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# The influence of the financial and accounting information adjustments on the decisions of Rating agencies

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## **Abstract:**

*Credit rating agencies (CRA) are qualified as “auxiliaries of the financial information” by all the investors. Ratings are the results of a methodology used by CRA. Within the framework of a demystification of the method of work of agencies, the objective of this paper is to identify the importance of the accounting and financial information adjustments in the decisions of rating agencies. This allows estimating the explanation proportion of this type of information that contributes in the development of the assigned rating.*

*We suggest a statistical and econometrical study that aims at determining the ratings from the accounting and financial variables adjusted by the credit rating agencies to better understand the relation between the adjustments of the ratings and the level of the ascribed score.*

*Keywords: Accounting and financial information, accounting and financial adjustments, rating agency, logistic analysis.*

## 1 Introduction

The crisis of confidence we are facing in relation with the credit rating agencies (recently the crisis of real-estate loans in United States) is the outcome of an uncertainty regarding the quality of the data they broadcast. The assigned ratings have become the target of the main reproaches due to the ambiguity of the methodology adopted for the rating decisions, which results largely from a subjectivity correlated with the determination mode of the rating.

At the origin of this ambiguity, there is the incomprehension of the analysis elements originated from a change or an allocation of rating.

This work aims at one of the elements of the analysis methodology of the credit rating agencies, that of the accounting and financial data, trying to explore the relation between the accounting and the financial variables and the broadcast ratings.

This goal can be conveyed through several attached questions. Is the accounting data useful for the various decisions taken within the framework of the rating activity? If it is complete, what is

its influence on the final decision? What is the adjustment power of the accounting and financial data adjusted by ratings? Is there any informative power superior to adjusted data in relation with published data in the rating determination?

In order to answer these questions, a first part will be dedicated to literature review about the rating components. The research hypotheses are afterward formulated. The descriptive statistics of the empirical study are exposed, which introduces the last point where the results are presented and discussed.

## 2 The rating determiners of the commercial and industrial companies: relevant literature

The issue of the rating determiners is widely discussed in the existing literature. The rating determiners are centered around four statistical methods. We distinguish the linear regression, the discriminating analysis, the logistic approach and the modern techniques.

### 2.1 linear Regression:

The first studies of the rating determiners that used a linear regression are the ones of Horrigan (1966), Pogue and Soldofsky (1969) and West (1970). They used simple models of regression using less squares, having for dependent variable the *rating*.

The calculations of the determination coefficients' indicate that an important percentage of rating (up to 79 % in the study of West) can be explained with a number relatively reduced by financial variables.

The factors that have the most impact on the rating are: the total assets, the level of debts, the cover of the financial charges, the profitability and the volatility of the results. Noting that several variables are not quoted such as the measures of liquidity (cash ratio, days in inventory, days in receivables...).

This approach supposes that the various values which take the dependent variable are also spaced out, it means that the difference of risk between a transmitter rated AAA and the other one rated AA is equal to that existing between BBB and BB or as it has been indicated by Kaplan and Urwitz (1979), this supposition is incompatible with the rating attribution methodology.

### 2.2 linear discriminating Analysis:

This method has as a purpose "to discriminate, to oppose, to differentiate" from companies having the same rating according to a number of selected variables. It is consisted of determining empirically the linear combination (or quadratic ) of variables which allow to better discriminate between companies having the same rating, by maximizing the variance between every group of companies of the same score with regard to the group interior.

Altman and Katz (1976), Pinches and Mingo (1973) and Perry, Cronan and Henderson (1985) are the first ones to use the discriminating method to determine the factors of attributing scores. These studies showed that in 60 % to 80 % of the cases we can determine the company's rating in a more precise way when we use sample tests of companies. Peavy and Edgar (1983) reached a rate of 91,6 % of predictive capacity.

The level of debts, the cover of the interest charges of and the cash flows are the main factors for attribution ratings.

These good results should be considered with precaution. According to Paget-Blanc (2003), the discriminating analysis suffers from methodological limits. Indeed, this type of analysis does not seize the ordinal character of the ratings through classifying the explained variable into various categories which are not ordered.

