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modefinance Review Function Report on Validation of MORE Methodology 2017

July, 2017
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To the attention of the members of the administrative board of modefinance
To the attention of modefinance Compliance Officer

Executive Summary

The present report contains the outcome of validation of MORE Score Methology carried out under Section B of Chapter IV of modefinance Policies and Procedures.

The validation phase was requested by modefinance compliance officer Mr. Zorzi on June 7th, 2016.

The quantitative team selected by me Ms. Lucia Parussini as responsible for Review was the following:

– Ms. Lucia Parussini, Head of Review Function
– Mr. Simone Ziraldo, Head of Quantitative Methods Function

According to modefinance Policies and Procedures, the Team collected all relevant information on credit scores issued by modefinance in the previous years using MORE Methodology.

At June 2016, the number of credit scores issued by modefinance is 134.828.155.

13.144.033 of these scores have been calculated or updated in 2016.

ACD	#
1983 - 2006	19.665.050
2007	9.938.539
2008	11.497.523
2009	13.203.946
2010	13.901.036
2011	14.617.297
2012	15.664.537
2013	16.748.980
2014	15.130.912
2015	4.372.887
2016	87.448
Total	134.828.155

Table 1: The distribution of issued credit score per accounting closing date.

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Period of Scoring Activity: Jan 2012 – Jun 2016

During Jan 2012 – Jun 2016 modefinance has issued 52.004.764 credit scores referred to financial accounts closed in the same period.

Table 2 shows how they are distributed per Accounting Closing Date and major area. The most refer to European companies. The distribution of these credit scores over the MORE classes per Accounting Closing Date are available in Table 3. The most significant years are 2012, 2013 and 2014 because of the greater number of scored financial accounts at disposal.

Figure 1 shows the distribution over the MORE classes for the most significant years.

Area	2012	2013	2014	2015	2016
Africa	128.056	116.329	5.980	654	-
Asia	1.487.489	1.846.845	1.432.825	455.744	2.030
Europe	13.533.293	14.175.202	13.094.575	3.716.581	84.997
Latin America and Caribbean	369.001	541.592	566.186	183.192	17
Northern America	139.422	52.626	12.745	9.067	378
Oceania	7.252	16.367	18.591	7.646	26
Unknown	24	19	10	3	-

Table 2: Number of credit scores issued by modefinance per Accounting Closing Date and major Area between Jan 2012– Jun 2016.

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MORE	2012	2013	2014	2015	2016
AAA	0.12%	0.11%	0.07%	0.09%	0.03%
AA	0.86%	0.79%	0.64%	0.79%	0.19%
A	16.16%	16.61%	17.15%	16.01%	3.85%
BBB	11.70%	11.74%	11.73%	10.83%	2.83%
BB	22.66%	22.52%	23.46%	29.46%	43.71%
B	12.66%	12.15%	11.64%	9.58%	5.08%
CCC	12.97%	12.78%	12.76%	12.05%	13.52%
CC	9.94%	10.38%	12.12%	6.94%	4.76%
C	6.10%	5.81%	5.40%	4.49%	2.82%
D	6.82%	7.10%	7.02%	9.76%	23.21%

Table 3: Distribution over the MORE classes per Accounting Closing Date.

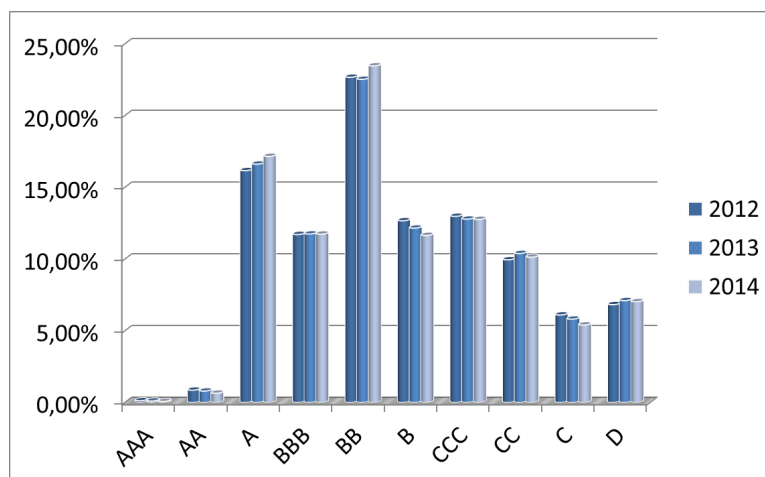**Figure 1: Distribution of credit scores issued by modeFInance between Jen 2012- Jun 2016 for Accounting Closing Dates 2012, 2013 and 2014.**

