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ONE APPROACH TO THE ASSESSMENT OF THE FINANCIAL SITUATION OF SME IN THE REGION

The financial situation of the enterprises is estimated on such parameters, as: profitability of business (indicators like ROTA, ROE, ROS) and solvency indicators. These indicators can directly pay off from statistical data, and also on the basis of data processing from questionnaires.

Stability of a financial situation of the enterprises, is usually estimated on the basis of David Durant's technique. This technique is based on classification of the enterprises by risk degree proceeding from observed level of such indicators as return on total assets (ROTA), autonomy ratio (AU) and cover ratio (CR) and constructing on their basis of the integrated indicator.

According to this model of the enterprise have the following classes of risk:

- 1) The enterprises with a good stock of the financial stability, allowing to be sure of return of borrowed funds;
- 2) The enterprises showing some degree of risk on debts, but not being considered yet as risky;
- 3) Problem enterprises;
- 4) The enterprises with high risk of bankruptcy even after taking measures to financial improvement;
- 5) Enterprises of the highest risk, almost insolvent.

The assessment of points on the basis of indicators of a covering, independence and profitability of the capital is given in table 1.

Table 1

Return on total assets (ROTA), %	
Borders of intervals	Rules for points calculation
30% & more	50 points
from 20 to 30%	$50 + (\mathbf{ROTA} - 0,3)15$
from 10 to 20%	$35 + (\mathbf{ROTA} - 0,2)15$
from 1% to 10%	$20 + (\mathbf{ROTA} - 0,01)16,7$
less 1%	0
Cover ratio (CR)	
Borders of intervals	Rules for points calculation
2,0 & more	30
from 1,7 to 2,0	$30 + (\mathbf{CR} - 2) * 33,33$
from 1,4 to 1,7	$20 + (\mathbf{CR} - 1,7) * 33,33$
from 1 to 1,4	$10 + (\mathbf{CR} - 1,4) * 25$
1 и ниже	0
Autonomy ratio (AU)	
Borders of intervals	Rules for points calculation
0,7 & more	20
from 0,5 to 0,7	$20 + (\mathbf{AU} - 0,7) * 50$

from 0,3 to 0,5	$10 + (AU - 0,5) * 25$
from 0,2 to 0,3	$5 + (AU - 0,3) * 50$
less 0,2	0

The integrated assessment of a situation for the enterprise is defined as a score, received by each assessment. The class is defined according data presented in table 2

The assessment of a financial situation on the separate enterprise is carried out on the basis of data presented in the financial reporting, and also as the results of data processing received from questioning by special technique.

Table 2.

Borders of classes according to criteria				
I class	II class	III class	IV class	V class
100 points	From 65 up to 99,99 points	From 35 up to 64,99 points	From 6 up to 34,99 points	Less than 6 points

The general data concerning situation in small business can be received from different statistical reviews, for example in statistical yearbook "Financial and Property Condition of the Organizations of Small Business" for the corresponding year. The aggregated data are presented in these collections characterizing only average situation in branch as a whole. However, to the industry average value of each of the indicators included in a technique of an assessment of a financial condition on Durand, there corresponds a certain frequency distribution of indicators for the enterprises being in the most different financial condition the part from which can be in perfect tune, and others in the most deplorable condition. Probabilistic distributions of indicators autonomy ratio, cover ratio and profitability of assets were received on the basis of the analysis of samples for these indicators in small enterprises (SE) (3669 enterprises for 2005-2006. 15000 SE for 2007-2009gg.i 2500 for 2010).

All considered coefficients have peaked distributions with heavy left and right tails.

Research showed that distributions of ROTA submit to distribution with positive asymmetry. As a hypothesis the assumption was made that ROTA submit to Simpson's exponential distribution

$$\rho(ROTA) = \min(L_1 e^{-h_1 \max(0; M-ROTA)^{0,5}}; L_2 e^{-h_2 \max(0; ROTA-M)^{0,5}}) \quad (1)$$

where M – mode of distribution; h_1, h_2 – coefficients of an inclination of the right and left deviation from mode; L_1, L_2 – parameters of the left and right part of distribution.

Example of distribution of ROTA for data of St. Petersburg SE in 2010 is shown in fig. 1