Another corresponding limit is to suppose that the dependent variables follow a normal multi-varied law, a hypothesis which was not systematically verified in these studies.

Besides, Kliger and Sarig (2000) underline that the changes of the rating scale<sup>1</sup> may have an impact on the methodology of agencies. Now, the quoted studies based themselves only on data previous to the 80s.

### **2.3 The logistic approach and the modern techniques:**

As a non-parametric procedure, the logistic regression presents the advantage of not requiring constraints as well as for the normality of the variables' distribution. The explanatory variables are not necessarily of continuous nature and the link between explained variable and explanatory one is not necessarily linear. The logistic regression is a method of statistical inference less than a method of classification. Indeed, the studied equation translates the probability of membership of an individual to a category or a group (Sheskin, on 2007). Therefore, contrary to the traditional regression, the explained variables can be of quantitative and qualitative nature.

The most recent studies of the rating factors bent toward the logistic approaches. The logistic functions of LOGIT / PROBIT type allow modeling dichotomous or polyatomic variables whose behavior is not linear.

This type of logistic function allows to discriminate between a discreet dependent variable  $Y_n$  (the rating of the company  $n$ ) being able to take the values  $k$ ,  $k$  being an integer varying between 1 and  $L$ . The number of values taken by  $Y_n$  is superior here to two, which distinguishes the dichotomous functions model, where the variable is binary. It seems coherent with the modeling of the rating determiners.

In an orderly polyatomic model, a variable score  $Z_n$  is associated with  $Y_n$ .  $Z_n$  is obtained by linear combination of  $X_n$  variables; it spells under the following shape:

$$Z_n = \beta \cdot X_n$$

Where  $\beta$  is the coefficients' vector of the linear combination of the  $X_n$  independent variables.

$Z$  is a partitioned continuous variable in  $k$  intervals. The borders of each interval are defined by threshold values of  $Z$  noted  $\alpha_k$ .

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<sup>1</sup> Since the 80s, rating agencies reported ratings by coarse rating classes; its began reporting ratings using a finer rating partition by attaching sign modifiers to some of its coarse rating categories

The determination conditions of  $Y_n$  in relation with  $Z_n$  are the following ones:

$$Y_n = 1 \text{ if } Z_n \leq \alpha_1$$

$$Y_n = 2 \text{ if } \alpha_1 < Z_n \leq \alpha_2$$

$$Y_n = L \text{ if } \alpha_{L-1} < Z_n$$

The values thresholds  $\alpha_k$  and the coefficient vector of  $\beta$  of the linear combination are obtained by maximizing the log-credibility function.

We determine the probability so that every value of  $Y_n$  belongs to a category of rating  $k$  in the following way:

$$P(Y_n = 1 | X_n, \beta, \alpha) = F(\alpha_1 + \beta X_n)$$

$$P(Y_n = 2 | X_n, \beta, \alpha) = F(\alpha_2 + \beta X_n) - F(\alpha_1 + \beta X_n)$$

$$P(Y_n = k | X_n, \beta, \alpha) = F(\alpha_k + \beta X_n) - F(\alpha_{k-1} + \beta X_n)$$

$$P(Y_n = L | X_n, \beta, \alpha) = 1 - F(\alpha_{L-1} + \beta X_n)$$

$F$  is a logistic function of the shape  $F(x) = \frac{1}{1 + e^{-x}}$

Kaplan and Urwitz (1979) realized one of the first studies using a logistic function where the variables are multinomial. Their model succeeds in identifying the explanatory factors of the ratings which are of financial nature. They are mainly: the size, the debts and the profitability. The authors notice that the results are not significantly different from those obtained by using a regression by the slightest squares

We notice that the logistic multinomial regression allows studying the relation between a coded answer variable and several explanatory variables. One of the specificities of this method is to examine the joint effects of several explanatory variables and their interactions.

With regard to the common regression, the logistic regression distinguishes itself essentially by the fact that the explained variable is category-specific. When the independent variable  $y$  has more than two categories, we can speak about logistic multinomial regression.

