THE PREDICTION OF THE BANKRUPTCY RISK

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Abstract

The study research results of the bankruptcy risk in the actual economic crisis are very weak. This issue is very important for the economy of every country, no mattter what their actual development level.

The necessity of bankruptcy risk prediction appears in every company, but also in the related institutions like financial companies, investors, suppliers, customers.

The bankruptcy risk made and makes the object of many studies of research that want to identify: the moment of the appearance of the bankruptcy, the factors that compete at the reach of this state, the indicators that express the best this orientattion (to the bankruptcy).

The threats to the firms impose the knowlwdge by the managers, permanently of the economic-financial situations, of the vulnerable areas and of those with potential of development. Thus, these must identify and gesture the threats that would stop the fulfilment of the established purposes.

Key words: risk, bankruptcy, uncertainty, insolvency, rate, Z score.

The permanently knowledge by the managers of the economic-financial situations, of the vulnerable areas and of those with potential of development was imposed by the threats to the firms. Thus, these must identify and gesture the threats that would stop the reach of the established purposes.

The bankruptcy represents for the companies one of the biggest threats and appears as the incapacity of the economic agent to make the payments in time.

Among the problems that preoccupied for a long time ago the specialists and the common people, there are the risk and the uncertainty, that we meet in different acceptances in literature, law, technics, economy etc.

The risk of bankruptcy is from the category of the internal risks of the firms and it appears thanks to the incapacity to make the payments in time.

The term of bankruptcy has its origin in the latin verb ,''fallo-fallere'', which means ,''to miss'', to escape'' and it indicates the fact that the bankruptcy doesn't make the payments to its creditors [3].

The actual legislation defines and makes the difference between the state of insolvence and the one of insolvability, the first being characterized by

the insufficiency of the funds available for the payment of the certain, liquid and exigible debts [9], and the second by the possibility of appearance of the incapacity of the falling dues.

Research studies

In 1966, after the study on a paper of 79 bankrupt firms and 79 not bankrupt firms, Beaver [2] publishes in Empirical Research in Accounting: Selected Studies, Supplement to Journal of Accounting Research, no 4, ,''Financial Ratios as Predictors of Failure'', a model of prevission of the bankruptcy risk based on 5 financial rates.

In the same year, 1966 Altman [1] analysed the activity, from the period 1946-1965, of 33 of industrial firms with financial problems and 33 firms without problems, form 22 indicators and makes a model based on 5 rates, considered to be relevant, that publishes with commentaries, in 1968, in ''Financial Ratios, Discriminant Analysis and the Prediction of Corporate Bankruptcy'', Journal of Finance, September. As this model had applicability only for the firms quoted at exchange, the author replaces the indicator that was reported at the value of the market and recalculates the weight of all the indicators, and for the extension of the application of the model at other branches (not only from industry), reconsiders the score function and retaines 4 rates.

J.Argenti [2] analyzed in 1976 the manifestation of the risk of bankruptcy and saw that the financial indicators didn't have the same value, they were different from one case to another.

Conan and Holder [5] published in 1979 a model based on the conclusions of the research made on a paper of 95 firms from the industrial domain for the period 1970-1975. They also collaborated at the elaboration of some models specific for other domains of activity.

In the Note of Information Note no 65 of the Bank of France appears in 1985 a model of the Center of Balances from the Bank of France that has 8 rates from 26 observed at firms with less than 500 employees for the period 1977-1979.

Keasey and Watson, in 1987, show that, by the study made on 73 bankrupt firms and 73 non-bankrupt firms, that including the nonfinancial variables grows the power of prediction of the model.

In "*A nonfinancial Bussiness Failure Prediction Model for Young Firmes",* appeared in Journal of Small Bussines Management in 1995, we met the model created by Lussier by observing an equal number of bankrupt and non bankrupt firms, based on 15 nonfinancial variables.

Manecuta and Nicolae [2], two specialists from the National Commision of Prognosis, proposed in 1996 a model for the metaulrgic industry

on base of the observations made on a paper of 59 firms.

Gheorghe Bailesteanu, starting from the models Altman, Argenti, Conan and Holder, proposed in 1998 for the Romanian firms a model from 4 variables[2].

The economist Paul Ivoniciu, after the study made on base of the dates of over 50 firms from different domains of activity, proposed in 2002 the model of the score function formed by 6 indicators.