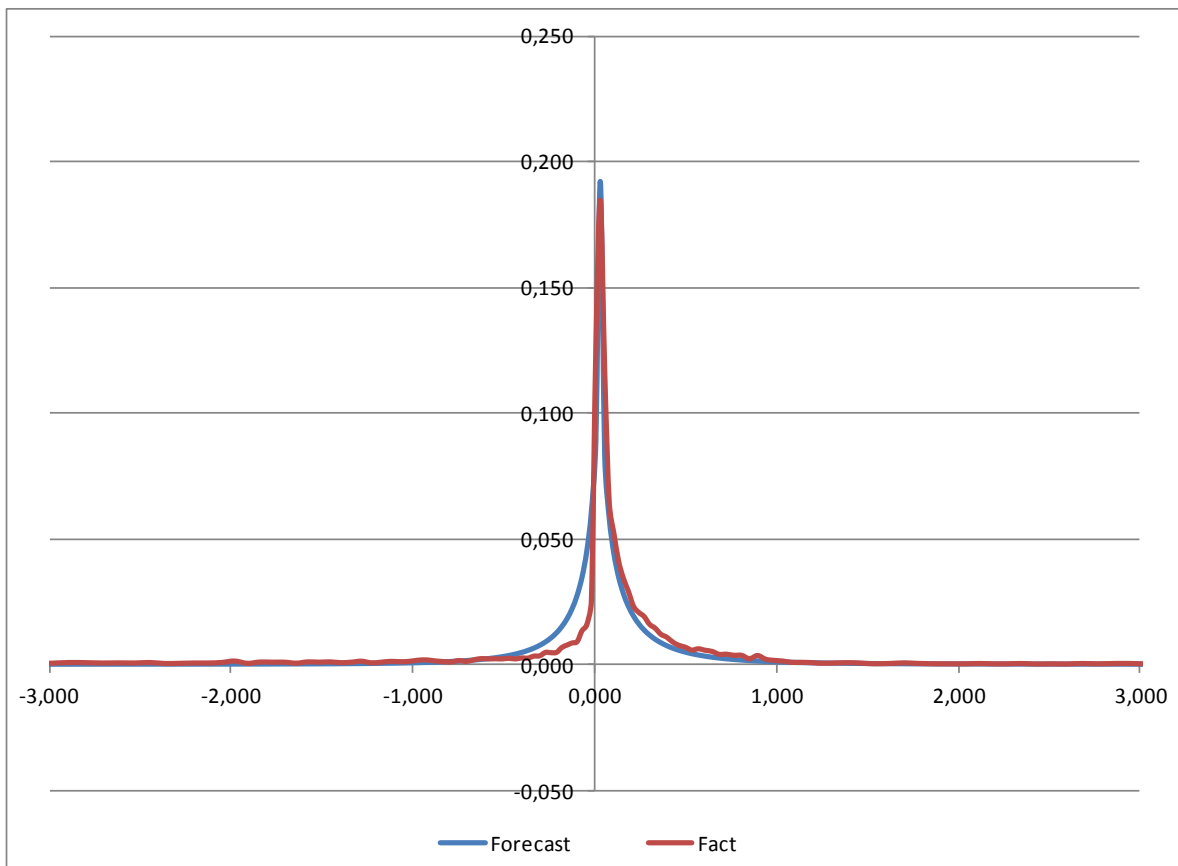


Fig. 1. Example of distribution of ROTA indicator of SE for data of 2010.

The analysis of distributions showed that a share of the enterprises having indicators of ROTA of corresponding to allocated above to categories of risk depending on average value (AR) of an indicator of profitability of assets submit to the following dependences:

Category 5 (ROTA less than 0) $P_{R5}(AR) = e^{-1,02-5,14AR}$

Category 4 (ROTA from 0 to 10%) $P_{R4}(AR) = \ln(1,574 - 1,314AR)$

Category 2 (ROTA from 20 to 30%)

$$P_{R2}(AR) = \max(0; 0,041 + 0,625 \log_{2+12*AR}(1 + AR))$$

Category 1 (ROTA more than 30%) $P_{R1}(AR) = 0,0752 + 0,689AR$

Category 3 (ROTA from 10 to 30%) $P_{R3}(AR) = 1 - \sum_{j=1,2,4,5} P_{Rj}(AR)$

Coefficients of a variation make no more than 15%, and correlation coefficients - not less than 93%

Data on distribution of the enterprises on 5 categories of risk according to revealed are shown to dependences in fig. 2.

