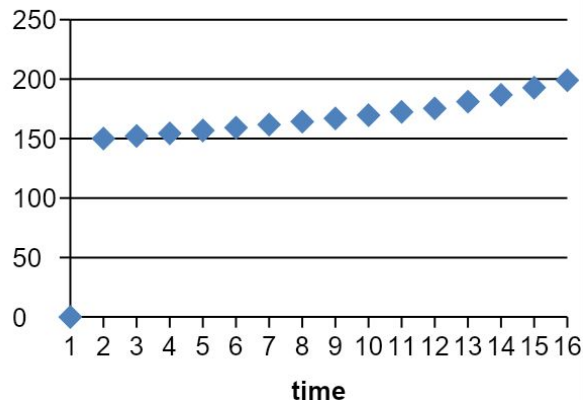
SCENARIO MODE

- * The result of the work of the program in the scenario mode is a consolidated reporting table in which you can find vector components, initial parameters and present value of the company.

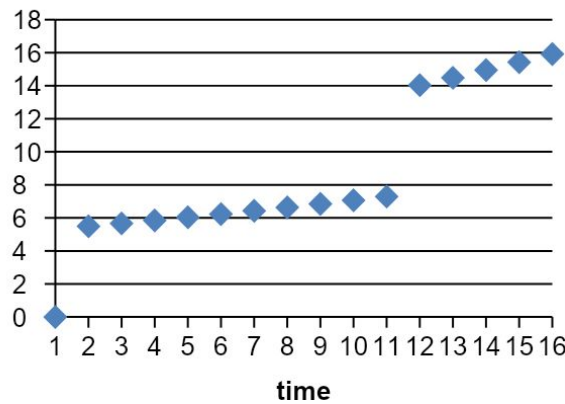
Forecast period, years	5
Initial capital, units	250
Discount rate, percent	10
Market growth rate, percent	2
Number of parameters	8
Cost, share of revenue	0,8
Credit period, years	10
Debt interest rate, share	0,1
Debt ratio, share of equity	0,8
Tax rate, share	0,2
Depreciation rate, share	0
Dividends, share	0,2
NWC needed to get REV, share	0,5
FA needed to get REV, share	1,5