Ion Anghel in the paper *The Bankruptcy, Radiography and Prediction*, appeared at the Economic Publishing House, proposed in 2002 a model made by a constant and 4 indicators [2].

Thus, it can be easily observed how the risk of bankruptcy represented and represents a sensitive domain in which the specialist proposed to research and to elaborate a mathematical model which can respond to the question '' *is or not the firm in bankruptcy?"*

The prediction of the bankruptcy risk-the analytical presentation of the main models

To observe the accuracy of the prediction of the bankruptcy risk of different models for the Romanian firms we accessed the dates of a society quoted at the exchange from the domain of aeronautics with a good financial state:

Situation indicators for the period 2006-2008, the company considered

Line no.	Indicator	2008	2007	2006
1	Net working capital used	41.236.751,00	30.157.321,00	40.392.711,00
2	Total Assets	106.646.060,00	94.140.518,00	107.993.624,00
3	Reserves	30.308.223,00	28.021.083,00	25.183.629,00
4	Gross operating result	6.666.747,00	10.021.848,00	17.026.971,00
5	Financial expenses	66.767.822,00	199.132.101,00	93.123.541,00
6	Long-term debt	1.127.393,00	720.978,00	1.178.995,00
7	Sales	152.697.736,00	139.190.732,00	140.976.614,00
8	Own capitals	68.461.773,00	66.532.144,00	66.823.961,00
9	Total debts	32.068.222,00	25.392.926,00	29.534.327,00
10	Total passive	106.646.060,00	94.140.518,00	107.993.624,00
11	Availabilities and investments	19.798.634,00	4.794.822,00	51.355.934,00
12	Financial expenses	3.965.943,00	1.814.506,00	2.269.375,00
13	Expenses with the personal	54.681.733,00	48.567.245,00	42.865.950,00
14	Added value	78.016.535,00	61.524.351,00	76.307.514,00
15	Necessary of floating capital	22.052.081,00	28.346.459,00	-7.575.565,00
16	Ongoing capital	75.585.148,00	69.310.658,00	79.449.063,00
17	Invested capital	3.583.754,00	5.455.644,00	2.843.914,00
18	Self-financing capacity	16.116.342,00	17.381.223,00	17.984.619,00
19	Average balance providers	118.309,00	77.413,00	51.370,00
20	Purchases of goods	3.646.468,00	3.373.578,00	2.098.103,00
21	VA1-VA0	16.492.184,00	-14.783.163,00	-
22	VA0	61.524.351,00	76.307.514,00	-
23	Average Balance reviews	160.772,00	135.187,00	100.113,00
24	Investments	3.583.754,00	5.455.644,00	2.843.914,00
25	Lawns + interests (arrearage)	1.127.393,00	720.978,00	1.178.995,00
26	Availabilities + debts	53.910.862,00	38.924.531,00	55.739.854,00
27	Debts on short term	29.813.436,00	23.950.970,00	27.176.337,00
28	Assets	34.348.397,00	39.153.337,00	39.056.352,00
29	Stocks	18.386.801,00	16.062.650,00	13.197.420,00
30	Commercial debts	32.663.508,00	34.414.534,00	7.415.345,00
31	Current assets	72.297.663,00	54.987.181,00	68.937.272,00
32	Current passives	30.940.829,00	24.671.948,00	28.355.332,00
33	Net profit + amortization	16.116.342,00	17.381.223,00	17.984.619,00
34	Rate loan repaid + interest	1.127.393,00	720.978,00	1.178.995,00
35	Customers	33.142.836,00	34.909.003,00	6.573.241,00
36	Profit	11.085.258,00	10.918.559,00	17.396.720,00
37	Cost	147.262.570,00	129.617.373,00	125.037.392,00
38	Net profit	9.503.724,00	10.146.868,00	13.450.668,00
39	Incomes	168.174.814,00	143.206.879,00	146.425.517,00
40	cash-flow	16.116.342,00	17.381.223,00	17.984.619,00
41	Obligations	32.068.222,00	25.392.926,00	29.534.327,00

Altman model

a) for the firms quoted at the exchange

In conformity with the Altman model, where:

$$Z = 1,2\ r1 + 1,4\ r2 + 3,3\ r3 + 0,6\ r4 + 1,0\ r5 \quad [1]$$

The value of the Z score establishes two limits and an area of uncertainty:

$Z < 1,8$ – bankruptcy in one year;

$1,81 \leq Z \leq 2,675$ – area of uncertainty with high risk of bankruptcy;

$2,677 \leq Z \leq 2,99$ – area with low risk of bankruptcy;

$Z > 2,99$ – area without the threat of bankruptcy.

r1 – working capital / total assets - rate of structure of the asset and it measures the grade of flexibility of the economic agent;

r2 – retained earnings / total assets - indicates own contribution of the economic agent at financing the investments;

r3 – earnings before interest and taxes / total assets - quantifies the performances of the patrimonial asset;

r4 – the value of market of the capital/obligations on long term-quantifies a part of the grade of indebtedness;

r5 – sales / total assets-expresses the yield of the patrimony.

The Z score obtained is of 50,06 at the end of the year 2006, of 168,42 at the end of the year 2007 and of 38,11 at the end of the year 2008, it shows us that the firm is without threat of bankruptcy. The increase/decrease of Z must determine managers to find the sensitive areas and eventually to express a point of view referred to the relevance of the model (maybe the results obtained by the society are good, and the model doesn't reflect correctly the state of society, so it doesn't have signification).

b) for the firms that aren't quoted at the exchange.

The author, to extend the applicability of the model, replaced in r4 the value of market of the capital with the size of own capitals, which led to the modification of the value of the average coefficients of weight affected to the rates, the model having the following structure:

$$Z = 0,717\ r1 + 0,847\ r2 + 3,107\ r3 + 0,420\ r4 + 0,998\ r5 \quad [2]$$

In conformity with the new model the Z score obtained is of 26,06 at the end of 2006, of 41,05 at the end of 2007 and of 27,05 at the end of 2008, which would conclude that the firm is not missed by the bankruptcy threat.

Comparing the 2 situations it is observed very clear the difference between the results obtained, and the afct that these models don't have signification for the firm in discussion.

The model Conan and Holder

a) for the firms from the industrial domain

In conformity with the model Conan/Holder, where:

$$Z = 0,24\ r1 + 0,22\ r2 + 0,16\ r3 - 0,78r4 - 0,10\ r5 \quad [3]$$

The value of the Z score establishes 3 areas this way:

$Z < -0,2$ – probability of bankruptcy 100%;

$Z = 0,068$ – probability of bankruptcy 50%;

$Z > 0,164$ – probability of bankruptcy 10%.

r1 – gross result of the exploitation/total debts-indicate own capacity of financing of debts;

r2 – own capitals/total passive-indicates the patrimonial solvability;

r3 – availabilities and investments/total asset-quantifies the performances of the patrimonial asset;

r4 – financial expenses/number of business –indicates the level of the financial expenses;

r5 – expenses with the personal/added value-expresses the grade of remuneration of the personal;

The Z score is of 0,28 at the end of 2006 (without problems of bankruptcy), of 0,17 at the end of 2007 (without problems of bankruptcy) and of 0,13 (bankruptcy over 10 %) at the end of 2008, which could conclude that the firm doesn't have a good financial situation, presenting a risk of bankruptcy of over 10 % and the tendency of this one is of emphasis of the area of bankruptcy.

b) for the firms with commercial activity of ''en-gross'' (it's not the case of the society in cause)

$$Z = 0,0136\ r1 + 0,0197\ r2 + 0,0341\ r3 + 0,0185\ r4 + 0,0158\ r5 - 0,0122 \quad [4]$$

Where r2 and r3 have the same signification as in the model above,

r1 – own capitals/total passive;

r2 – availabilities and investments/total asset;

r3 – own capitals/total asset;

r4 – gross result from exploitation/total asset;

r5 – necessary of the floating capital/number of business.

The Z score, this way obtained, has the following interpretation:

$Z \geq 0,2$ – probability of bankruptcy is lower than 40%;

$-0,3 < Z < 0,2$ – probability of bankruptcy is between 40% and 65%;

$Z < -0,3$ – probability of bankruptcy is over 65 %

From the calculations made on the dates of the society it was obtained the Z score for 2006 of 0,03 (area of bankruptcy 50 %), for 2007 of 0,02 (area of bankruptcy 50 %) and for 2008 of 0,02 (area of bankruptcy 50 %), that shows that the society is in the area of bankruptcy of over 50 %.