Besides, other techniques were used to foresee factors at the origin of ratings. In fact, Kumar and Haynes (2003) opted for a comparison between a discriminating analysis and the artificial intelligence technique. The latter bases itself on learning via systems which study by themselves the relations between the different variables. These authors showed that the ANN model (Artificial Neural Networks) gives better results than a discriminating function.

In the same way, Kim (2005) iii used the artificial intelligence by building a model according to a technique called ALN (Adaptive Learning Networks). The results have demonstrated that ratings can be estimated in a more precise way than a linear simple model and the critical variables are successfully identified.

The following table summarizes the methods used to determine the rating factors:

Study	Statistical method	Explanatory variables
<b>Horrigan (1966)</b>	Linear regression	Total assets; BFR / Sales; capital / Debt; Sales / capital.
<b>Pogue &amp; Soldofsky (1969)</b>	Linear regression	Total assets; Debt / Capital; Net profit / Total assets; Variation of net profit / total assets; (Net profit + Interest) / Interests

<b>West (1970)</b>	Linear regression	Volatility of the profits; Interest coverage ratio; capital / debt.
<b>Pinches et Mingo (1973)</b>	Discriminating analysis	Size indicator; (Net profit + Interest) / Interests; number of consecutive years of dividends distribution; Long term debt / Total assets; Net profit/total assets.
<b>Altman &amp; Katz (1976)</b>	Discriminating analysis	Interest coverage ratio; Cash flow.
<b>Kaplan &amp; Urwitz (1979)</b>	Logistic analysis	size; Interest coverage ratio; debt to equity ratio; ratios of profitability; coefficient of variation of assets; Coefficient of variation of the net profit.
<b>Peavy &amp; Edgar (1983)</b>	Discriminating analysis	Net profit; capital /total assets; Rate of assets' increase; Return on equity; Provisions for doubtful debts.
<b>Ederington (1985)</b>	Linear regression Logistic analysis. Discriminating analysis	Size; Interest coverage ratio; profitability ratio, debt to equity ratio.
<b>Chandy &amp; Duett (1990)</b>	Logistic analysis. Discriminating analysis	Sales; Return on assets; Shareholder equity; Earning capacity.
<b>Kumar &amp; haynes (2003)</b>	ANN Discriminating analysis	Sales; net profit; operating profit; capital; debt to equity ratio; profitability ratio; Interest coverage ratio; Quick ratio.
<b>Paget-Blanc (2003)</b>	Logistic analysis	Financial debt / EBITDA; capital / total assets; net profit/ average total assets; logarithm of the total assets operational cash flow / Sales.
<b>Kim (2005)</b>	ALN	Size indicator; Profitability; financial leverage; cash flow; asset management.
<b>Gray, Mirkovic &amp; Rangunathan (2006)</b>	Logistic analysis	Business risk ; Interest coverage ratio; operating profit; long term debt.

*Table 1. Statistical Synthesis of the methods used for the rating determination.*

From this literature analyzed on the rating determiners, our hypotheses will be explained and the statistical method will be chosen

### **3. Hypotheses models and the empirical study results**

The model proposed in this study tries to explain the weight of the accounting and financial information in the decision making of rating. We formulate the hypotheses of our research afterward we present and discuss the results.

#### **3.1 Hypotheses Formulation**

In order be able to explain the weight of the accounting and financial information in the decision making of rating, three hypotheses have been formulated: (1) the choice of the accounting and financial variables, (2) the information adjustment and (3) the superiority of the explanatory power of the adjusted information with regard to the declared information

##### *3.1.1 The selection of variables:*

The size indicator, the leverage ratio, the interest coverage ratio and the profitability ratio are directly included in the studies of factors that are at the origin of the rating attribution (Ederington, 1985; Kaplan and Urwitz 1979).