We can observe forecasted financial statement of a company

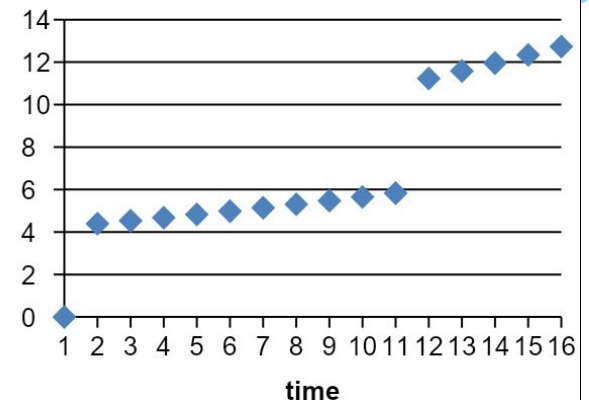
Revenue



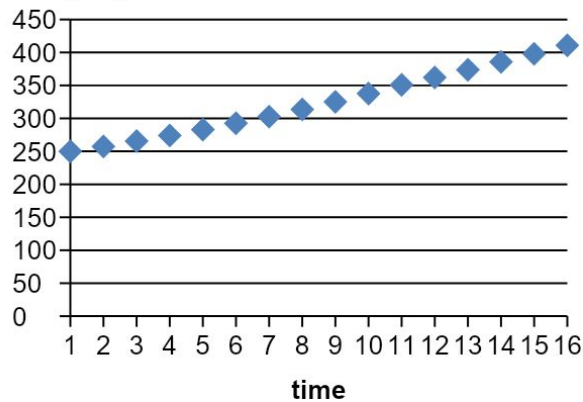
NET



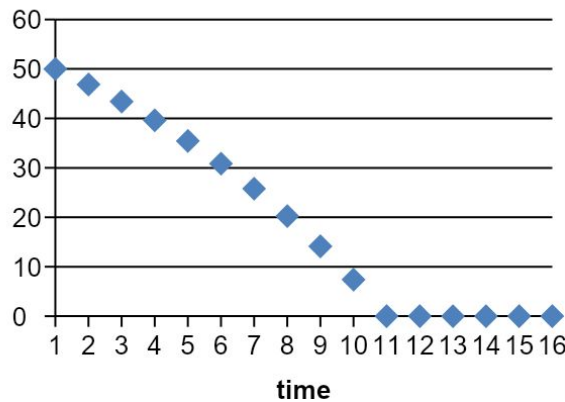
CF



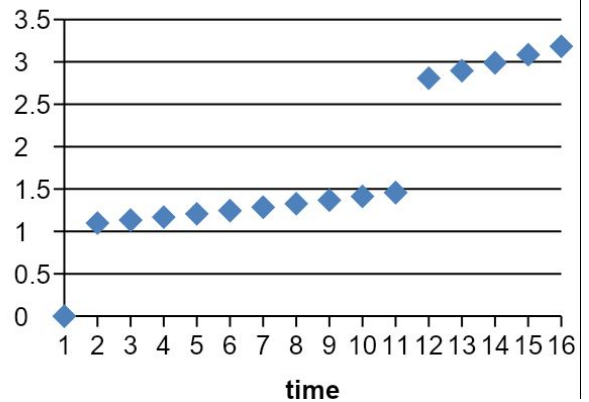
Equity



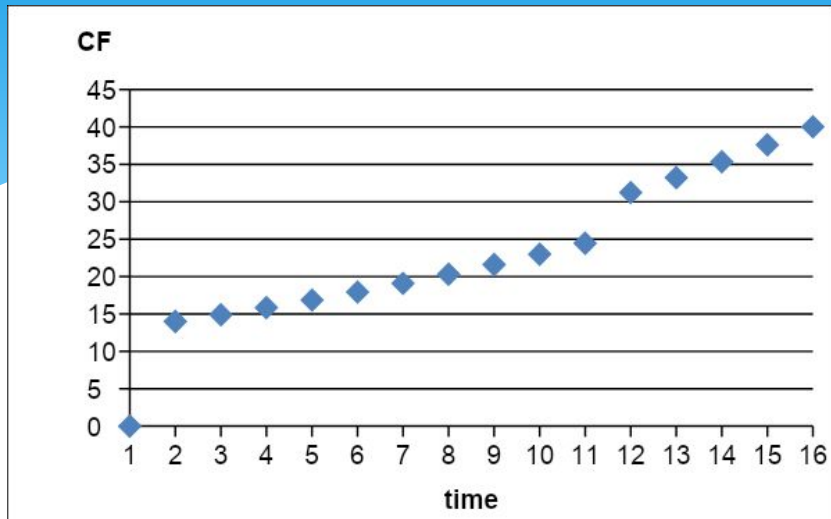
Debt



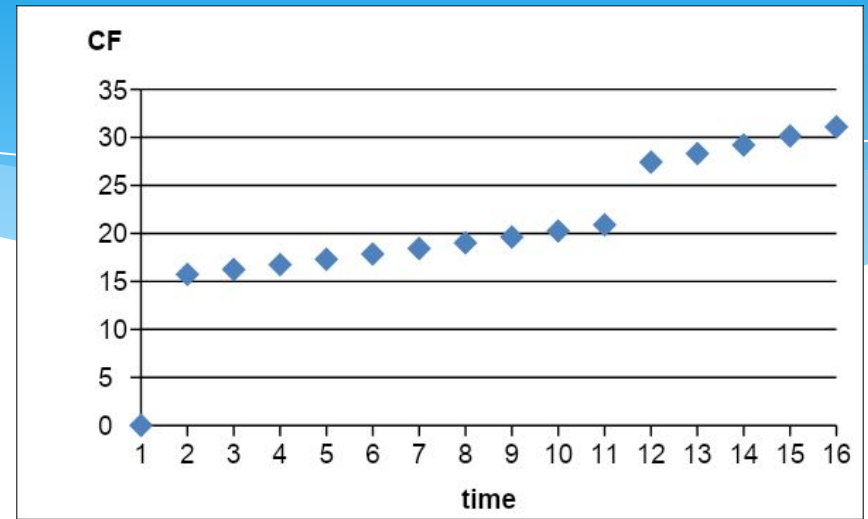
DIV



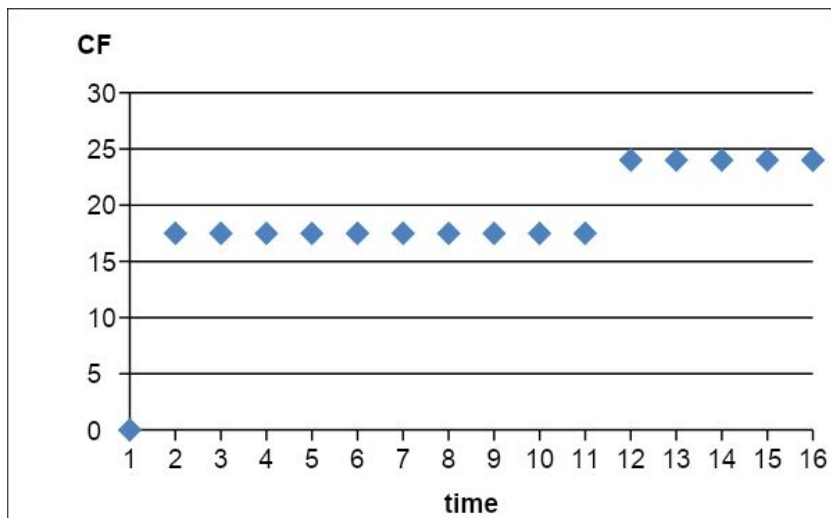
Observation of company dynamics for different parameters



Dividends, share	0,2
