

Quantitative vs. Qualitative Criteria for Credit Risk Assessment*

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Abstract

The existing vast literature on credit risk assessment and default prediction provides models building mostly in quantitative indicators. We present the results of a survey carried out of experts from the main banks in Portugal, conveying evidence on the dominant procedures undertaken by the Portuguese banking system. Our analysis concludes on the relevance of qualitative criteria, particularly management's experience and reliability, and on their significant negative correlation with banks' default records. Within this context the paper reflects on the role of multi-criteria decision analysis (MCDA) models as a way to process credit risk assessment integrating qualitative and quantitative aspects.

Keywords: banking; credit risk; qualitative criteria; multi-criteria decision analysis.

JEL Classification: C12; C22; C44; G21; G32

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The authors are grateful to the participants at the 39th Meeting of the Euro Working Group on Financial Modelling, and particularly to Michel Bouchet, for their comments and incentive. Any remaining errors are the authors' responsibility.

1 - Introduction

Since the seminal articles of Beaver (1966) and Altman (1968), a large stream of literature has been devoted to problems related to credit granting and business bankruptcy. Different approaches have been proposed, depending on the type of credit involved and on the statistical or operational research tools employed.⁵ Three generic kinds of approaches to customer grading can be recognized [Alibhai, Gaeta and Hingorani (2003)]: purely qualitative, resulting from staff assessments of the market potential of the customer and his/her management competence; purely quantitative, largely relying on a rigorous balance sheet analysis and external ratings; and mixed, the most commonly used by banks. The relevance of including non financial information is documented, among others, by Couderc and Renault (2005), who show that misspecifications of financial based factor models is largely corrected by this inclusion.

The credit market is typically characterized by severe information problems, both regarding moral hazard and adverse selection. The risk of borrowers is difficult to assess and their performances are difficult to monitor. These features call for complex but inevitably incomplete contracts. It is up to the banks -in some countries co-aided by a central authority- to try to mitigate these problems, in order to protect themselves from default and to ensure a more efficient allocation of funds.⁶ Credit risk assessment plays a crucial role in this field and the increase in the use of computer technology, as well as the development of new statistical and risk models, have improved the quality of the information available for decision makers. These improvements, by allowing greater rating accuracy, become particularly important in the context of the new Basel Accord (Basel II).

In this paper we concentrate our attention on banks' assessment of business credit applications aimed at financing medium and long-term investment projects. This type of credit analysis has some relevant features. First, it implies an evaluation of the commercial potential of the operation for

⁵ See, for example, the surveys carried out by Altman and Saunders (1997) and Thomas (2000).

⁶ Default occurs whenever a borrower is not able to repay his/her debt obligations in full (principal, interest or fees). Another mechanism that may insure credit granting is the information gains from sharing credit records when banks merge, or when a central database is made available [see, e.g., Catalão-Lopes (2006)].

the bank, which includes considering the duration of the customer-bank's relationship and the amount of deposits and other frequent operations undertaken by this customer. Second, it involves the analysis of the expected return and risk of the proposed investment and also the appropriateness of the schedule of the financial operation to support this project. Third, the bank's decision concerns not only the approval or refusal of the credit application, but also, in the event of approval, its classification according to different risk classes. So, as for rating systems, these risk classes correspond to different spreads.⁷ Finally, the analysis cannot rely exclusively on historical data, which would allow the direct use of techniques such as discriminant analysis or logit and probit regressions.

Bearing in mind these characteristics, some authors like Bana e Costa, Barroso and Soares (2002) and Bana e Costa, Lourenço and Soares (2007) proposed a multicriteria model for credit risk assessment, based on its capability of incorporating value judgements and dealing with qualitative aspects. The relevance of qualitative criteria was also highlighted by Lehmann (2003) and recognized, among others, by Altman and Sabato (2007). Following this line of research, the goal of this paper is to reveal the results of a survey carried out of loan officers from different banks in Portugal, in order to determine common criteria and procedures used in their analysis, as well as the relevance given to qualitative information.

The rest of the paper is organized as follows. In the next section we present the methodological approach followed to question the loan officers. Section 3 discusses the results of the survey. In the fourth section we present and discuss some of the characteristics of the MCDA approach to credit granting, which makes it appropriate for dealing with the aspects identified in the previous sections. Finally, in section 5 we draw some conclusions.

