

DEVELOPING AN INFORMATION SYSTEM
FOR CREDIT RISK RATING
USING ANALYTICAL HIERARCHY PROCESS (AHP)

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Thesis Abstract

Bahar Tekin, “Developing an Information System for Credit Risk Rating by Using Analytical Hierarchy Process (AHP)”

Credit risk management is one of the main activities of banks, and credit risk ratings are an essential part of the process. In the rating process statistical models and judgmental systems can be employed. At the evaluation of larger exposures, however, judgmental systems are preferred more than statistical models, although they are more costly.

Different parties in a bank participate through the rating process and since performance assessment criteria of these parties are totally different from each other, disagreements in the rating process are inevitable.

This thesis aims to show the differences between the judgments of two departments through the credit risk rating process in one of the banks in Turkey. Additionally the effect of group decision making on the accuracy of credit risk ratings is aimed at. The information system developed for credit risk rating is based on a descriptive and structured model called the Analytical Hierarchy Process (AHP).

Tez Özeti

Bahar Tekin, “Kredi Riskinin Derecelendirilmesinde Analitik Hiyerarşi Sürecine Dayalı Bir Bilişim Sistemi”

Kredi riskinin yönetilmesi bankaların ana faaliyetlerinden biridir. Kredi risk dereceleri ise kredi risk yönetimi sürecinin ayrılmaz bir parçasıdır. Kredi derecelendirme sürecinde istatistiksel modeller ve kişisel tecrübelerden yararlanan sistemler kullanılabilir. Ancak yüksek tutarlı kredilerin değerlendirildiği durumlarda, çok daha yüksek maliyetleri olmasına rağmen, kişisel tecrübelerden yararlanan sistemler istatistiksel modellere göre daha fazla tercih edilmektedir.

Bir bankanın derecelendirme sürecinde farklı birimler görev almaktadır ve bu birimlerin performans değerlendirme kriterleri birbirinden tamamen farklı olduğundan, derecelendirme sürecinde anlaşmazlıklar ortaya çıkması kaçınılmazdır.

Bu çalışma Türkiye’deki bir bankada kredi riskinin derecelendirilmesi sürecinde iki ayrı birimin değerlendirmeleri arasındaki farkları bir bilişim sistemi kullanarak göstermeyi amaçlamaktadır. Ek olarak, belirlenen risk derecesinin doğruluğu üzerinde ortak karar verme mekanizmasının etkisinin de görülmesi hedeflenmektedir. Kredi riskinin derecelendirilmesinde kullanılan bu sistem Analitik Hiyerarşi Süreci (AHS) adı verilen bir model üzerine kurulmuştur.

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DEDICATION

This thesis is dedicated to my mother and grand mother.

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ABBREVIATIONS

AHP:	Analytic Hierarchy Process
AIJ:	Aggregation of Individual Judgments
AIP:	Aggregation of Individual Priorities
ALEES:	Agricultural Loan Evaluation Expert System
CA:	Credit Application
CI:	Consistency Index
CR:	Consistency Ratio
CR:	Customer Rating
DSS:	Decision Support System
EL:	Expected Loss
ER:	Exposure Rating
GMM:	Geometric Mean Method
LIED:	Lost in the Event of Default
MCCR:	Multi Criteria Credit Rating
MCDA:	Multi Criteria Decision Aid
M.H.DIS:	Multi-Group Hierarchical Discrimination
OPM:	Option Pricing Models
PD:	Probability of Default
RFID:	Radio Frequency Identification
RM:	Relationship Manager
ROA:	Return on Assets
WAMM:	Weighted Arithmetic Mean Method
TNW:	Tangible Net Worth

CHAPTER 1

INTRODUCTION

Almost all businesses have a credit relationship with a bank and there exists a broad range of loans that can be utilized by companies. When evaluating loan requests of companies, bankers should make systematic analysis about the borrowers' ability to repay. Analysis of commercial credit requests has both qualitative and quantitative aspects. Evaluation of qualitative factors requires "experience" and "hands-on-knowledge". On the other hand, quantitative factors provide numerical indicators about a company's ability to repay a loan.