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Dividends, share	0,6
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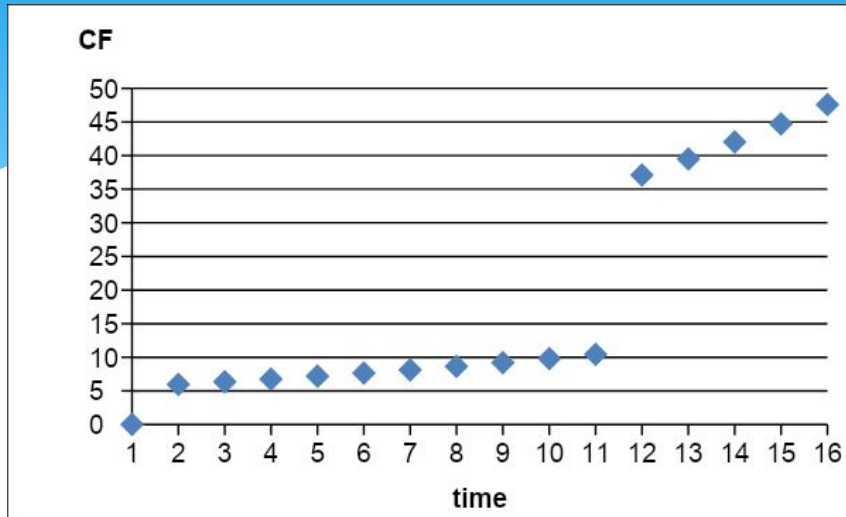


Dividends, share	1
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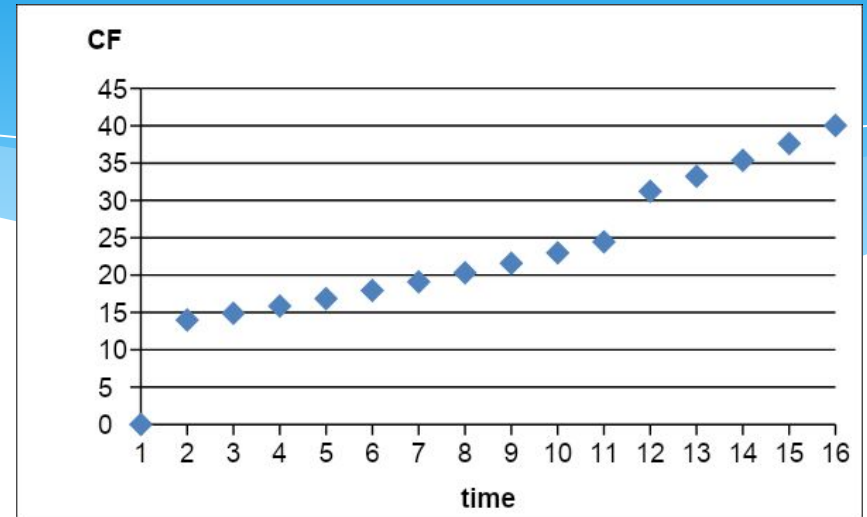
- * Charts for different values of share of dividends in net profit are listed. The comparison shows that the increase in share leads to decrease in intensity of cash flow growth. When all net profit is given to dividends, cash flow stays constant