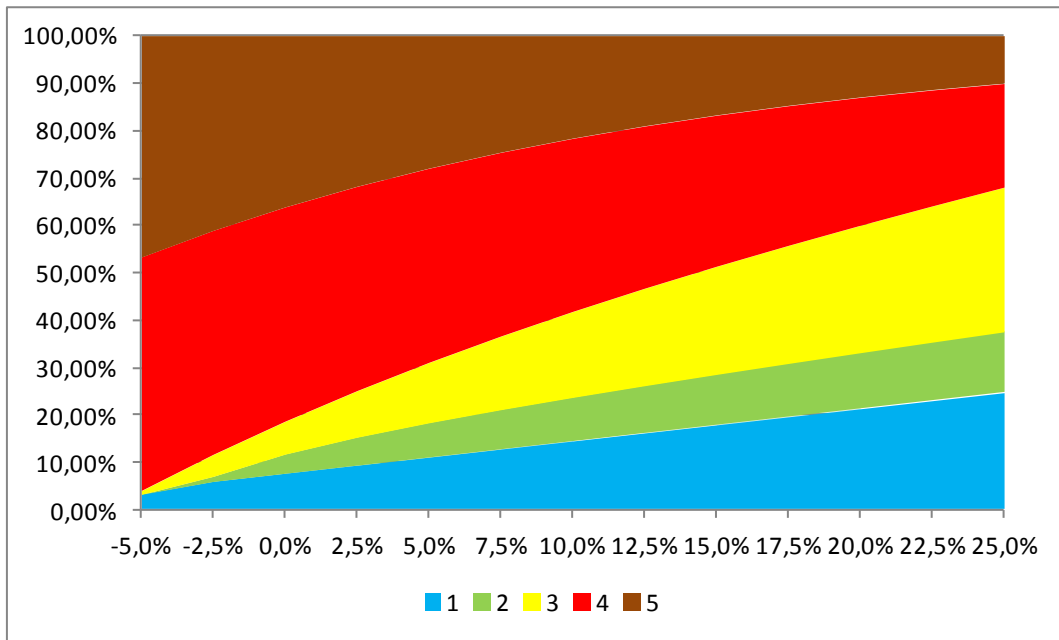


Fig. 2. SE distribution to different categories of risk on ROTA indicator, in dependence on its average value.

Distributions of cover ration submits to dependence

$$\rho(CR) = \min(L_1 e^{-h_1 \max(0; \ln(M) - \ln(CR))^{0.25}}; L_2 e^{-h_2 \max(0; \ln(CR) - \ln(M))^{0.25}}) \quad (2)$$

where M – mode of distribution; h_1, h_2 – coefficients of an inclination of the right and left deviation from mode; L_1, L_2 – parameters of the left and right part of distribution.

Example of distribution of a cover ratio for data of SE of St. Petersburg in 2010 is shown in fig. 3.