2 - The survey

Credit decisions are usually based on four types of information: i) information of a commercial nature, related to the bank-client's relationship history; ii) information of a financial nature, quantitatively assessed through some indicators; iii) information related to the firm's management; and iv)

⁷ For an analysis of the relationship between risk and price of credit in the Portuguese banking system see Catalão-Lopes (1994).

information which mitigates the credit risk (collateral and other guarantees, in the context of Basel I and Basel II).⁸ Our survey was mainly focused on information types ii), iii) and iv). Indeed, type i) may be taken for granted *a priori* in this context, since it is common practice for a prior phase to take place, consisting of a commercial analysis of the customer and the proposed operation.

The survey was carried out in order to assess the most common procedures and criteria employed in Portuguese banks. The inquiry was aimed at a panel of six loan officers from the six major banks in the country.⁹ These banks represent nearly 80 per cent of the whole system in terms of loans to non-financial corporations. It was clear from the beginning that their answers would not be interpreted as representing the official position of the institutions to which they belong, but instead they would be regarded as simply reflecting the prevalent practices.

The methodology followed for approaching our panel of experts may be referred as an *a la* Delphi methodology [see Dalkey and Helmer (1963), Parenté and Anderson-Parenté (1987), Rowe and Wright (2001)]. This methodology is characterized by anonymity, successive iteration to reach convergence of opinions, controlled feedback of the judgements of the members of the panel, and statistical aggregation of responses. It is a method typically used for medium and long-term predictive purposes when few or no historical data is available. Although we had no forecasting objectives, but solely intended to reach the largest consensus among the loan officers surveyed, we followed a methodology which resembles the Delphi one in that the four aforementioned characteristics are respected. This approach differs from other well-known methods such as brainstorming or decision conferencing since people being surveyed are not supposed to meet.

⁸ One may note some correspondence between this classification and the so-called 4 “C’s” of credit on which most financial institutions relied almost exclusively some decades ago to reach a somewhat subjective judgement: borrower’s character (reputation), capital (leverage), capacity (volatility of earnings), and collateral.

⁹ In order of importance of the amount of credit granted, from the first to the sixth rank: Banco Comercial Português, Caixa Geral de Depósitos, Banco Espírito Santo, Banco Santander Totta, Banco Português de Investimento and Montepio Geral. For confidentiality reasons, their answers will not be identified in the analysis that follows.

Although there is no standardization in the credit risk assessment practices, and although these obviously vary with the characteristics of the operation in question (amount, term, firm's dimension, project, etc.), it is clear that all institutions adopt some common procedures. From a first approach of a bank in the sample we selected a list of aspects that were taken into consideration for analysing the credit applications. These aspects, which we will call criteria in a broad sense, were shown to the other members of the panel. They were then asked to validate them, adding others that they considered relevant and suppressing items that were, in their opinion, of no importance. In two rounds, a grid was built comprising the forty criteria accepted by all banks in the sample, and also the descriptors corresponding to these criteria (see Table 1). These criteria were classified into three groups: financial criteria – the usual financial ratios; market criteria – market conditions, the firm's positioning and its adaptability; and management criteria – management's experience and its behaviour towards stakeholders and the society in general. Market and management criteria are considered mainly of a qualitative nature, and the most common procedure undertaken by the banks' analysts is to rate them according to a usual categorical scale of the type: poor, fair, good, very good and excellent. As for financial criteria, while the underlying descriptors correspond to real numbers and so we consider them as quantitative for the purpose of this analysis, they are frequently conceptually converted into a qualitative scale in the analysts' minds. This scale is usually a five-class scale as the one above. Finally, it should be noted that some criteria are also described as binary variables (e.g. 28 - Certified accounting).

Having established the criteria, a new round was carried out to rate them according to the following classification:

- 1- the criterion has no influence at all in the bank's decision;*
- 2- the criterion has only a slight influence in the bank's decision;*
- 3- the criterion has medium influence in the bank's decision;*
- 4- the criterion has high influence in the bank's decision;*
- 5- the criterion has a decisive influence in the bank's decision.*

Also, it was made clear to all members of the panel that the distance between each scale response was meant to be of equal semantic intensity. Consequently, the results (240 scores = 6 experts x 40 criteria) could be

addressed as being quantitative variables measured on an interval scale, enabling the calculation of several statistical measures, tests and multivariate methods.

