Including environmental risk when rating the financial risk of loan applications to a development bank

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Abstract

This article discusses a methodology for including environmental factors in risk assessment of projects submitted to development or commercial banks for obtaining a loan. Granting a loan involves multidisciplinary personnel, usually including engineers, lawyers, environmentalists and financiers.

This text is basically divided into four stages: first, the introduction discusses the importance of this kind of integrated assessment. Next is a discussion on questions about the credit assessment methodology, also known as rating, and some traditional rating models are described. The third stage considers models covering the environmental aspects with a presentation of the proposed model. This stage involves questions relating to the development and risk rating model, including the economic-financial and environmental aspects. The paper ends with conclusions and recommendations about the pros and cons, drawbacks and possibilities of a multi-criterion credit system.

Key words: Risk, Scoring, Rating.

1. Introduction

The inclusion of environmental risk in rating financial risk is a topic very much in vogue today. According to Carvalho (2002), today's major financial institutions, namely the International Finance Corporation (IFC) and ABN Amro Real, are now asking their customers to respect environmental issues.

In Brazil, special attention should be paid to environmental issues, since Brazilian biodiversity is unlike any other country in the world. Some ecosystems in Brazil are the sole representation of species and biological environments, and a matter of interest to biologists and environmentalists worldwide, motivating the cooperation with other countries on the environmental factor.

The system proposed herein offers banks (commercial or development) flexibility to include economic-financial and environmental factors in rating credit extensions. Projects potentially detrimental to the environment may be refused or penalized by increasing the interest rate of the loan, unless proper mitigating measures are taken against environmental impacts.

2. Credit models

Traditional credit extensions generally involve statistical models and regressions in order to rate the potential default of a certain client, company or project. Such models apply to a widely differing aspects, ranging from personal credit, through small company loans to ratings of major world-class oil or mining corporations.

A corporate rating model usually examines indicators from the balance sheet and other financial statements, in terms of indebtedness, profitability and other aspects. Another important data in the model is the behavior of the company in terms of other loans that it may have requested.

Normally a credit-granting model involves three stages:

(a) Scoring: It consists of creating a number based on indicators, background and other data, which will represent the scoring of the company for credit purposes;

(b) Rating: It consists of using a table to transform the scoring in a specific credit risk classification, typically between A and D. AAA rating is the best that a company can achieve, and D the worst, meaning potentially very serious default (e.g., Motta and Calôba, 2002);

(c) Deciding on credit extension: If the rating recommends credit, an interest rate is fixed that will necessarily adopt the criterion of charging lower interest rates for companies with higher ratings.

In terms of multi-criterion models, the procedure may be repeated for the aspects to be rated.

2.1 Solely financial extension models

Some credit extension models use a discriminant analysis (Altman, 1968) and other statistical techniques, such as *Logit* and *Probit* (Neves, 1990); others use artificial intelligence techniques, namely neural networks, to classify the companies in similar groups, which will then receive the same rating. This bypasses the scoring stage. There are other methodologies by which a scoring, rating and interest rate are given when granting loans.

3. Adding the environmental aspect

This paper began when the authors hereof performed consulting services for a development bank and involved suggestions from the consulting firm and bank staff who accompanied the work and criticized the reports, developing a system to include the environmental issues in the risk analysis for credit extension.

The premises of the paper consider that the environmental factor will only be effective should the environmental risk be greater than the financial risk. Otherwise, the financial risk will prevail.

The scoring methodology was divided into two stages:

1. Three elements are assessed in the first:
   a. Company;
   b. Type of loan; and
   c. Project or Design.
   A specific scoring is given to each of the above elements.

2. In the second phase, the activity of the project is rated and a rate is given so that a fraction of the difference between the financial and environmental scoring is applied, thereby penalizing the credit rating due to the environmental risk.

All scoring for rating purposes will be comprised in an interval between 10 and 30 points, the last being equal to the maximum AAA rating. The following table illustrates the scoring and corresponding ratings.

Each item described above will be analyzed separately in the following sessions.