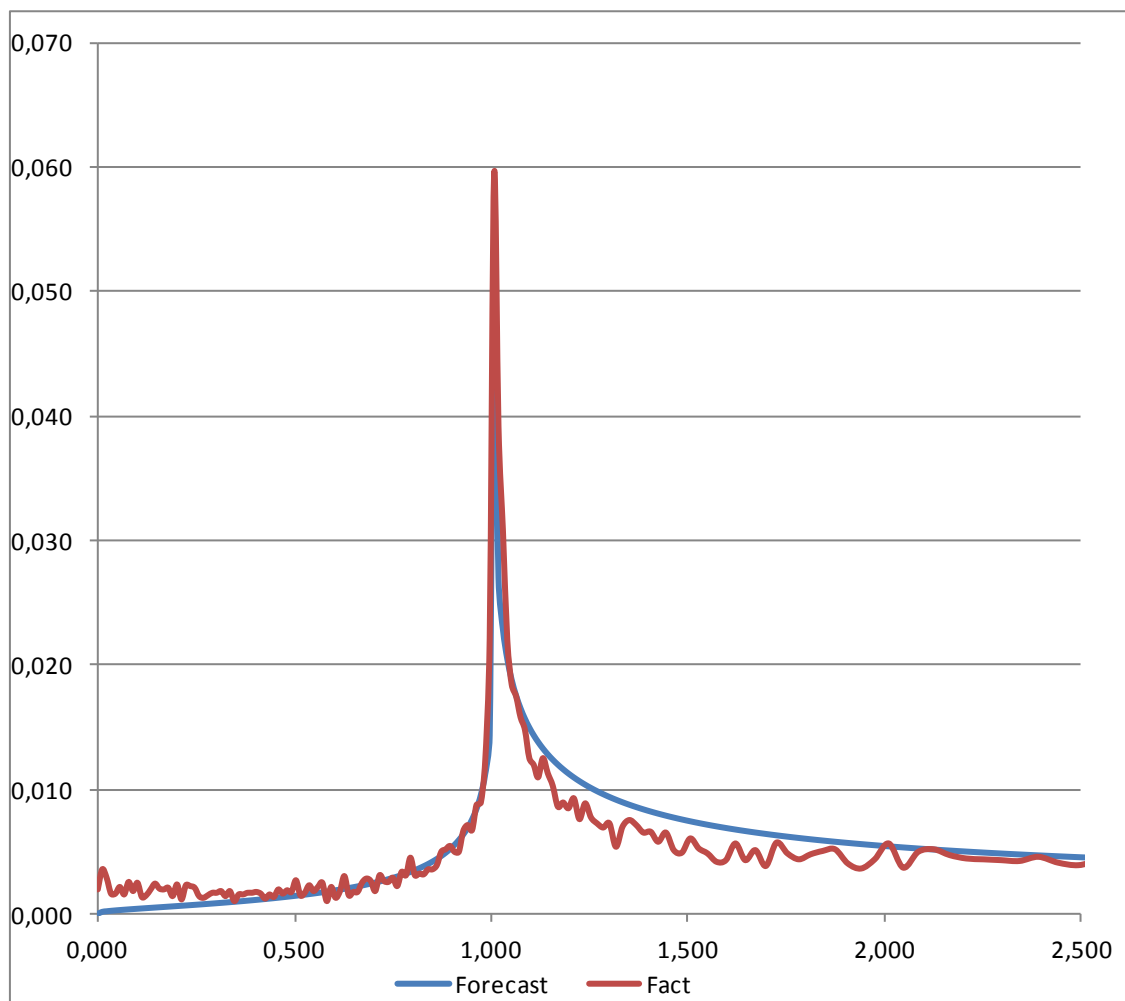


Fig. 3. Example of distribution of an indicator of a covering for data of 2010

The analysis of distributions showed that a share of the enterprises having cover ratio of corresponding to allocated above to categories of risk depending on average value (AC) of an indicator of a covering submit to the following dependences:

Category 5 (CR less than 1)

$$P_{C5}(AC) = 0,132 + \frac{2,285}{(1+8AC)^{AC}}$$

Category 3 (CR from 1,4 to 1,7)

$$P_{C3}(AC) = \max(0; 0,140 + 0,152 \log_{2+1,4(AC-1)}(AC))$$

Category 2 (CR from 1,7 to 2)

$$P_{C2}(AC) = \max(0; 0,052 + 0,087 \log_{2+0,59(AC-1)}(AC))$$

Category 1 (CR more than 2)

$$P_{C1}(AC) = \max(0; 0,201 + 0,327 \log_{2+0,3(AC-1)}(AC))$$

Category 4 (CR from 1 to 1,4)
$$P_{C4}(AR) = 1 - \sum_{j=1,2,3,5} P_{Cj}(AR)$$

Coefficients of a variation make no more than 14%, and correlation coefficients - not less than 93%

Data on distribution of the enterprises on 5 categories of risk on a cover ratio according to revealed are shown to dependences in fig. 4.

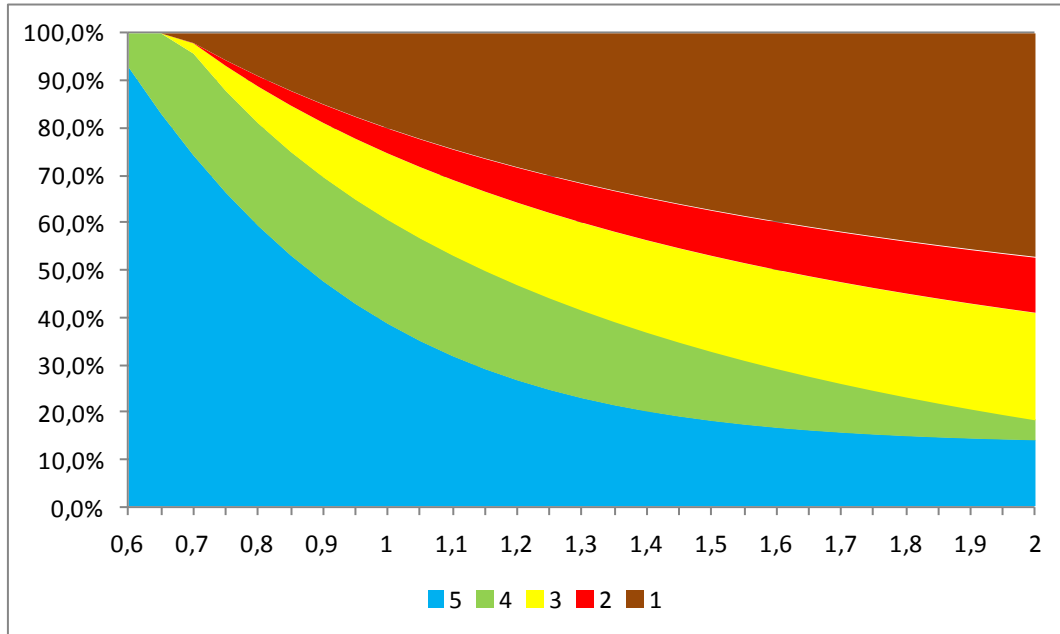


Fig. 4. SE distribution to different categories of risk on a cover ratio in dependence on its industry average value.

Distributions of an autonomy ratio submits to dependence

$$\rho(AU) = \min(L_1 e^{-h_1 \max(0; \ln(l-M) - \ln(l-AU))^{0,4}}; L_2 e^{-h_2 \max(0; \ln(l-AU) - \ln(l-M))^{0,4}}) \quad (3)$$

where M – mode of distribution; h_1, h_2 – coefficients of an inclination of the right and left deviation from mode; L_1, L_2 – parameters of the left and right part of distribution.

Example of distribution of an autonomy ratio for data of SE of St. Petersburg in 2010 is shown in fig. 5.