Observation of company dynamics for different parameters.

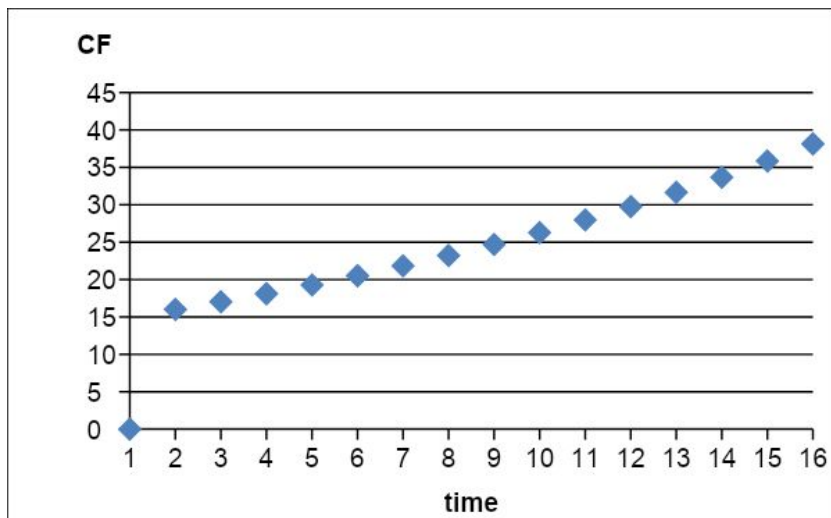
VBM



Debt ratio, share	1
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Debt ratio, share	0.2
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Debt ratio, share	0
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- * We can see the jump on upper charts. This jump reflects the fact that debt payments are finished.
- * On the bottom chart there is no jump, since there was no debt in the beginning of the period