Rating	Scoring		Rating	Scoring	
	Bottom limit	Top Limit		Bottom limit	Top Limit
AAA	28,001	30,000	BB	19,501	20,500
AA+	27,501	28,000	BB-	19,001	19,500
AA	25,501	27,500	B+	18,501	19,000
AA-	25,001	25,500	B	17,501	18,500
A+	24,501	25,000	B-	17,001	17,500
A	23,501	24,500	CCC+	16,501	17,000
A-	23,001	23,500	CCC	14,501	16,500
BBB+	22,501	23,000	CCC-	14,001	14,500
BBB	21,501	22,500	CC	12,001	14,000
BBB-	21,001	21,500	C	10,001	12,000
BB+	20,501	21,000	D	0,001	10,000

Table 1 – Rating and Scoring

3.1 Company

The company analysis, comprising 50% of the environmental risk scoring, seeks to produce an environmental profile of any company that request credit, assessing certain parameters. An analogy is made in environmental terms with the Competitive Strategy Wheel of Michael Porter (1986, xxvp). The company objective in the middle of the wheel is to obtain credit from the financing agency and around it are all aspects to be rated in the company for which it manages to obtain credit (figure 1).

Figure 1 – Corporate assessment wheel

The rating parameters were chosen by analogy, based on ideas developed by Mendonça and Bobsin (2002) and Brigham et al. (2001), to a total of ten aspects. Each

of these parameters is rated as bad, regular or good. A scoring of 0 to 2 is given to a bad rating, grade 5 to a regular rating and good ratings are given scorings of 8 to 10. The fact of using value bands eliminates aspects of excessively accurate ratings for each item. An average is calculated between 1 and 10 by adding up all grades and dividing by 10. Since the scoring scale is between 10 and 30, the company's scoring, N_{Co}, will be given by:

$$N_{Co} = 10 + 2 * \text{(average scoring)} \qquad (1)$$

The aspects will be described below, giving an example for the hypothetical company XX:

1. Willingness/Aptitude: Measuring the previous efforts of the company that denote willingness and/or aptitude to deal with the environmental question. Company XX: Regular (Grade 5);
2. Tradition/Experience: Is linked to environmental certifications that the company has past experience in addressing the environment. Company XX: Regular (Grade 5);
3. Clients: Analysis of the environmental behavior of the company's clients, checking the dissemination of the care toward the environment that the company is generating, a concept similar to the cascade effect of quality. Company XX: Bad (Grade 1);
4. Sales Behavior. Company XX: Good (Grade 10);
5. Suppliers: Environmental behavior of the company suppliers. Company XX: Bad (Grade 1);
6. Environmental Structure. Company XX: Regular (Grade 5);
7. Stage of Environmental Awareness. Company XX: Good (Grade 10);
8. Human Resources. Company XX: Regular (Grade 5);
9. Environmental Status. Company XX: Good (Grade 10); and
10. Environmental Risk Insurance. Company XX: Bad (Grade 1)

The average company XX scoring is calculated by (5+5+1+10+1+5+10+5+10 +1) / 10 = 5.3 and then, the company's scoring can be calculated using equation (1):

$$N_{Co} = 10 + 2 * 5.3 = 20.6.$$

3.2 Type of loan

The assessment of the type of loan or project was based on a paper by Bergamini Junior, credit manager for BNDES (1998), and was responsible for 25% of the final scoring. Depending on the type of loan requested, different environmental requirements are requested by the relevant authorities in order to grant the credit. If all are met, the grade given for the type of loan will be 30, equal to an AAA rating. Otherwise, the grade may be penalized. The projects may be characterized in one of the four classes as follows:

Class	Type of loan	Penalty
A	Support for small and medium-size projects	4.2%
B	Small and medium-size high risk projects	50.0%
C	Support for large projects	37.5%
D	Large high risk projects	100.0%

Table 2 – Assessment of type of loan

The size of the project is directly related with the size of the company and its structure in terms of an economic group.

For each of the four types of loan certain procedures are required from the environmental viewpoint, which may be: Environmental Compliance, Audit, Environmental Impact Assessment (EIA) and Risk Analysis. The absence of any of these topics, when requested, will result in a penalty on the maximum scoring. The worst situation in this aspect is that of a project in class D, without meeting any requirement, as can be seen in table 1 above.

In the case of a project in class B, this should hypothetically comply with the formalities (compliance), Audit and EIA. If only compliance is present, weighting will be done to discount noncompliance with the other procedures.

The grade attributed to the type of loan, N_{Type}, will be given by:

$$N_{Type} = 10 + 20 * (100\% - \%_{Pen}), \qquad (2)$$

where the term $\%_{Pen}$ is the penalty rate for failing to comply with procedures from the environmental viewpoint. In the case of the previous class B project, the grade will then be $N_{Type} = 20$.