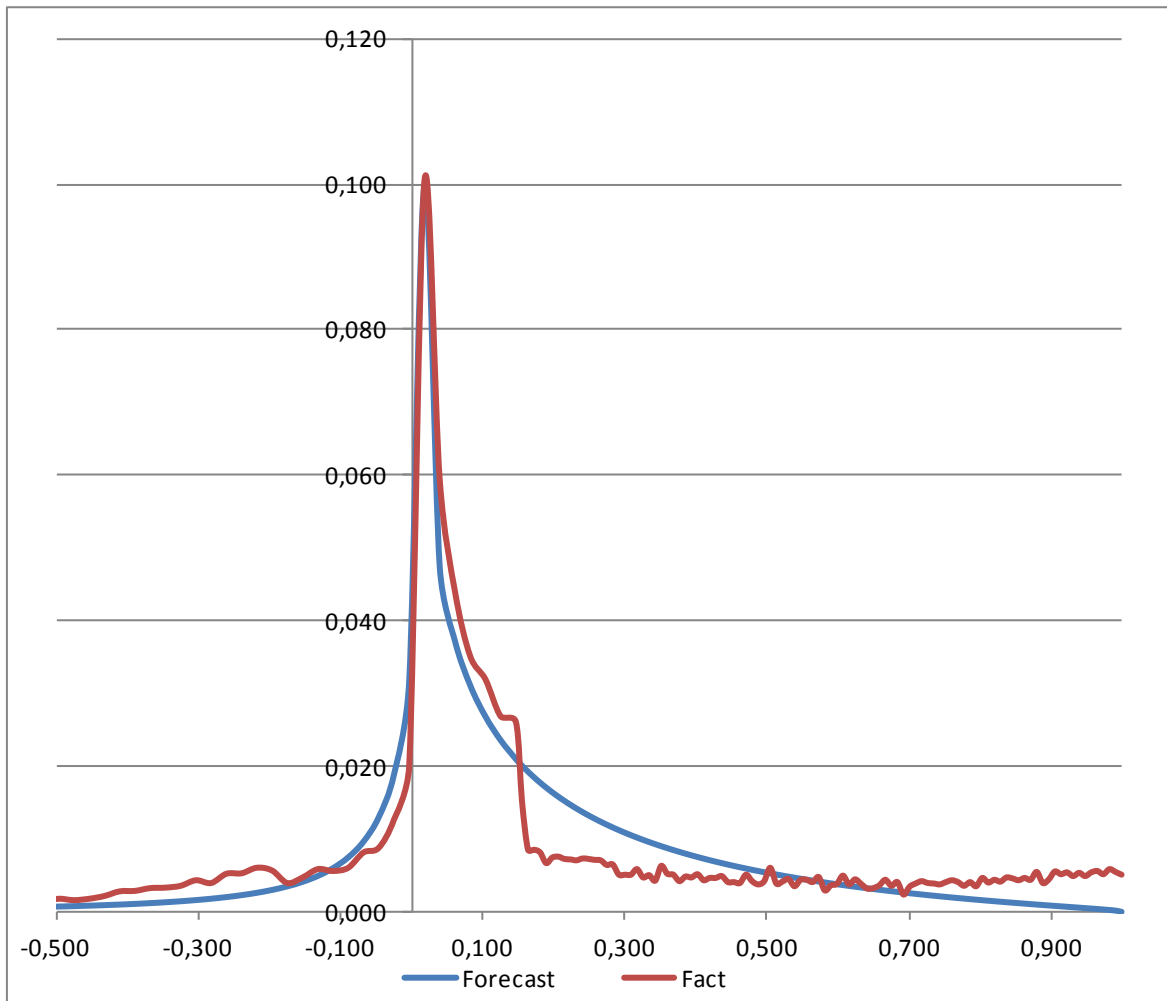


Fig. 5. Example of distribution of an autonomy ratio for data of 2010

The analysis of distributions showed that a share of the enterprises having autonomy ratio of corresponding to allocated above to categories of risk depending on average value (AA) of an indicator of independence submit to the following dependences:

$$\text{Category 5 (AU less than 0,2)} \quad P_{A5}(AA) = 0,332 + \frac{0,425}{(5,3)^{8AA}}$$

$$\text{Category 4 (AU from 0,2 to 0,3)} \quad P_{A4}(AA) = 0,048 + \frac{0,116}{(5,3)^{6,5AA}}$$

$$\text{Category 2 (AA from 0,5 to 0,7)} \quad P_{A2}(AA) = \max(0; 0,189 + 0,058 \log_{2+70AA}(AA))$$

$$\text{Category 1 (AA more than 0,7)} \quad P_{A1}(AA) = \max(0; 0,444 + 0,08 \log_{2-0,5AA}(AA))$$

$$\text{Category 3 (AU ot 0,5 to 0,7)} \quad P_{A3}(AA) = 1 - \sum_{j=1,2,4,5} P_{Aj}(AA)$$

Coefficients of a variation make no more than 14%, and correlation coefficients - not less than 93%

Data on distribution of the enterprises on 5 categories of risk by autonomy ratio according to revealed dependences are shown to dependences in fig. 6.