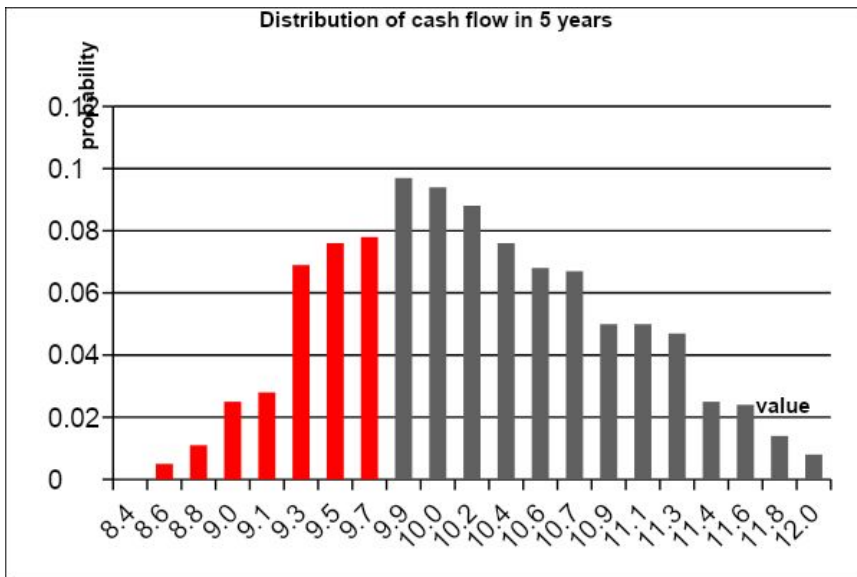
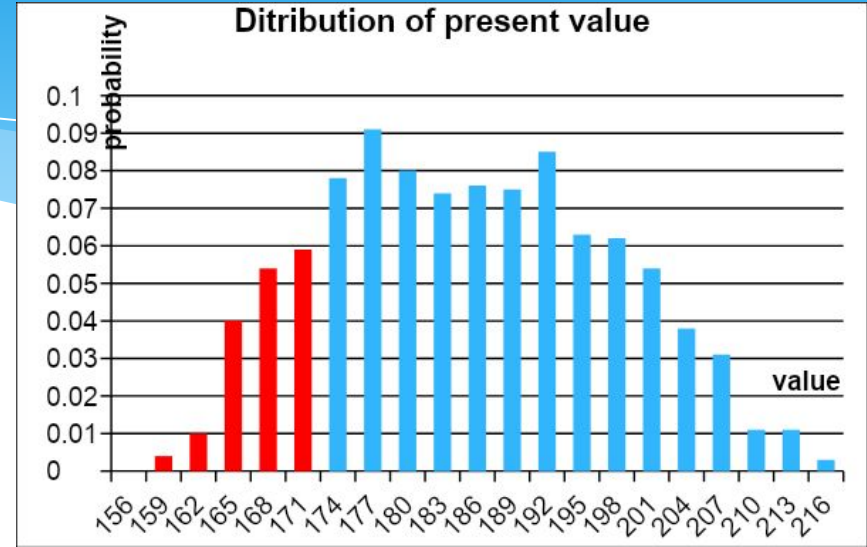
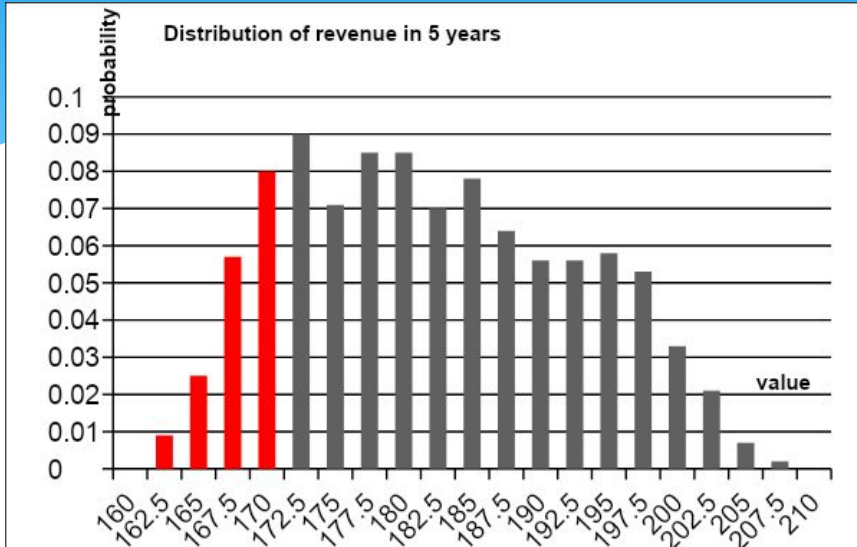
SOFTWARE IMPLEMENTATION.

RISK ANALYSIS MODE

- * Second mode is designed for risk analysis. The Monte-Carlo method is used here for random quantity formation. The table represents the configuration of data given to the program. Here three types of parameters are represented: domestic and external parameters which are uncertain and are set as intervals and managerial factors that are preset

Number of iterations, count	15
Number of realizations, count	1000
Initial capital, units	200
Discount rate, percent	5 - 15
Market growth rate, percent	1,5 - 2,5
Number of parameters	8
Cost, share of revenue	0,8
Credit period, years	10
Debt interest rate, share	0 - 0,2
Debt ratio, share of equity	0,8
Tax rate, share	0,1 - 0,3
Dividends, share	0,2
NWC needed to get REV, share	0,4 - 0,6
FA needed to get REV, share	1,4 - 1,6

Random distributions



- * Uncertainty in initial data generates uncertainty in final results. Specified requirements for company value or other parameters are achieved with certain probability that can be calculated with use of histogram analysis. Histogram analysis allows us to calculate probability of achievement