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Qualitative validation

The MORE methodology has not been modified in the period of scoring activity, except for the updating of the statistics used by the model. Excluding very rare and particular cases, no abnormal behavior of MORE methodology has been observed.

For the quantitative validation of MORE methodology companies in European Union and Euro Zone have been considered, in particular companies having financial accounts with confidence level higher than 95% in years 2012, 2013 and 2014.

Quantitative validation

At March 2016, **83.383** companies of the sampled set, having operating revenue greater than 15.000 th. euros, had status **active** and **11.978** companies of the sampled set had status **bankruptcy**.

Transition matrices

The transition matrices specific to each rating model indicate the probability of transition for current ratings (listed in columns) to the various rating classes (listed in rows) during a specified time period.

Table 4 shows one-year transition matrix considering the MORE scores of both active and bankrupt companies at beginning 2016.

2013-2014	AAA	AA	A	BBB	BB	B	CCC	CC	C	D
AAA	57,41%	32,24%	5,17%	3,10%	1,03%	0,34%	0,69%	0,00%	0,00%	0,00%
AA	4,85%	63,66%	24,01%	4,93%	1,31%	0,88%	0,26%	0,06%	0,04%	0,00%
A	0,54%	14,85%	55,97%	20,36%	3,16%	2,44%	1,43%	0,43%	0,66%	0,16%
BBB	0,09%	1,42%	16,19%	60,66%	15,09%	3,54%	1,71%	0,66%	0,52%	0,11%
BB	0,02%	0,30%	1,98%	19,96%	57,79%	12,98%	4,11%	1,66%	0,96%	0,23%
B	0,01%	0,24%	1,22%	5,55%	23,90%	50,04%	11,81%	3,89%	2,70%	0,64%
CCC	0,03%	0,18%	0,90%	3,66%	10,70%	22,46%	38,26%	13,29%	7,85%	2,66%
CC	0,02%	0,06%	0,56%	2,05%	5,95%	10,89%	21,77%	34,07%	19,60%	5,02%
C	0,06%	0,03%	0,47%	1,12%	1,84%	3,18%	14,25%	18,08%	43,88%	17,10%
D	0,00%	0,08%	0,38%	0,46%	0,85%	1,00%	12,07%	8,92%	22,67%	53,57%

Table 4: 1-year transition matriz of all sampled companies for validation.

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The stability of the rating procedure can be observed on the transition matrix by observing the diagonal. Frequently cases accumulate along the main diagonal of the matrix: these cases represent borrowers which did not migrate from their original rating class over the time horizon observed. This concentration around the main diagonal is an indicator of the stability of the rating procedure.

Tables 5, 6 and 7 show respectively one-year, two-year and three-year transition matrices considering the MORE scores of defaulted companies of validation set.