Table 1 – Criteria for analysing credit applications

	Financial Criteria	Descriptors/Indicators	Mean	Rank	
Liquidity	1	Cash balance	Operating sources of cash/ Operating uses of cash	3.83	25
	2	Quick ratio	(Current assets- Inventories)/ Current liabilities	3.83	25
	3	Required financing period	Days Accounts Receivable Outstanding + Days Inventory Held - Days Accounts Payable Outstanding	4.17	11
Leverage	4	Coverage of fixed assets	Permanent capital/Fixed assets	3.50	38
	5	Equity ratio	Equity/Net total assets	4.17	11
	6	Times interest earned ratio	EBIT/Interest payments	4.00	18
Profitability	7	Return on equity	Net income/Equity	3.67	30
	8	Return on assets	EBIT/Net total assets	3.67	30
	9	Economic margin	EBITDA/Sales	3.67	30
	10	Percentage of fixed costs	Fixed costs/Sales	3.67	30
	11	Profit margin	Net income/Sales	4.17	11
	12	Firms cash-flows	Cash-flows expected evolution	4.17	11
	13	Profitability of the investment project	Net Present Value	4.17	11

Table 1 (cont'd)

	Market Criteria	Descriptors/Indicators	Mean	Rank
14	Sensitivity to macroeconomic environment	Past evolution of operating income over the business cycle	4.00	18
15	Sensitivity to legal and political environment	Dependence on legal and regulation changes	3.33	39
16	Market share	Judgement concerning firm's market share	3.83	25
17	Market trend	Expected market growth and its sustainability	4.00	18
18	Variability of demand	Cyclical and seasonal behaviour of demand	3.67	30
19	Technology and innovation	Technological sophistication	4.33	6
20	Production flexibility	Capability of production process to face market changes	3.83	25
21	Product-mix	Diversification and match of product-mix to market demand	3.83	25
22	Price level	Pricing vs competition	3.17	40
23	Placement	Dependence on distribution channel and consumer choices	4.00	18
24	Brand value	Rating for quality, design and perceived value for customers	4.17	11
25	Dependence on portfolio of customers and suppliers	Concentration of customers and suppliers	4.00	18

Table 1 (cont'd)

	Management Criteria	Descriptors/Indicators	Mean	Rank	
Trustworthiness	26	Planning and forecasting data	Fit of forecasting data to needs of all business areas	4.33	6
	27	Timely and reliable reporting	Existence of regular and reliable information	4.67	1
	28	Certified accounting	Certified accounting information	4.50	4
	29	Performing behaviour with respect to bank loans	Historical loan credit records	4.67	1
	30	Performing behaviour with respect to tax obligations	Fulfilment of tax, social security and other public obligations	4.33	6
	31	Performing behaviour with respect to suppliers	Fulfilment of commercial and financial contracts	3.67	30
	32	Performing behaviour with respect to customers	Time to deliver the product and services offered	3.67	30
	33	Collateral	Possibility to cease assets upon non-performing loans	4.50	4

Table 1 (cont'd)

	Management Criteria (cont'd)	Descriptors/Indicators	Mean	Rank	
Performance	34	Human resources motivation and productivity	Human resources motivation, productivity, timely compensation	3.67	30
	35	Management and business continuity	Renewal of patents, franchising and ability to substitute managers	4.17	11
	36	Experience and past performance of managers	Historical information on managers' previous successes and failures	4.67	1
	37	Commitment and skills of the managing team	Stability and appropriateness of management skills and choices for the specific businesses.	4.33	6
	38	Management performance	Ability in combining all resources of the firm. Growth of firm's value.	4.00	18
Ethics and social responsibility	39	Ethical management	Honesty in negotiation, credible external auditing reports and business practices within competition law	4.33	6
	40	Environmental and customer value orientation	Cooperation with environment policy, customer value creation when selling and running post-sales attendance	4.00	18

The main purpose of our study was to identify any existing relationship between the different weights assigned to the three groups of criteria and the banks' characteristics and performance in terms of overdue credit. The most relevant ratio employed to assess this performance corresponds to $\frac{\text{Gross Overdue Credit}}{\text{Gross Total Credit}}$. "Gross" means that provisions for overdue credit and non-performing loans are included. This ratio is required by the Portuguese central bank in its Instruction 16/2004. In 2005 it ranged from 0.011 to 0.034 for the banks included in our sample.

3 - Analysis of the results

This section addresses the results of the survey in three subsections. The first shows the relative importance of qualitative criteria. In the second subsection, this result is related with the credit performance of banks, as measured in terms of overdue credit. Finally, the third subsection extends the previously established facts by splitting the sample according to the size of the banks.