Out of basing itself on the literature review of the rating factors<sup>2</sup>, the following accounting and financial variables are the most used:

X1: Interest coverage = EBITDA / Interest charges; X2: Return on permanent capital = EBITDA / (equity + debt); X3: Debt Coverage ( 1 ) = operating cash flow / debt; X4: Debt Coverage ( 2 ) = free operating cash flow<sup>3</sup> / debt; X5: Debt Indicator ( 1 ) = Debt / (debt + equity); X6: Debt Indicator ( 2 ) = Debt / EBITDA; X7: Total assets and X8: Debt.

The majority of these indicators take the shape of ratios in order to be able to compare financial indicators of different firm size.

Whatever is the rating level, the same variables are studied. Indeed, several works (Horrigan, 1966; Pogue and Soldofsky, 1969; West, 1970; Altman and Katz, 1976; Chandy and Duett, 1990) showed that it is possible to explain a significant part of the rating with a same accounting and financial variables.

All this information compete the rating explanation. We note that the significant or non significant character of certain explanatory variables is not the object of our study which focuses on the influence of the adjustments of the accounting and financial information on the rating awarded by the rating agencies.

Besides, the main researches on the rating determiners treat indifferently the scales of long-term and short-term rating. So the selected accounting and financial variables should explain the rating for the long term as well as for the short term.

Hypothesis 1: the size, the debts, the solvency and the profitability are the main rating factors.  
H1a: the long-term ratings are determined, mainly, through the size variables, debts and profitability.  
H1b: the short-term ratings are determined, mainly, through the size variables , debts and profitability.

### 3.1.2 Adjusted Variables

The weak explanation capacity of the *rating* in the previous studies (only two thirds of the rating) using the published information confirms the theory according to which the scores contain information published but adjusted according to the analysis step followed by the agencies. (Ziebart, Reiter, 1992).

Therefore, the adjusted accounting and financial information compete to better explain the rating indifferently from the two rating horizons: long term rating/ short term rating.

The adjusted variables are the same ones selected initially. The difference resides at the values' level since they are calculated on the basis of adjusted information:

X1: Interest coverage = EBITDA adjusted / Interest charges adjusted; X2: Return on permanent capital = EBITDA adjusted/ (equity adjusted+ debt adjusted); X3: Debt Coverage ( 1 ) = operating cash flow adjusted / debt adjusted; X4: Debt Coverage ( 2 ) = free operating cash flow adjusted / debt adjusted; X5: Debt Indicator ( 1 ) = Debt adjusted / (debt adjusted + equity adjusted); X6: Debt Indicator ( 2 ) = Debt adjusted / EBITDA adjusted; X7: Total assets and X8: Debt adjusted.

Hypothesis 2: The adjusted accounting and financial information explains the rating assigned by the credit rating agency.  
H2a: The adjusted accounting and financial information explains the long-term rating

<sup>2</sup> see table about literature review of the rating determiners

<sup>3</sup> operating cash flow minus capital expenditure

H2b: The adjusted accounting and financial information explains the short-term rating

### 3.1.3 Comparison of the explanatory powers of the adjusted and published accounting and financial variables

Relying on the hypothesis, the rating does not only contain published information but also informative bonus which corresponds to the adjustment of information (Ziebart, Reiter, 1992), the explanatory power of the accounting and financial variables should be superior to that of the financial data retrieved from the published accounts.

This superior depiction of the explanatory power should be well applicable for both the long-term the short term rating.

Hypothesis 3: The explanatory power of the adjusted information is superior to that of the published information

H3a: In the long term, the explanatory power of the adjusted accounting and financial variables is superior to that of the published accounting and financial variables.

H3b: In the short term, the explanatory power of the adjusted accounting and financial variables is superior to that of the published accounting and financial variables

## 3.2 The statistical methodology of hypotheses validation and presentation of the data:

Several authors showed that the logistic regression is more adapted to the identification of the explanatory factors of ratings since it allows to model dichotomous or polyatomic variables whose behavior is not linear. (Kaplan and Urwitz, 1979; Chandy and Duett, 1990; Resti and omacini, 2001; Paget-Blanc, 2003).

With regard to the common regression, the logistic regression distinguishes itself essentially by the fact that the explained variable is category-specific. A relation is studied between a variable coded answer and several explanatory variables.