The same, as at the model Altman, we can conclude that this model doesn't have signification for the analyzed society. The results obtained in the two cases are totally different.

The model of the Center of the Balances from the Bank of France

For this model the Z score has the following formula:

$$Z = -1,255\ r1 + 2,003\ r2 - 0,824\ r3 + 5,221\ r4 - 0,689 r5 - 1,164\ r6 + 0,706\ r7 + 1,408\ r8 - 85,54 \quad [5]$$

And the rates represent:

r1 – gross result of exploitation/total debts-indicate own capacity of financing debts;
r2 – own capitals/total passive-indicates the patrimonial solvability;
r3 – availabilities and investments/total asset-quantifies the performances of the patrimonial asset;
r4 – financial expenses/number of business-indicates the level of the financial expenses;
r5 – expenses with the personal/added value-expresses the grade of remuneration of the personal;
r6 – own capitals/total asset;
r7 – gross result from exploitation/total assets;
r8 – necessary of floating capital/number of business.

The values of Z show:

$Z < -0,25$ – area with difficulties;

$-0,25 < Z < 0,125$ – area of uncertainty;

$Z > 0,125$ – favorable area.

The values of Z at the level of the analyzed society, have value of -1,72 at the end of 2006 (area of bankruptcy), of -0,86 (area of bankruptcy) for 2007 and of -0,86 (area of bankruptcy) for 2008, that indicates the fact that the society is in the area of bankruptcy, and its tendency is of appreciation.

The model of the French Commercial Credit

For this model the Z score has the following formula:

$$Z = 6,47 - 9\ r1 - 1,1\ r2 \quad [6]$$

And the rates represent:

r1 – financial expenses/gross result from exploitation;
r2 – (lawns + interests)/ own capitals.

The value of Z=0 separates the firms in good ones and with difficulties.

The values of Z, at the level of the analyzed society, have a value of 5,25 at the end of 2006, of 4,83 for 2007 and of 1,10 for 2008, which indicates the fact that the society has a good financial situation, but the trend of this one

isn't one that can satisfy.

The method "credit-man" or "security-analysis" –used in SUA for the establishment of the risk in the activity of credit.

$$Z = 0,25\ r1 + 0,25\ r2 + 0,10\ r3 + 0,20\ r4 + 0,20\ r5 \quad [7]$$

Where:

r1 = (availabilities + debts)/debts on short term-the rate of intermediate solvability ;

r2 = own capitals/total debts-rate of financial structure that shows own capacity of covering the debts;

r3 = own capitals/assets-rate of the floating capital;

r4 = number of business/stocks-rate of rotation of stocks;

r5 = number of business/commercial debts-rotation of debts;

The value of Z is compared with the one of the average on the domain, and the appreciation is made after the relation:

$Z < 0$ – not favorable area

$Z > 0$ – favorable area.

The values of Z, at the level of the analyzed society have a value of 7,19 at the end of 2006, of 3,77 for 2007 and of 3,78 for 2008, that indicates the fact that the society has a good financial situation, but the trend of this one isn't one that can satisfy.

Model B – Băileşteanu (1998)

Starting from the traditional studies (Altman, Argenti, Conan and Holder etc.) the author considers that the appearance of the bankruptcy is determined by the following factors:

- The impossibility of paying the current obligations;
- The lack of financial sources for the reimbursement of credits;
- Cashing with a big delay of consideration of delivered products;
- Registration of losses.

The author proposes the following variables:

G1, general liquidity (current) = current assets/current passives

G2, solvability= (net profit + amortization)/ (rate loan repaid + interest)

G3, recuperation customers= number of business/customers

G4, return of costs = profit / cost x100

The function is:

$$B = 0,444\ G1 + 0,909\ G2 + 0,0526\ G3 + 0,0333\ G4 + 1,414 \quad [8]$$

B has a maximum value equal with 4 and a minimum value equal with –1,4.

The function of the registered value is considered:

B < 0,5 – imminent bankruptcy ;
0,5 < B < 1,1 - limited area ;
1,1 < B <2,0 - intermediate area ;
B >2,0 – favorable area.

The values of Z, at the level of the analyzed society, of 17,49 at the end of 2006, of 24,53 at the end of 2007 and of 15,69 at the end of 2008 indicate the fact that the society has a good financial situation, but the trend of this one isn't one that can satisfy.