3.1 - The relative importance of qualitative criteria

The last two columns of Table 1 express, respectively, the average scores for each of the criteria analysed by the loan officers and its rank position among all criteria. As one can see, the average bank valuation ranges from a minimum of 3.33 (sensitivity to legal and political environment) to a maximum of 4.67 (recorded simultaneously by three criteria: timely and reliable reporting; performing behaviour with respect to bank loans; experience and past performance of managers).

Table 2-A shows that management criteria are clearly the most valued by loan officers, with an average of 4.23. Financial and market criteria are valued, respectively, at 3.90 and 3.85, on average. Every bank considers management criteria as the most important or the second most important category. Noteworthy is that, as a whole, qualitative criteria (management + market criteria) record an average of 4.06 against 3.90 for quantitative criteria (i.e., financial criteria).

Table 2-A - Average scores by group of criteria

Quantitative (Financial) criteria	3.90
Market criteria	3.85
Management criteria	4.23
Qualitative (Market + Management) criteria	4.06

As we said in the previous section, the members of the panel belong to the largest banks in the country, covering a large majority of the Portuguese banking system. However, before proceeding with the statistical analysis, we may still want to extrapolate the above conclusions to the population of loan officers in the Portuguese banks. The inference on the statistical significance of the differences among the mean scores found in table 2-A, could be realized through the calculation of dependent t-tests for pairs of average scores (the pairs Financial vs. Market, Financial vs. Management, and Financial vs. Market + Management). This analysis, however, would be undermined by the fact that we would only have 6 pairs of observations. This fact led us to an alternative exercise considering the scores as a whole, independently of the analysts. We take the scores for all the criteria included in each group, and then compare the difference in means, taking the view that we are now in the independent sample case (criteria cannot be paired and groups have different number of criteria). For this case, we verify that since our dataset has ties, some of the standard Normality tests give misleading results. At the end, we focused on Bera-Jarque test, somewhat less sensitive to that problem, and concluded for not rejecting Normality (p-values of 0.328, 0.197 and 0.109 respectively for the financial, market and management groups of criteria). Hence, we pursued to test for the difference in means, using the Welch variant of the t-test whenever we found differences among the variances shown by the Levene test. The results found can be seen in table 2-B. They show clearly a significant difference between management and either financial or market criteria. The difference between qualitative criteria and quantitative (financial) criteria can still be considered significant if we take a significance level just slightly larger than the usual 5% threshold (7.1% in this case).

**Table 2-B – Independent t-test for difference between means.
Unequal sample sizes**

		Levene's Test for Equality of Variances		t-test for Equality of Means				
		F	Sig.	t	df	Sig. (2- tailed)	Mean Diff.	Std. Error Diff.
Market vs Financial	Equal variances assumed	7.532	.007	.452	148	.652	.05021	.11118
	Equal variances not assumed			.448	138.185	.655	.05021	.11203
Management vs Financial	Equal variances assumed	6.648	.011	-3.31	166	.001	-.33590	.10137
	Equal variances not assumed			-3.34	165.819	.001	-.33590	.10057
Management vs Market	Equal variances assumed	.281	.597	-3.42	160	.001	-.38611	.11279
	Equal variances not assumed			-3.39	146.583	.001	-.38611	.11379
Qualitative vs Financial	Equal variances assumed	5.605	.019	-1.70	238	.090	-.16429	.09645
	Equal variances not assumed			-1.81	179.084	.071	-.16429	.09060

Note: n_1 and n_2 range from 72 to 162 scores, corresponding to the number of criteria included in each group \times six panel members.

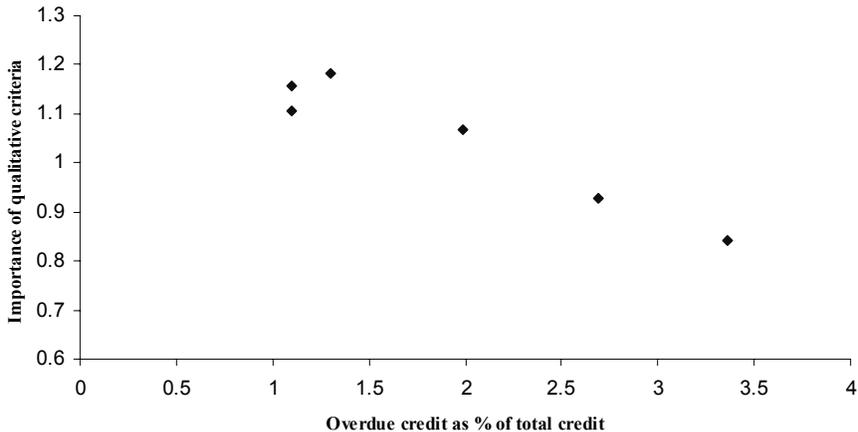
Finally, on average it can also be stressed that the five most valued criteria belong to the class of management criteria, with an average score higher than or equal to 4.5. Among the ten most valued, nine are management criteria and the other one is also qualitative (Technology and innovation). Financial criteria only appear after the eleventh position.