When the independent variable **Y** has more than two categories, we can speak about logistic multinomial regression.

Our study aims at studying the relation between accounting and financial variables (independent variables) and various rating (independent variable) coded according to the number of ratings' category. The logistic multinomial regression has been thus applied through following relation:

$$\text{Prob}(Y \leq j | x) = \frac{\exp(\beta_{0j} + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8)}{1 + \exp(\beta_{0j} + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8)}$$

long term :  $j = 1, \dots, 10$   
Short term:  $j = 1 \dots 5$

We can note that the studied dependent variable is realized by 10 modalities for the long-term rating: AAA; AA; in +; In; In; BBB +; BBB; BBB-; BB; B and by 5 modalities for the short-term rating: A-1 +; A-1; A-2; A-3; B.

Our sample is consisted of 64 French commercial and industrial companies scored by **S** and **P** during the period between 2001-2 006.

Let us remind that, the objective of this study resides in the used sample which is consisted exclusively of French companies.



We observed the rating level for every French company scored for the period 2001-2006. It gives a total of 319 long-term ratings and 218 short-term ratings.

Moreover, the sample includes companies having long-term ratings which are situated in both levels: investment and speculative:

The speculative category part varies of an unimportant proportion in 2001 in the quarter of the ratings attributed in 2005.

Besides, the AMF (2004) clarifies that the companies of commercial and industrial sector are the only ones to contain risks of important defect. It is completely normal thus that our sample contains ratings situated in the speculative category in regard with its composition.

Therefore this allows us to draw conclusions for the investment category as well as for the speculative one. Interpretations which were not determined with precision in previous studies<sup>6</sup>

One of the contributions of this work is to analyze the financial data for attributed ratings in the short term. They are scores which justify the capacity of a transmitter to refund the amounts owed according to analysis criteria in 1 year at most.

The published accounting and financial data were collected from two financial data bases: CORPORATE FOCUS PREMIUM and AMADEUS.

The adjusted accounting and financial variables were collected from the data base of S&P<sup>7</sup> which provides accounting and financial data adjusted by the agency.

Let us remind that the adjusted variables are the same players selected initially. The difference resides at the values' level because they are calculated on the basis of ' adjusted data.

### **3.3 Statistic results of the rating determiners:**

The tests' results of the of the model are presented here

#### *3.3.1 Explanation of the rating by published accounting and financial data Plain varied tests:*

The problem of the multi co linearity exists since certain explanatory variables are correlated strongly or perfectly between themselves, provoking thus instability of the estimated coefficients and a strong increase of their distance-types. Consequently if the explanatory variables are collinear, the regression algorithm cannot be applied and the regression coefficients can be estimated in a incorrect way.

The tables supply Pearson's matrices for LT and ST ratings. The correlation coefficients between the independent variables are very weak in most of the cases (the totality of the coefficients are less than 0,71 either for long term or short term) which suggests that the model very probably has no problem of multi colinarity.

Besides, the significativity and explanatory power of the model are high for the long-term ratings. It is less high for the short-term ratings.

#### *3.3.2 Explanation of the rating by accounting and financial adjusted data Plain varied tests:*

The explanatory powers of both adjusted and published models can be considered as satisfying (Table). The published or adjusted accounting and financial information explain the decisions of

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<sup>6</sup> Notably Page-Blanc(2003) study on European companies whose results were interpreted with precision only for the investment category

<sup>7</sup> Available on [www.RatingsDirect.com](http://www.RatingsDirect.com)

rating. Indeed, we obtain  $R^2$  pseudo satisfying whatever is the nature of the information (published or adjusted).

In the long term, the explanatory power of the adjusted variables is superior to that of the published information. In the short term, the report is reversed because the published information explains better the rating than the adjusted information.