2013-2014	AAA	AA	A	BBB	BB	B	CCC	CC	C	D
AAA	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	100,00%	0,00%	0,00%	0,00%
AA	9,09%	18,18%	27,27%	0,00%	9,09%	9,09%	0,00%	9,09%	18,18%	0,00%
A	0,00%	0,35%	28,50%	11,57%	7,25%	15,20%	16,06%	6,56%	11,57%	2,94%
BBB	0,00%	0,35%	13,00%	15,08%	13,00%	10,57%	14,38%	12,31%	17,33%	3,99%
BB	0,00%	0,12%	2,74%	7,99%	15,38%	14,30%	15,14%	16,81%	21,57%	5,96%
B	0,00%	0,00%	2,25%	3,27%	7,33%	21,57%	17,50%	15,83%	25,13%	7,12%
CCC	0,00%	0,05%	1,39%	2,59%	4,23%	7,62%	24,94%	18,57%	28,52%	12,10%
CC	0,00%	0,00%	0,81%	1,52%	3,25%	4,87%	12,23%	27,00%	36,85%	13,47%
C	0,00%	0,04%	0,51%	0,76%	1,23%	1,53%	12,56%	13,33%	46,14%	23,90%
D	0,00%	0,09%	0,35%	0,52%	0,78%	0,61%	12,29%	8,57%	20,69%	56,10%

Table 5: 1-year transition matrix of defaulted companies.

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2012-2014	AAA	AA	A	BBB	BB	B	CCC	CC	C	D
AAA	0,00%	0,00%	0,00%	50,00%	50,00%	0,00%	0,00%	0,00%	0,00%	0,00%
AA	7,69%	15,38%	30,77%	0,00%	0,00%	15,38%	15,38%	0,00%	7,69%	7,69%
A	0,00%	0,46%	17,47%	10,20%	8,19%	16,38%	15,61%	8,81%	16,54%	6,34%
BBB	0,00%	0,15%	7,52%	9,77%	9,62%	10,83%	18,65%	15,49%	20,75%	7,22%
BB	0,00%	0,10%	2,76%	4,94%	11,60%	11,79%	16,63%	17,02%	26,24%	8,94%
B	0,00%	0,06%	1,71%	2,57%	5,63%	14,75%	14,14%	16,59%	31,15%	13,40%
CCC	0,00%	0,00%	2,05%	2,37%	3,42%	6,32%	20,28%	18,23%	31,72%	15,60%
CC	0,00%	0,00%	0,85%	1,63%	3,07%	5,23%	13,33%	20,92%	36,47%	18,50%
C	0,00%	0,00%	0,65%	1,00%	1,59%	2,12%	15,63%	13,51%	37,88%	27,61%
D	0,00%	0,00%	0,45%	0,75%	0,30%	0,89%	13,86%	14,75%	24,59%	44,41%

Table 6: 2-year transition matrix of defaulted companies.

2011-2014	AAA	AA	A	BBB	BB	B	CCC	CC	C	D
AAA	0,00%	0,00%	0,00%	0,00%	50,00%	0,00%	0,00%	50,00%	0,00%	0,00%
AA	5,56%	5,56%	16,67%	5,56%	11,11%	11,11%	22,22%	5,56%	16,67%	0,00%
A	0,00%	0,31%	11,92%	6,81%	6,97%	15,94%	17,03%	15,02%	18,73%	7,28%
BBB	0,00%	0,28%	5,04%	7,70%	8,26%	10,50%	20,45%	15,41%	23,95%	8,40%
BB	0,00%	0,08%	2,44%	3,82%	8,13%	12,76%	15,85%	17,64%	28,13%	11,14%
B	0,00%	0,00%	2,06%	2,18%	5,01%	11,55%	14,97%	16,44%	32,35%	15,44%
CCC	0,00%	0,00%	1,50%	1,96%	4,37%	6,50%	17,88%	16,33%	32,95%	18,52%
CC	0,00%	0,00%	1,81%	1,73%	1,65%	5,58%	13,76%	20,68%	35,85%	18,95%
C	0,00%	0,00%	0,81%	1,14%	1,63%	1,71%	17,40%	14,80%	36,42%	26,10%
D	0,00%	0,00%	0,91%	1,37%	0,46%	1,60%	13,01%	12,56%	22,83%	47,26%

Table 7: 3-year transition matrix of defaulted companies.