The main objective of credit analysis is to assess the risk of making a loan. Here, the risk mainly refers to the volatility in earnings. Bankers are especially concerned with events or situations, which may cause a borrower to not repay a loan. This kind of a risk may happen in the form of borrower defaulting in the worse case, or not making timely interest and / or principal payments in a relatively better case.

While making credit analysis, a probability is assigned to the likelihood of default based on both qualitative and quantitative factors. Historical and projected financial data are used widely to measure most of the risks related to the firms' ability of repayment. However, some risks, such as borrower's character are not directly measurable.

In this study, approaches of two departments in the credit analysis process in a bank in Turkey, are evaluated by using an analytical method. The aim is to show the difference between the evaluations of two main units in a bank. Additionally, the effect of group decision making on credit risk ratings is aimed at. Based on the current credit analysis structure, an analytical model, including main decision criteria, for credit risk rating is developed and enhanced by user interfaces.

In the current credit analysis structure, relationship managers (RMs) in the Corporate Marketing department, who are responsible for finding new customers and profitably managing existing customer relationships, prepare “Credit Applications” (CAs), in order to establish a limit to a commercial customer. The CAs are then sent to the Credit Evaluations department for the final decision. Since Corporate Marketing and Credit Evaluations departments have different performance measurement criteria, disagreements occur and reaching the final decision takes a long time.

While preparing the model in the study, the CAs were taken as the starting point. Since both departments base their evaluations on the CAs, the criteria in the model are developed according to the main parts in the CA form. Since the criteria are familiar to the users, this approach provides the chance to focus on conflicting points in evaluations.

Although the model is developed based on existing CAs, it gives the user the chance to locate the conflicting points very rapidly. In the current system, the CAs are prepared without getting any feedback from the Credit Evaluations department. Because of that, after the CA is sent to the Credit Evaluations department, most of the time they turn back to RMs with additional questions. In this structure, evaluation takes a long time.

In order to provide a Decision Support System (DSS) environment for bankers, the model is integrated with an easy to use graphical user interface. Users are able to provide their evaluations as input values to the system and draw conclusions from the results, by using graphics and tables provided by the system.

The organization of the study is as follows: In Chapter 2, background information on banks' internal risk rating structures, differences between agency and bank ratings and Analytic Hierarchy Process (AHP) are provided. In Chapter 3, the literature on credit risk rating structures and AHP are briefly overviewed. In Chapter 4, the current credit analysis structure and the proposed model are described in detail. In Chapter 5, the outputs of the model are analyzed. In Chapter 6, DSS framework is demonstrated within an illustrative example. Finally in Chapter 7, conclusions drawn from the study and possible future work are emphasized.

CHAPTER 2

BACKGROUND

In this section of the study general information about banks' internal risk rating structures, differences between banks' ratings and agency ratings, and the theoretical and mathematical structure of Analytic Hierarchy Process (AHP) is presented.

Banks' Internal Risk Rating Structures

A rating is a value that shows the risk of loss in the event of payment failure by a given borrower. In the rating process, both the risk of the borrower and the structure of the facility are considered.

The uses of internal ratings in banks can be classified in two broad categories (Treacy et al., 1998):

1. Analytical Uses
2. Administrative Uses

Analytical uses of internal ratings include analysis and reporting of risk postures, loan pricing, profitability analysis, loan / capital loss reserving, and (indirectly) employee compensation. Administrative uses include portfolio monitoring, regulatory compliance, and credit culture maintenance. Internal ratings

guide the loan origination process. With consistent and accurate rating assignments, banks can analyze risk postures and establish their risk appetites effectively.

Three main concepts in all types of credit risk rating procedures are Probability of Default (PD), Lost in the Event of Default (LIED), and Expected Loss (EL). PD reflects the creditworthiness of the borrower. The assumption lying under this concept is that, if a borrower defaults on any of its obligations, then it will default on all of its obligations. LIED is the portion of the loan that will be lost when the default actually occurs. As the definition implies, LIED is directly related to the structure of the facility. EL is the product of PD and LIED and is an estimate of the average percentage loss rate over time on a group of loans all having the given expected loss (Treacy et al., 1998).