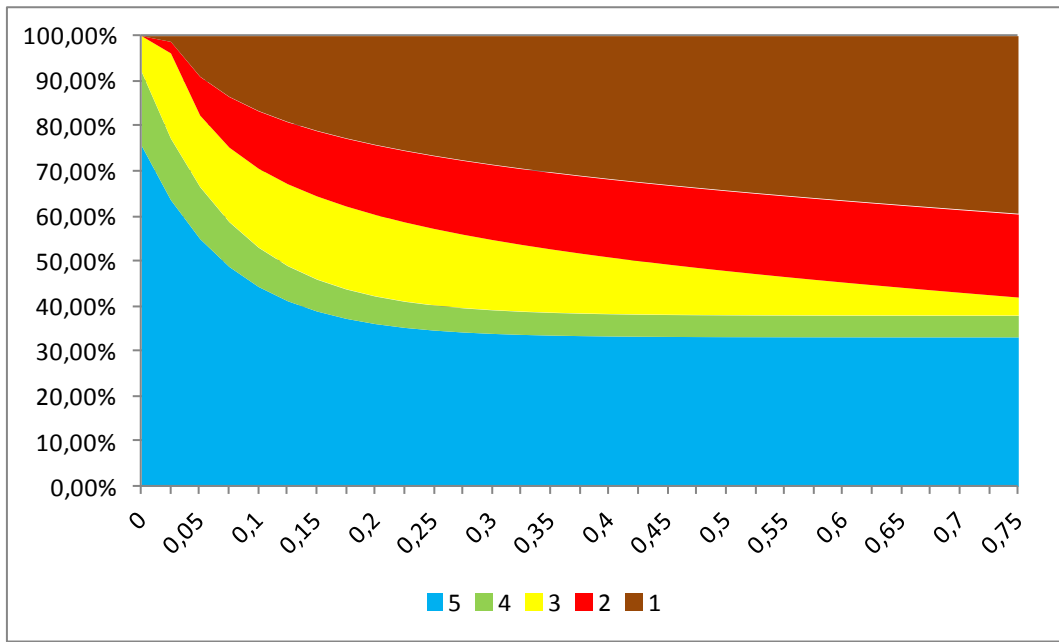


Fig. 6. SE distribution to different categories of risk on an autonomy ratio in dependence on its industry average value.

As the received dependences of probability of hit in a certain class of risk define only average value, it is expedient to define, except a principal value, maximum permissible deviations, both towards optimism of estimates, and towards their pessimism.

Optimistic shift of parameters of distribution for coefficient of K (K=ROTA, CR, AU) decides on the help of the solution of a task:

$$\sum_{j=1:5} E_{Kj} P_{Kj} \Rightarrow \max \quad (4)$$

$$\sum_{j=1:5} P_{Kj} = 1 \quad (5)$$

$$\max(0; P_{Kj}(AK) - n\sigma_{Kj}) \leq P_{Kj} \leq P_{Kj}(AK) + n\sigma_{Kj} \quad j = 1 : 5 \quad (6)$$

Where $P_{Kj}(AK)$ – probability of hit in a class of risk of j on K indicator at its average AK value; E_{Kj} – average value of risk in a class of risk of j on K indicator; σ_{Kj} - standard deviation of probability of hit in a class of risk of j on K indicator; n – confidential coefficient (is accepted ranging from 1 to 3)

The solutions of a task (4 – 6) values of probabilities of hit found in result on K indicator in a class j we will designate $P_{OKj}(AK)$

Pessimistic shift of parameters of distribution for coefficient of K decides on the help of finding of a minimum on a set (5) – (6). The solutions of this task of value of probabilities of hit found in result on K indicator in a class j we will designate $P_{PKj}(AK)$

Pessimistic shift of parameters of distribution for coefficient of K decides on the help of finding of a minimum $\sum_{j=1:5} E_{Kj} P_{Kj}$ on a set (5) – (6). The solutions of this task of value of probabilities

of hit found in result on K indicator in a class j we will designate $P_{PKj}(AK)$

On each indicator of risk of K distribution of estimates of risk on the basis of definition of a vector of its parameters $V = (M, L_1, L_2, h_1, h_2)$ which turn out proceeding from knowledge can be constructed:

- 1) Type of the distribution which is set by dependences (1) – (3);
- 2) Probabilities of hit in a certain class of risk of $P_{NKj}(AK)$ (N=base, optimistic, pessimistic; K=CR,AU,ROTA; j=1,2,3,4,5)
- 3) Average value of coefficients of risk for branch (AR; AC, AA).

Average assessment of E (K, N, j) on K indicator for a class j according to basic, optimistic and pessimistic scenarios is on a formula:

$$E(K, N, j) = \frac{1}{P_{NKj}(AK)} \int_{Q(K,j)}^{Q(K,j-1)} E_K(x) \rho(x, V(N, K)) dx \quad (7)$$

Where Q (K, j) – the bottom admissible value for a class of risk of j for K indicator; $E_K(x)$ – an assessment according to Durand’s indicator K at value x; $\rho(x, V(N, K))$ – distribution of values on K indicator at the found vector of parameters V (N, K).