3.2 - Overdue credit and relative importance of qualitative criteria

To assess the relation between the importance given to qualitative criteria and the performance in terms of credit overdue, a correlation coefficient was computed between the ratio $\frac{\text{Gross Overdue Credit}}{\text{Gross Total Credit}}$ and the ratio $\frac{\text{Mean Score (Qualitative Criteria)}}{\text{Mean Score (Quantitative Criteria)}}$.

The Pearson correlation coefficient, -0.964, is significant at a five per cent level, and indicates that the use of qualitative information mitigates the information problems present in lending activity, leading to lower levels of overdue credit. Spearman's rank correlation is still highly negative (-0.78). Figure 1 shows the dispersion of the banks interviewed regarding these two indicators.

Figure 1 – Relation between overdue credit and the importance of qualitative information



We also divided the sample into two groups: the three best banks in terms of overdue credit (i.e. those with the lowest overdue credit ratios), and the three worst. Table 3-A shows that the banks with best overdue credit ratios

are those that rate preferentially the qualitative criteria (average score of 4.23 against 3.69 for the quantitative criteria). The three banks with the worst performance show an opposite pattern – average score of 3.89 for qualitative criteria against 4.10 for quantitative criteria. The results of the independent t-test for difference between means can be found in table 3-B¹⁰. They confirm that the set of three banks with best overdue credit record favour, significantly, the qualitative criteria over the quantitative. For the three worst banks, however, the difference between means is not statistically significant at the usual 5% significance level.

Table 3-A - Average score by class of criteria. Sample split according to bank overdue credit

	<i>3 best banks</i>	3 worst banks
Quantitative (Financial) criteria	3.69	4.10
Qualitative (Market + Management) criteria	4.23	3.89

Table 3-B – Independent t-test for difference between means. Sample split according to bank overdue credit

		Levene's Test for Equality of Variances		t-test for Equality of Means				
		F	Sig.	t	df	Sig. (2- tailed)	Mean Diff.	Std. Error Diff.
Quantitative vs Qualitative for 3 Best banks	Equal variances assumed	.271	.604	-4.324	118	.000	-.54226	.12540
	Equal variances not assumed			-4.430	79.969	.000	-.54226	.12241
Quantitative vs Qualitative for 3 Worst banks	Equal variances assumed	10.407	.002	1.543	118	.126	.21368	.13850
	Equal variances not assumed			1.732	101.026	.086	.21368	.12340

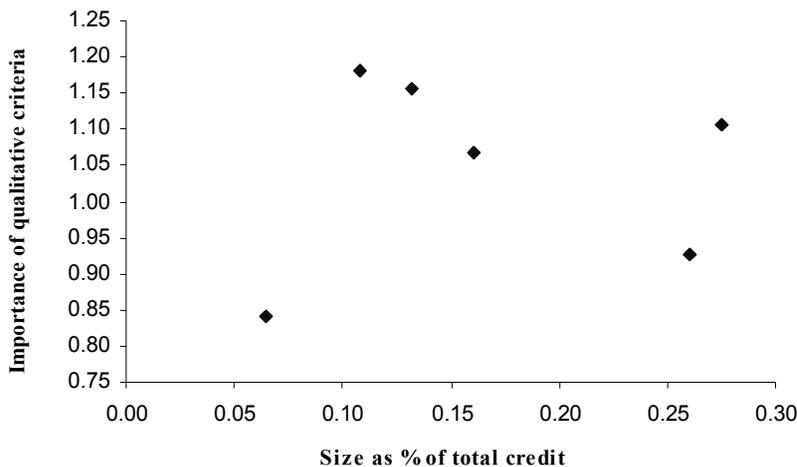
Note: n₁ and n₂ range from 36 to 81 scores, corresponding to the number of criteria included in each group × 3 panel members.

¹⁰ We did not compute the paired samples test since here the number of observations is rather small.