Banks may have two types of rating systems. In one-dimensional systems, ratings approximate EL and are assigned to facilities. In two-dimensional systems, on the other hand, in addition to EL, PD is also appraised and there are two grades related to these concepts. In these systems the grade of the borrower (PD) is determined first, and then the grade of the facility is equalized to the grade of the borrower, unless the structure of the facility is such that LIED is substantially better or worse than “normal” (Treacy et al., 1998). In practice, grades measuring EL are calculated by multiplying assigned PD by a standard or average LIED.

In some two-dimensional systems, some type of loans can receive lower risk grades than “ordinary” loans, although they are given to the same borrower. Some of the loans that fall into this category are cash-collateralized loans, asset-based loans, or loans with government guarantees. Since collateral and loan structure play essential roles in these systems, they can be categorized as systems with mixed conceptual basis.

The number of grades on internal rating scales change among banks. In general, there are large numbers of grades in banks which heavily use ratings in analytical purposes.

The rating process always involves human judgment. While designing the rating process, banks try to find ways to promote accurate ratings without restricting human judgment. Although statistical models are used in the rating process, it is believed that they have limitations and that systems including properly managed human judgment produce more accurate results (Treacy et al.,1998).

Ratings may be assigned at each underwriting or at the time of credit approval. Underwriting limits and approval conditions are directly affected by the rating. In banks, generally all credit approval decisions are made by individuals with related signature authority rather than by committees. The number and level of required signatures depends on business line, credit type, size, and rating.

Initial assignment of ratings can either be done by relationship managers (RMs) or credit staff. RMs are responsible for marketing activities and their performance are evaluated on the basis of relationship profitability. Main responsibilities of the credit staff, on the other hand, are loan approvals, credit portfolio quality assessment, and sometimes rating assessment, especially for large loans. Credit staff and RMs have different chains of command and different performance evaluation criteria. Although rating criteria and definitions are the same for both parties, the differences in the working structures of these parties sometimes lead to disagreements in the evaluation and rating processes.

Banks' Ratings versus Agency Ratings

Risk factors that are considered by agencies and banks are similar, and human judgment is an essential part of the rating process for both parties. However, rating systems of banks and agencies are significantly different from each other. Some of the differences are listed below (Treacy et al., 1998):

1. Agencies do not take part in the transactions and do not make any investments.
2. Revenues of two parties are different. While agencies sell publications and get fees from their customers, the banks' revenue comes from credit products.
3. Banks' ratings are assigned by personnel and are not publicized to outsiders. Since the ratings are kept private and their costs and benefits are internal, the level of accuracy and consistency of the ratings depends on the ways in which ratings are used. Additionally, restructuring of the rating system is possible, whenever the benefits of doing so exceed the costs.
4. Agency ratings are publicized and used by different parties. Wide usage provides more revenue, and to promote wide usage agency ratings should always be accurate and consistent. Rating systems of the agencies should be stable over time.
5. Agencies grade borrowers according to their expected conditions under stress. However, banks prefers to grade borrowers according to their current conditions.

Analytic Hierarchy Process

Analytic Hierarchy Process (AHP) was developed by Thomas L. Saaty in the 1970s. As the name implies, AHP breaks down a decision problem in a hierarchical way, and each level in the hierarchy consists of interrelated decision elements. The top level is made up of the goal of the decision problem; criteria, sub-criteria, and alternatives of the problem are represented at lower levels (See Figure 1). By structuring a complex problem as a hierarchy, not only is the analysis made more manageable, but also interrelationships among the decision variables can be identified.