Model A – Ion Anghel

$$A = 5,676 + 6,3718\ X1 + 5,3932\ X2 - 5,1427\ X3 - 0,0105\ X4 \quad [9]$$

X1 = net profit/incomes;
X2 = cash-flow/Assets;
X3 = Debts/Assets;
X4 = (Obligations/number of business) x 360;
C = 5,676 – constant.

The correspondency between the value of the function A and the probability of the bankruptcy is the following:

A < 0 – bankruptcy/failure;
0 < A < 2,05 areas of uncertainty;
A > 2,05 non-bankruptcy.

The values of Z of 4,96 at the end of 2006, of 5,05 at the end of 2007 and of 4,51 at the end of 2008 indicate the fact that the society has a good financial situation, but the trend of this one isn't one that can satisfy.

By presenting *"The sintetic values of the models of risk analyzed"* and *The evolution of the Z score (A or B)* in *the period 2006-2008*, the accuracy of prediction of the risk of bankruptcy is questionable.

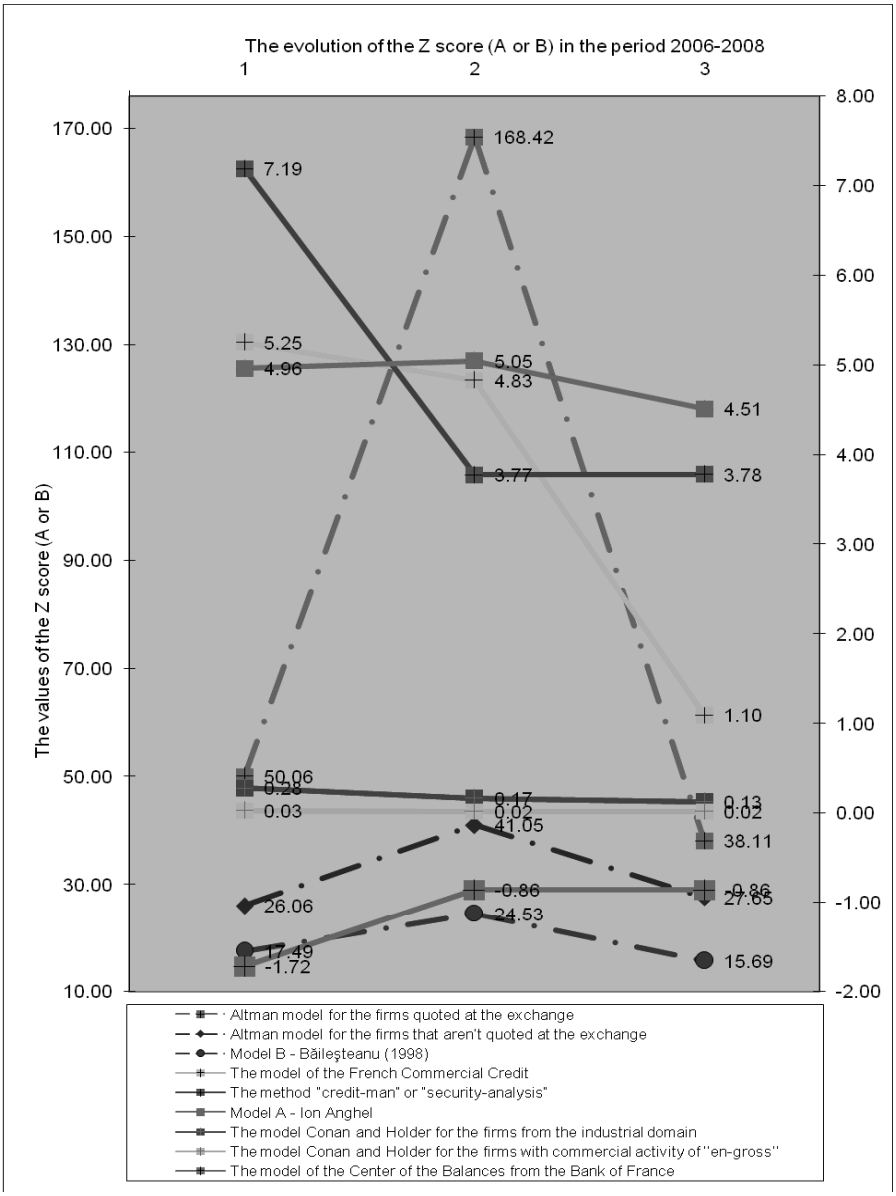
The analyzed society presents a good financial situation, in conformity with the quotes from the exchange of values, but the values of the Z score (A or B) for the models applied doesn't reflect the same state.