3.3 Enterprise or project

The rating of the project or design considers various environmental impacts that it may cause during its installation and duration. Each impact can be mitigated or not. From two matrices – one for impacts and the other for mitigation – the project grade is given based on the number of impacts without mitigation in relation to all environmental impacts. The following impacts are analyzed from the viewpoint of the loan candidate and from the bank itself:

Opening access roads and borrow areas for material	Increase in sound emissions	Ousting productive activities incompatible with the new areas of the project	Rise or spread of new regional sub-centers
Sediment re-suspension and pollutant remobilization	Increase in erosion processes	Population relocation	Sound emission by increasing vehicular traffic
Leakage/spill of fuel oils, lubricants or hazardous products	Changes to the urban structure	Production of solid waste	Vegetation clearance
Dust emissions during the building process	Urban planning and visual impacts/changes in general structure of the landscape due to a more dense population	Change to the regional microclimate	Change in modals/location alternatives
Loss of habitat	Change in quality of water in seas, rivers and lakes		

Table 3 – Analyzed Impacts

The 18 impacts above might influence the environment as follows:
- Physical environment: Impacts on land, air and water;
- Biotic environment: Impacts on flora, fauna and paleontology;
- Human environment: Impacts on productive activities; structure and services; and environmental heritage (cultural and natural).

Therefore, the 18 kinds of impacts are analyzed according to nine different environments, totaling 182 items to be studied in the two matrices. In the Excel and Visual Basic software, the cell corresponding to the impact is marked with an "x". The activities are then determined that have their impacts potentially attenuated in the mitigation matrix. To make things easier, the actual software spreadsheet has a de-

scription of the measure to be taken to mitigate the impact. It is then marked with a "v", above the "x", and the Excel cell referring to the impact is shaded in green. The idea is for the software to be completed by the loan applicant for later checking and analysis by the bank.

To summarize the rating of the project or enterprise, a final spreadsheet includes impacts with and without mitigation, as can be seen in the following figure:

	PHYSICAL			BIOTIC			HUMAN			
	Soil	Air	Water	Flora	Fauna	Paleontology	Productive Activity	Structures Services	Environmental Heritage (Cultural and Natural)	
Percentage impacts without mitigation/ Total impacts	100%	80%	100%	100%	100%	0%	71%	29%	100%	**75.6%**
Percentage os impacts with mitigation	0%	20%	0%	0%	0%	100%	29%	71%	0%	**24.4%**
Sum os impacts without compensatory mitigation measures	8	4	8	7	8	-	5	2	6	48
Total impacts (with or without mitigation)	8	5	8	7	8	1	7	7	6	57
Scoring of project	14.89									

Figure 2 – Summary of impacts/mitigation

The sum of impacts without mitigation, in the above case, is 75.6%. The enterprise or project grade, N_{Proj}, will be:

$$N_{Proj} = 10 + 20 * (100\% - \%\text{Impacts without Mitigation}), \quad (3)$$

where the term %Impacts without Mitigation can be calculated by the spreadsheet.

If all impacts are mitigated, then the enterprise or project will receive the maximum grade 30. In the above example, using equation (3), the project grade is:

$$N_{Proj} = 10 + 20 * (100\% - 75.6\%) = 14.89$$

3.4 Intermediary scoring

On reaching this point, the scorings of the items Company, Type of Loan and Enterprise or Project are already available, which is enough to now calculate the scoring of the environmental risk. This scoring is obtained by the average grades of each item, considered by their specific weights:

$$N_{\text{Environ Risk}} = N_{Co}*(50\%) + N_{Type}*(25\%) + N_{Proj}*(25\%) \quad (4)$$

In the example, using equation (4),

$$N_{\text{Environ Risk}} = 20.6*(50\%) + 20*(25\%) + 14.89*(25\%) = 19.02.$$

For this scoring, the environmental risk is classified as BB-.

3.5 Final scoring

To continue the classification, it is now necessary to establish a financial risk in order to compare the two scorings. Thus, the financial risk scoring will be hypothetically considered as 28.00, classified as AA+. The financial areas of the bank will calculate this rating as usual.

In this case, the environmental scoring (19.02) is worse than the financial scoring (28), so the project activity should also be

analyzed. Where the financial risk scoring is less than the environmental risk scoring, (which indicates that the financial risk is greater than the environmental) the economic-financial risk will prevail, since the environmental factor only helps reduce the overall risk scoring.