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The color legend of Tables 4, 5, 6 and 7 is shown below:

	0,00%-5,00%
	5,00%-25,00%
	25,00%-50,00%
	50,00%-100,00%

Each color corresponds to a range of probability of transition: darker the color higher the probability. This helps the interpretation of the transition matrix for bankrupt companies, as it is immediately evident the higher probabilities are in the upper triangular part matrix which means the model is able to catch the score downgrade for the companies will default. This is visible considering the score transition from 4 to 1 year (Table 7) and from 3 to 1 year (Table 6) before default. A more clear downgrade can be easily noticed considering the transition of scores from 2 to 1 year (Table 5) before default.

Default rates

Let us consider the MORE scores assigned to financial accounts with accounting closing date in 2014. In Table 8 the score distribution for the companies of all validation set and for the defaulted companies is shown as well as the Default Rate (DR). In Figure 2 the Default Rate is plotted. Figure 3 shows the credit score distribution.

2014	#	Default	DR
AAA	648	1	0,15%
AA	5170	10	0,19%
A	11260	436	3,87%
BBB	20684	453	2,19%
BB	21485	610	2,84%
B	14706	947	6,44%
CCC	8905	1871	21,01%
CC	5192	1933	37,23%
C	4824	3627	75,19%
D	2194	2065	94,12%

Table 8: Distribution of 2014 credit score for all the companies of validation set and the defaulted and Default Rate (DR).
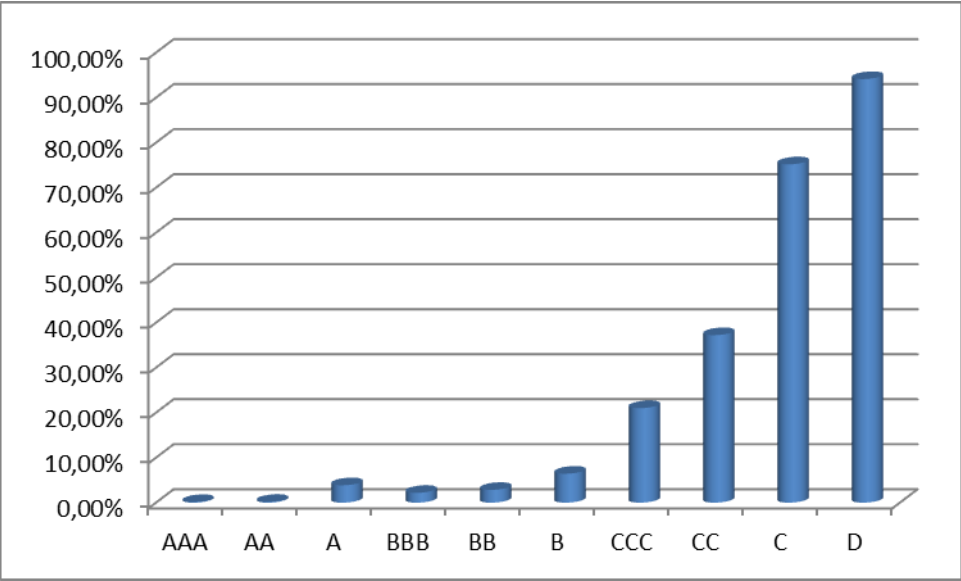
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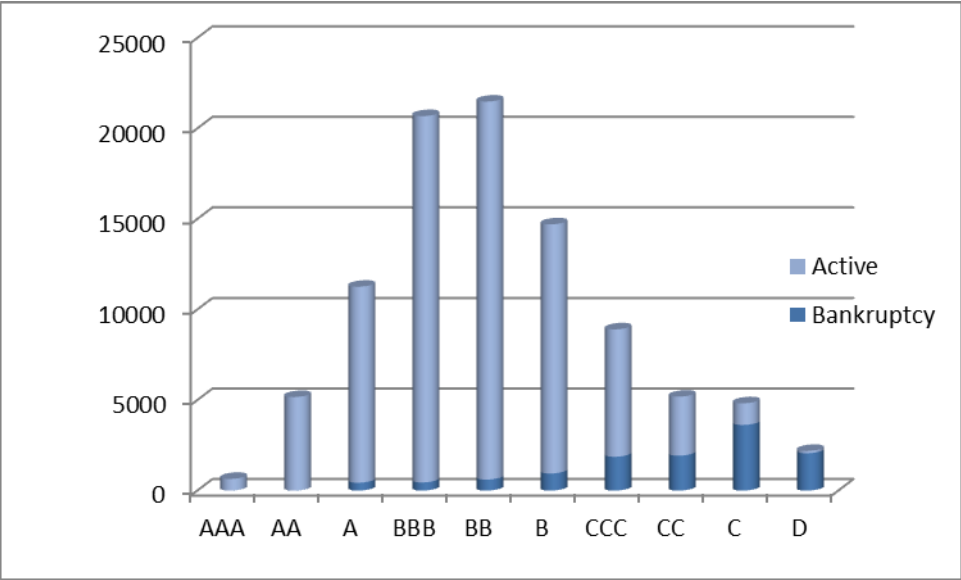AREA Science Park, Padriciano 99
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Figure 2: Default Rate.