Thus, we observe that the application of the proposed models has relevance only at the level of the branches/economies in which the studies were made.

Annexno 3

The sintetic values of the models of risk analyzed

Line no.	Model	2006	2007	Trend from 2006	2008	Trend from 2007	Interpretation Z value (A or B)
1	Altman model for the firms quoted at the exchange	good	good	assessment	good	depreciation	Z<1,8 – bankruptcy in one year; 1,81≤ Z ≤ 2,675 – area of uncertainty with high risk of bankruptcy; 2,67≤ Z ≤ 2,99 – area with low risk of bankruptcy; Z > 2,99 – area without the threat of bankruptcy.
		50.06	168.42		38.11		
2	Altman model for the firms that aren't quoted at the exchange	good	good	assessment	good	depreciation	Z≤1,23 – bankruptcy ; 1,23< Z ≤ 2,90 – area of uncertainty ; Z > 2,90 – solvency, good situation.
		26.06	41.05		27.65		
3	The model Conan and Holder for the firms from the industrial domain	good	good	depreciation	bankruptcy 10%	depreciation	Z<-0,2 – probability of bankruptcy 100%; Z=0,068 - probability of bankruptcy 50%; Z > 0,164 – probability of bankruptcy 10%
		0.28	0.17		0.13		
4	The model Conan and Holder for the firms with commercial activity of "en-gross"	bankruptcy 50%	bankruptcy 50%	depreciation	bankruptcy 50%	depreciation	Z≥0,20 – probability of bankruptcy less than 40%; -0,03< Z < 0,20 – bankruptcy probability between 35% and 65%; Z < -0,30 – bankruptcy probability greater than 65% (difficult situation for the company).
		0.03	0.02		0.02		
5	The model of the Center of the Balances from the Bank of France	bankruptcy 100%	bankruptcy 100%	assessment	bankruptcy 100%	assessment	Z <-0,25 – area with difficulties; -0,25< Z < 0,125 – area of uncertainty; Z > 0,125 – favorable area.
		-1.72	-0.86		-0.86		
6	The model of the French Commercial Credit	good	good	depreciation	good	depreciation	Z =0 separates the firms in good ones and with difficulties;
		5.25	4.83		1.1		
7	The method "credit-man" or "security-analysis"	good	good	depreciation	good	depreciation	Z < 0 – bad area; Z > 0 – favorable area.
		7.19	3.77		3.78		
8	B - Băileşteanu	good	good	depreciation	good	depreciation	B <0,5 – imminent bankruptcy ; 0,5< B < 1,1– limited area ; 1,1< B < 2,0 – intermediate area; B > 2,0 – favorable area.
		17.49	24.53		15.69		
9	A - Ion Anghel	good	good	assessment	good	depreciation	A <0 – bankruptcy/failure; 0 > A < 2,05 – areas of uncertainty; A>2,05 non-bankruptcy.
		4.96	5.05		4.51		


The evolution of the Z score (A or B) in the period 2006-2008
1
2
3
The values of the Z score (A or B)
170.00
150.00
130.00
110.00
90.00
70.00
50.00
30.00
10.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
-1.00
-2.00
168.42
7.19
5.25
4.96
5.05
4.83
4.51
3.77
3.78
1.10
50.06
0.03
0.17
0.02
0.13
0.02
41.05
38.11
-0.86
26.06
24.53
27.65
17.49
-1.72
15.69
· Altman model for the firms quoted at the exchange
· Altman model for the firms that aren't quoted at the exchange
· Model B - Băileşteanu (1998)
The model of the French Commercial Credit
The method "credit-man" or "security-analysis"
Model A - Ion Anghel
The model Conan and Holder for the firms from the industrial domain
The model Conan and Holder for the firms with commercial activity of "en-gross"
The model of the Center of the Balances from the Bank of France

Conclusion

The elaboration of a model of the bankruptcy risk prediction that can respond to the Romanian economy's requests is difficult to fulfill in the conditions when a part of the bankrupt firms are restricting their activity without declaring the state of bankruptcy in justice, aspect which makes harder the research.

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