Each aforementioned activity is classified within a structure divided into groups and classes. The divisions currently made in the software are Cattle Raising; Mining; Manufacturing; Trade & Services; and Infrastructure. In each division there is a series of groups, which in turn, include several classes. Altogether there are 449 classified activities. Each of these activities was classified according to factors, such as:

- Potential for reducing human impact on biodiversity;
- Potential for reducing human impact on air;
- Potential for reducing human impact on water (quantitative and qualitative);
- Potential for reducing human impact on the land;
- Potential for supplying basic goods for human requirements;
- Potential for reducing the consumption of non-renewable resources.

Each of these factors is analyzed on a scale from –5 to 5, due to the negative or positive impact and its scope. Total points are calculated by adding the impacts to the six factors. In the 449 activities under analysis, the worst result was -16, and the best result 21. To facilitate future calculations, the results are scaled between 0 and 10, using the following transformation:
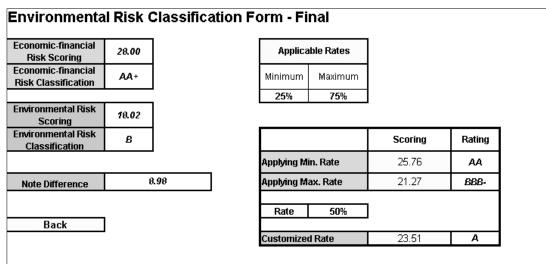
$$N_{APadron} = 10 * [N_{Activ} - (-16)] / [21 - (-16)]$$
$$= 10 * [N_{Activ} + 16] / [37]$$

$$(5)$$

Based on this standard grade, it is considered that activities with grades 0 to 2 have a strong impact; 2 to 8 have a variable impact potential; and 8 to 10 with little impact on the environment. These classes determine the rate to be applied to the difference between the economic-financial and environmental risk.

The rate of activities with little impact can vary between 0% and 50%; activities with a variable potential between 25% and 75%; and those with strong impact should be between 50% and 100%. In the case of an activity, such as exotic forestation, which is on the boundary between cattle raising and the forestation group, the potential environmental impact is variable, and the applicable rate between 25% and 75%.

Now it is possible to obtain the final grade for applying for finance. This grade varies according to the rate to be applied.

Environmental Risk Classification Form - Final

Economic-financial Risk Scoring	28.00
Economic-financial Risk Classification	AA+
Environmental Risk Scoring	18.02
Environmental Risk Classification	B
Note Difference	8.98
Back	

Applicable Rates

Minimum	Maximum
25%	75%

	Scoring	Rating
Applying Min. Rate	25.76	AA
Applying Max. Rate	21.27	BBB-
Rate	50%	
Customized Rate	23.51	A

Figure 3 – Final scoring

Presuming that the scoring of economic-financial risk is 28 points, which receives an AA+ classification, and that the environmental risk scoring is less, with 19.02 points, whose classification is BB-, the difference between them is 8.98. To determine the percentage limits of this difference that may be applied to reduce the financial risk scoring, the activity was analyzed, and since it is between 2 and 8 points, the limits will be 25% and 75%. These regularly broad rate bands are designed to give the bank's credit analyst more flexibility; in other words, room for maneuvering to include other factors not in the model.

As the example in figure 3 shows, the best classification, using 25% quota, will be 25.76 points, giving an AA rating. The worst classification, adopting the 75% quota, will be 21.27 points to give a BBB- classification. At the bottom of the figure, a rate can be arbitrated within the limits and check the scoring given and rating.

4. Conclusion

The purpose of this paper is to integrate the traditionally performed financial rating with the environmental aspect. Since, in the proposed model, this aspect is applied only to lower the rating of the project in the scoring scale, the bank can adopt a higher interest rate should the company and project fail to adapt to the required regulations. This is why this model can be considered to be a mechanism inhibiting predatory attitudes toward the environment, since higher interest has a direct impact on corporate finances. The diffusion of this methodology, on one hand, excludes the bank from participating by funding projects with a potential environmental liability. On the other, it encourages companies to spend money, which they would pay in higher interest (by being penalized by the negative environmental aspects), on mitigating the environmental risks associated with their productive activities.

In the future, a social aspect may be developed together with the environmental and financial to create a three-pronged rating. This new dimension could also encourage other projects with a positive impact on the social area. Depending on each case, financial institutions could associate different weights to each of these components, offering more flexible trade-off between these three important aspects.

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