Research of a sample showed that distribution of categories for an ROTA practically doesn't depend on distribution of categories on cover ratio and autonomy ratio. Two last indicators have positive correlation dependence (see table 3)

Table 3. Value of correlation coefficients for values of risk ratios

Ratios	2008	2009	2010
ROTA / CR	0,038	0,005	0,056
ROTA/AU	0,134	0,028	0,186
CR/AU	0,539	0,350	0,542

Existence of positive correlation between distribution of autonomy ratio and cover ratio forces to consider simultaneous distribution of categories on these parameters at creation of an integrated assessment. On the basis of the analysis of selective distributions for cover ratio and autonomy ratio the following values for an assessment of simultaneous distribution on risk classes were received

Table 4

Category according cover ratio	Category according autonomy ratio					
	1	2	3	4	5	
1	0,153	0,066	0,005	0,002	0,023	0,250
2	0,002	0,011	0,029	0,001	0,003	0,045
3	0,002	0,005	0,053	0,005	0,004	0,068
4	0,003	0,005	0,016	0,058	0,290	0,371
5	0,007	0,005	0,010	0,008	0,235	0,265
	0,167	0,091	0,113	0,074	0,555	1,000
	Normalized matrix by cover ratio					
1	0,613	0,265	0,020	0,010	0,093	1,000
2	0,054	0,235	0,638	0,011	0,062	1,000
3	0,029	0,067	0,771	0,072	0,062	1,000
4	0,008	0,013	0,044	0,155	0,780	1,000
5	0,025	0,017	0,037	0,032	0,888	1,000
	Normalized matrix by autonomy ratio					
1	0,613	0,265	0,020	0,010	0,093	1,765
2	0,054	0,235	0,638	0,011	0,062	0,399
3	0,029	0,067	0,771	0,072	0,062	0,604
4	0,008	0,013	0,044	0,155	0,780	1,516
5	0,025	0,017	0,037	0,032	0,888	0,715

For definition of probability of hit in certain classes of risk on autonomy ratio and a cover ratio it is offered to use the following procedure:

1) Simultaneous distribution of D_C on risk classes for autonomy and cover ratios based on normalized matrix for cover ratio calculated by the next rule

$$D_{Cij} = P_{NCj}(AC)R_{Cij} \quad j = 1:5$$

where R_{Cij} – an element normalized matrix for cover ratio corresponding i -th class on AR and j – th category for autonomy ratio

2) Simultaneous distribution of D_A on risk classes for for autonomy and cover ratios pays off based on the normalized matrix for autonomy ratio calculated by the next rule

$$D_{Aij} = P_{NAi}(AA)R_{Aij} \quad i = 1:5$$

where R_{Aij} – an element of normalized matrix for autonomy ratio corresponding j -th class on AR and i – th category for autonomy ratio

3) The problem on finding of the distribution providing performance of conditions, set found to distributions on classes of risk and minimization of deviations from calculated values of D_A and D_C is solved. i.e. the following problem is solved,

$$\sum_{i=1:5} \sum_{j=1:5} ((P_{ij} - D_{Aij})^2 + (P_{ij} - D_{Cij})^2) \Rightarrow \min \quad (8)$$

$$\sum_{j=1:5} P_{ij} = P_{NAi}(AA) \quad i = 1:5 \quad (9)$$

$$\sum_{i=1:5} P_{ij} = P_{NCj}(AC) \quad j = 1:5 \quad (10)$$

$$P_{ij} \geq 0 \quad j = 1:5; \quad i = 1:5 \quad (11)$$

The solution of a task (8) – (11) we will designate through $P_{NCAij}(AC, AA)$.

The general assessment of a financial condition of SE according to Durand is under construction by three options basic, pessimistic and optimistic by the following rule:

The probability of hit in f -th a class of financial risk, is determined by the rule:

$$\sum_{l=1:5} \sum_{i=1:5} \sum_{j=1:5} P_{NRI}(AR)P_{NCAij}(AC, AA)q_{flij} \quad (12)$$

Where $Q(f)$ – the lower bound of reference of a financial condition to a class f ;

$$q_{flij} = \begin{cases} 1, & \text{if } Q(f-1) > E(R, N, l) + E(C, N, i) + E(A, N, j) \geq Q(f) \\ 0, & \text{otherwise} \end{cases}$$

This technique was applied to an assessment of a financial condition of the small enterprises using traditional system of the taxation in St. Petersburg during the period from 2005 to 2011. Depending on level of an assessment were constructed a basic, pessimistic and optimistic assessment of reference of SE to various categories of business according to Durand (see fig. 7)