Figure 3: 2014 credit score distribution.

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CAP/ROC/AUC/Gini models

The discriminatory power of a rating or scoring model denotes its ability to discriminate ex ante between defaulting and non-defaulting companies. The validation process by CAP/ROC/AUC/Gini models assesses the discriminatory power of the scoring model, which for MORE methodology is confirmed by Figures 4, 5 and 6.
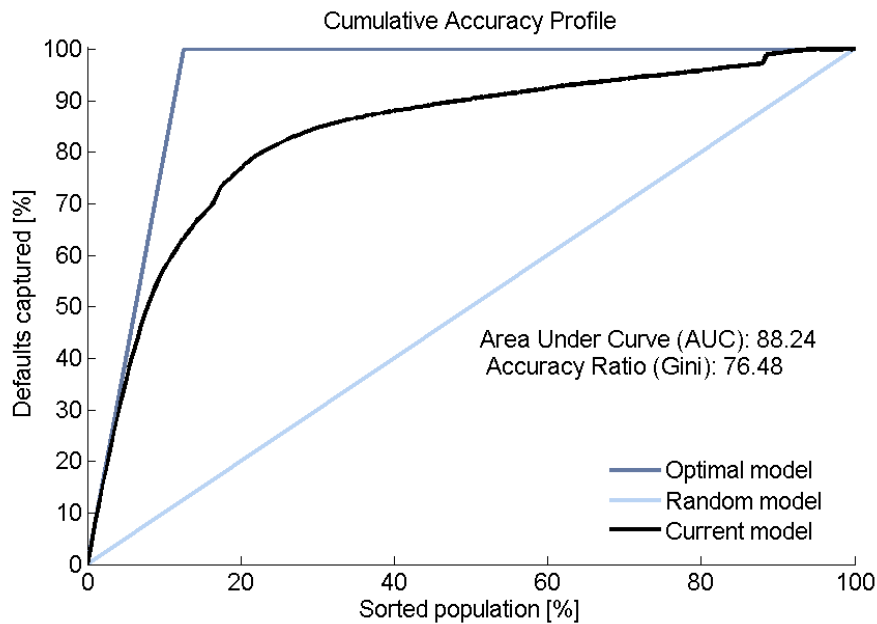