	<b>Adjusted data</b>	<b>Published data</b>
<b>R-deux de Cox &amp; Snell</b>	0,789	0,709
<b>R-deux de Nagelkerke</b>	0,801	0,793

*Table 2. Comparison of the explicative power of the LT model.*

**Table :20 Comparison of the explicative power of the LT model**

	<b>Adjusted data</b>	<b>Published data</b>
<b>R-deux de Cox &amp; Snell</b>	0,474	0.586
<b>R-deux de Nagelkerke</b>	0,521	0.638

*Table 3. Comparison of the explicative power of the ST model.*

#### **4. Discussion of the results and the conclusion:**

In its report on the rating agencies, the AMF<sup>9</sup> clarifies that the explanation of the individual ratings with the adjustments which underlie them is an aspect whose broadcaster call up for more transparency and where the risks of asymmetry of information are high.

The objective of these adjustments is to have a better representation of the underlying economic reality, to improve the comparability between companies and to neutralize the disparities which may exist between the information published by the rating companies.

This study aims at better understanding the relation between the accounting and financial data and the level of the rating awarded by the CRA identify the role of the accounting and financial information in the formation of the rating. It is a question of determining the nature of the variables that exercise a significant influence on the ratings.

For the financial market, this research allows to more understand the foundation of rating and so to go into detail the functioning of this information system.

As far as this report is considered, our objective has been to analyze the effect of the adjustments of agencies on the published ratings. We used the multinomial logistic regression method that presents the faculty to be applicable to a discreet variable and to avoid so the problems of the application of a linear regression, for example, which supposes that notes are represented by a continuous variable, what is not the case.

The obtained results using the multinomial logistic regression method allowed depict out two major conclusions:

The first, following the example of the previous researches, on one hand is a very important explanation of the rating with a quite big number of accounting and financial variables.

Thus the accounting and financial information seem to constitute a separate information in the attribution of the rating. These results confirm the literature notably of Wakeman ( 1998 ) who clarifies that the rating bases itself largely on reports published by companies.

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<sup>9</sup> The Autorité des marches financiers, report on the rating agencies, 2005.

The variables that exercise a significant influence on ratings are not individually studied. Indeed, the significant or non-significant character of certain explanatory variables is not discussed, the objective of this research focuses only on the choice of the reserved information (adjusted or published).

Besides, the explanatory power of the model is very high for the long-term ratings. It is lower than for the short-term ratings. This difference is justified by the idea stating that the evaluation of the company solvency is more in touch with the fundamental of the transmitter. This means that the rating system has a long-term projection horizon and that its cyclical sensibility is weak. Authors such as Cantor (2001), Fons (2002), Cantor and Mann ( 2003 ) and Altman and Rijken ( 2005 ) call this report " through the cycle credit rating ".

The second conclusion is relative to the comparison between the role of the adjusted information and the published information in the determination of the rating. The interpretation is not similar according to the rating horizon<sup>10</sup>.

In the long term, the explanatory power of the adjusted information is superior to that of the published accounting information. In the short term, the results are surprising because the explanatory power of the information taken from the published financial condition is superior to that of the adjusted information.

According to Cantor ( 2001 ), the rating agencies declare not to intervene when a reversal is likely to exist only in short term. The agencies are characterized by an approach which neglects the cyclic variations of the credit quality. This justifies the fact that the adjusted information explains better more the decision of the long term rating than short-term one

Besides, the broadcasters' membership in the industrial and commercial branch allows drawing conclusions for the investment category as well as for the speculative category since our sample includes a non-insignificant proportion of the speculative ratings (25 % of the long-term ratings in 2005).

Therefore, our model allows estimating with a degree of non-insignificant precision the rating in speculative category. The conclusions can be indifferently generalized for both categories. Interpretations which were not determined with precision in previous studies<sup>11</sup>.

Besides the aim of this study resides in the sample consisted exclusively of French companies.

To end with, this model presents certain limits. The first is the over representation of the two rating categories: A and BBB. The reason is that the main part of the French companies of the industrial and commercial branch have notes which are situated in these categories. On the other hand the relatively reduced number of our sample.

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<sup>10</sup> Noting that the majority of researches focused themselves on the long term, indeed a small number of American studies used the agencies' short term scale similar to that of Peavy and Edgar (1983).

<sup>11</sup> Notably Page-Blanc (2003) study whose results were interpreted with precision only for the investment category

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