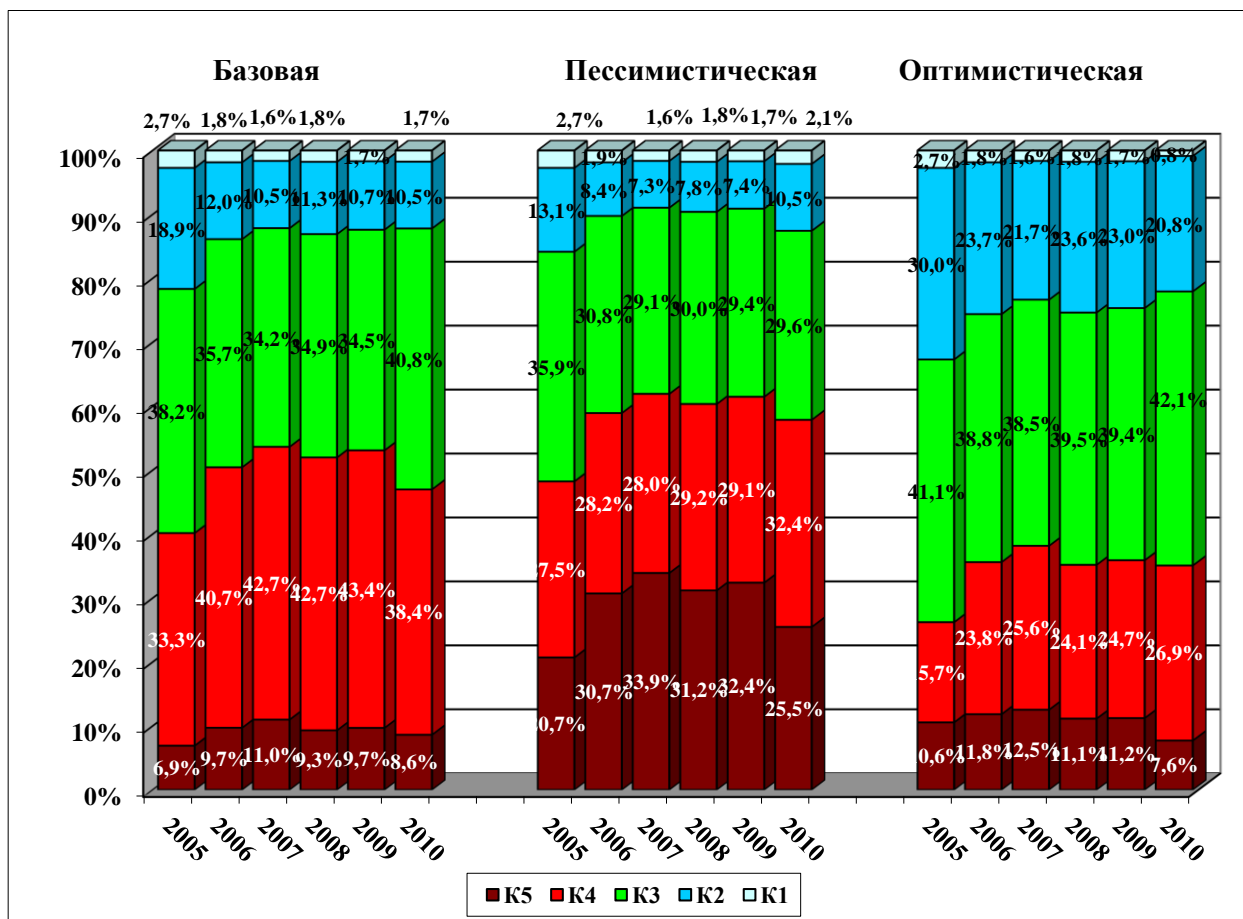


Fig. 7. Dynamics of distribution of SE on different categories of risk depending on assessment options

If to consider the received results, it appears that during the period from 2005 to 2009 the number of the enterprises which can be carried to number insolvent or close to bankruptcy rather sharply grew. In 2010 the situation improved a little, but remained nevertheless worse than in 2005. Dynamics of an assessment of number of SE insolvent (category 5) or close to it, is presented in table 5.

Table 5. Dynamics of number of SE insolvent or close to bankruptcy in 2005 - 2011.

		2005	2006	2007	2008	2009	2010
The insolvent	Optimistic assessment	3017	4301	3577	2376	2652	2021
	Basic assessment	1969	3542	3132	1988	2286	2301
	Pessimistic assessment	5818	11002	9531	6602	7541	6719
Close to bankruptcy	Optimistic assessment	4489	8615	7315	5123	5828	7207
	Basic assessment	9524	14756	12173	9088	1024	1029
	Pessimistic assessment	7886	10218	7994	6209	6865	8692
In total problem enterprises	Optimistic assessment	7506	12916	10892	7499	8480	9228
	Basic assessment	11493	18297	15306	11076	1253	1259
	Pessimistic assessment	13704	21220	17525	12811	1440	1541

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