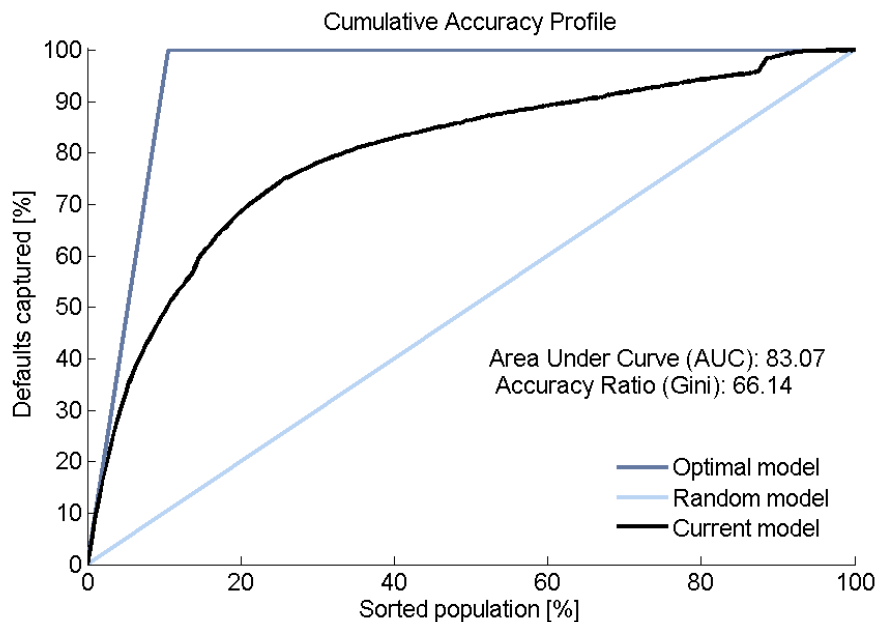**Figure 4: CAP plot with DD=1 year.**

Figure 5: CAP plot with DD=2 years.

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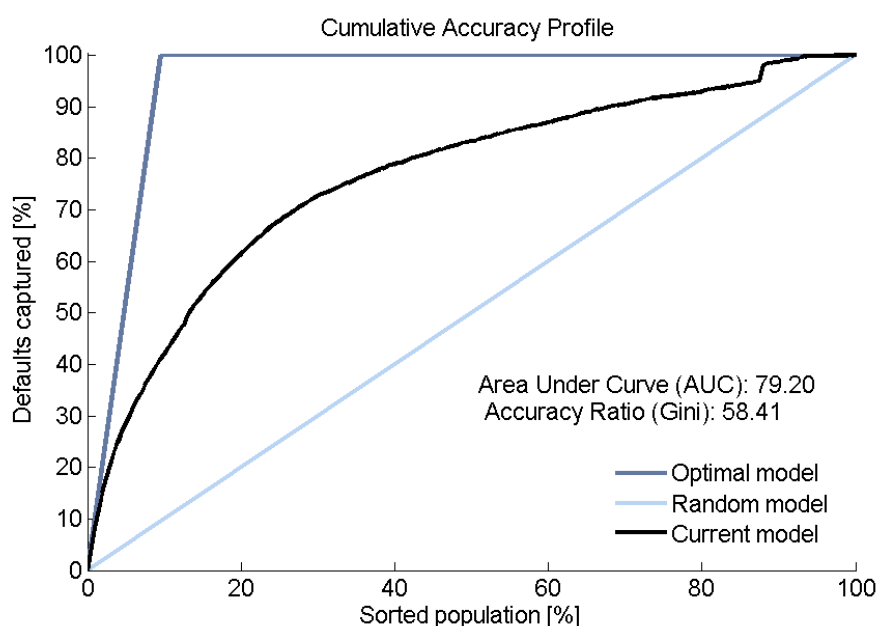validation of MORE methodology

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Figure 6: CAP plot with DD=3 years.

In the Cumulative Accuracy Profiles shown in previous figures a step can be noticed. This is expected due to some constraints provided in MORE methodology.

Table 9 summarizes the values of AUC and Gini index with Distance to Default equal to 1, 2 and 3 years.

DD	AUC	AR
1	88.24%	76.48%
2	83.07%	66.14%
3	79.20%	58.41%

Table 9: Area Under Curve (AUC) and Accuracy Ratio (AR) with different Distance to Default (DD).

Conclusions

The MORE methodology shows a high discriminatory power. The AUC is over 60% by taking into account the scores assessed on financial statements of bankrupted companies available 12 months before the notification of default. The MORE methodology has proved to be stable and able to identify risky companies ahead of default. According to these conclusions no review of the methodology is required.

Validation Team:
- **Ms. Lucia Parussini**, Responsible for Review
- **Mr. Simone Ziraldo**, Responsible for Quantitative Methods

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