3.3 - Size and relative importance of qualitative criteria

Finally, in this subsection we further inspect the relation between the relative importance assigned to qualitative criteria (measured as the ratio between the mean score of qualitative criteria and the mean score of quantitative criteria) and the dimension of the banks in the sample. As we can see in Figure 2, there is no evidence of a clear relationship between these two variables. Four of the six experts assign more importance to qualitative criteria (ratio >1) and two others, one small and one large bank, assign more importance to quantitative aspects. The Pearson correlation (0.08) confirms the lack of a significant relationship between the two variables. The same happens if we compute the Spearman's rank correlation, which is very similar (0.03). So, the conclusion from this analysis seems to be that the relevance of qualitative or quantitative criteria is not influenced by the size of banks.

Figure 2 - Relation between size and the relative importance of qualitative criteria



4 - Rationale and guidelines for a Multi-Criteria Approach

The results of the survey discussed in the previous section and the several interviews held with the bank officers confirm that the adoption of a MCDA approach may bring more consistency to the analysis of this type of credit. We are not going to illustrate in detail this approach, which can be found in Bana e Costa, Barroso and Soares (2002) and in Bana e Costa, Lourenço and Soares (2007), but we will try to expound the arguments in favour of this line of reasoning and highlight the main issues to be addressed in its implementation.

The first has to do with the prevalence of qualitative criteria, which in some cases are even expressed in a vague manner (see descriptors in Table 1). The inclusion of these criteria or aspects implies that the analysis is mainly judgmentally based, depending on the subjective assessment of the analysts. As such, it limits the usage of the most common statistical analysis. The main concern should therefore be to establish some boundaries on that subjectivity, focused on the research of value functions that may express a generalised point of view, for each bank, on the relevance of the various possible outcomes in terms of the performance of the different criteria. The value functions, usually defined as piecewise linear, enable to translate performances into value scores.

Another issue that must be discussed is whether the different aspects under consideration are really different criteria, investigating whether they are preferentially independent (which is different from being statistically non-correlated) and cover all the dimensions of the analysis.

Having determined the scores that evaluate each criterion, and having asserted that they are not redundant and cover all the dimensions of the problem, it seems obvious from the survey that the officers consider the possibility of compensation among criteria¹¹, which would suggest the adoption of an additive value model. This can be expressed as follows:

¹¹ It may happen that for some criteria this will only be true beyond some limits (e.g. NPV>0). In this case, some restrictions or rules may be added [again, see Bana e Costa, Barroso and Soares (2002)].

Let $v_j(a)$ ($j = 1, \dots, n_c$) be the value scores of application a in the n_c criteria. The overall score $V_c(a)$ of a will be given by the general expression

$$V_c(a) = \sum_{j=1}^{n_c} w_j \cdot v_j(a) \quad \text{with} \quad \sum_{j=1}^{n_c} w_j = 1 \quad \text{and} \quad w_j > 0$$

in which the parameters w_j are *scaling factors* of the value scales v_j ($j = 1, \dots, n_c$) – commonly known as “weighting coefficients” or relative “weights” – that allow one to harmonise value units in the different criteria.

Finally, the weight of the different criteria can still be subject to a sensitivity analysis in light of the records of past applications [see Bana e Costa, Lourenço and Soares (2007)].

5 - Conclusion

This paper surveys the practice of loan officers from the six main banks in Portugal, holding nearly 80 per cent of total loans to non-financial corporations. This practice refers to the analysis of business credit applications for financing medium and long-term productive investments.

The results show that banks include a wide range of criteria in their analysis, corresponding to three main areas: financial performance, market/competitive environment and the management’s experience and reliability. A high number of these criteria are of a qualitative nature and even those that can be expressed in quantitative terms (financial ratios) are commonly classified within qualitative categories.

A deeper analysis of the results also shows that qualitative criteria (particularly management criteria) are on average more important than quantitative criteria (financial) to the members of the panel. Furthermore, the correlation between the relative importance of qualitative criteria and the performance obtained by banks in terms of credit overdue showed a strong significant negative value (-0.964).

This evidence was further investigated when taking into account either the overdue credit performance of banks or their size. The results suggest that higher relative valuation of qualitative criteria is fostered by the best banks (in terms of overdue credit), but has no significant relationship with the size of the banks.

The relevance of qualitative criteria implies that credit analysis is mainly judgmentally based, depending on the subjective assessment of the analysts. As such, it limits the usage of the most common statistical analysis. The main concern should therefore be to establish some boundaries on that subjectivity, focused on the research of value functions that may express a generalised point of view inside the bank. We therefore argue in favour of the potential benefits of adopting a Multiple Criteria Decision Analysis approach for supporting decision makers in this type of credit analysis.

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