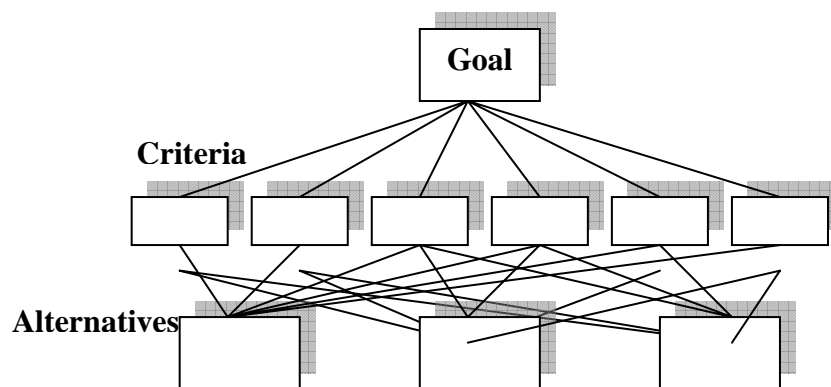


Figure 1. A three level hierarchy

According to Thomas L. Saaty, deciding on which factors to include in the hierarchy is probably the most creative task in the process. The hierarchy should be structured so that there must be enough detail to represent the problem. When the goals, environment, and participants of the problem are defined very well and the hierarchy is arranged accordingly, complex relationships within the decision process can better be identified.

Once the hierarchy is described, the elements at each level are compared pairwise, considering their relationship to a particular element in the next higher level. Beginning from the top of the hierarchy and working down, at each level,

square matrices called comparison (or preference) matrices are created by pairwise comparisons. An ordinal scale of 1-9, recommended by Saaty (1980), is used in this process, and shown in Table 1 on below.

Table 1. The Fundamental Scale

Intensity of Importance	Definition	Explanation
1	Equal Importance	Two activities contribute equally to the objective
2	Weak	
3	Moderate Importance	Experience and judgment slightly favor one activity over another
4	Moderate Plus	
5	Strong Importance	Experience and judgment strongly favor one activity over another
6	Strong Plus	
7	Very Strong importance	An activity is favored very strongly over another, its dominance demonstrated in practice
8	Very very strong	
9	Extreme importance	The evidence favoring one activity over another is of the highest possible order of affirmation
Reciprocal of above	If activity i has one of the above nonzero numbers assigned to it when compared with activity j, then j has the reciprocal value when compared with i.	A reasonable assumption
Rationals	Ratios arising from the scale	If consistency were to be forced by obtaining n numerical values to span the matrix.

The scale is analogous to 9 verbal statements reflecting the importance of one element compared to another. At the end of each comparison, a pairwise ratio w_i/w_j is generated. When the “preferred” element of the two gets a pairwise ratio of w_i/w_j , the “un-preferred” one directly gets the inverse of the ration, w_j/w_i , which indicates

that when there are n elements in a level, a comparison matrix is generated with $n*(n-1)/2$ comparisons. A representation of the pairwise comparison matrix can be seen on below.

	C_1	C_2	C_3	...	C_n
C_1	1	w_1/w_2	w_1/w_3	...	w_1/w_n
C_2	w_2/w_1	1	w_2/w_3	...	w_2/w_n
C_3	w_3/w_1	w_3/w_2	1	...	w_3/w_n
.
.
.
C_n	w_n/w_1	w_n/w_2	w_n/w_3	...	1

Here, $w_1, w_2, w_3, \dots, w_n$ are the weights (priorities) of the n criteria. By using the results of the pairwise comparisons, local and global weights of the criteria are determined. The most common way to transform pairwise comparison results to priority vectors is the “eigenvector method”, developed by Saaty. In this method, an eigenvalue problem related to the comparison matrix is solved. According to Saaty, principal eigenvector of C (Comparison matrix) is the desired priority vector, w . To find the principal eigenvector (or the priority vector), the linear system stated below is solved:

$$Cw = nw$$

Here, w , which satisfies this condition, is named as the principal eigenvector of C and it represents the relative importance of each criterion with respect to the element in the next higher level (local priorities). To find global priorities, local priorities at each level are weighted by the higher level priorities. In order to find

overall weight of alternatives, the weighted priorities of alternatives are added one by one. To calculate the eigenvector, a matrix is multiplied by itself many times until the intermediate vectors of each iteration do not change. A good estimate of the principal eigenvector can be obtained by continuously squaring the comparison matrix and normalizing the row sums each time.

The main problem related to the pairwise comparison matrix is that decision makers do not always state fully consistent comparisons. However, $Cw = nw$ equation specified before, only applies for fully consistent comparisons. Therefore, in this equation, a computational value called λ_{\max} is used instead of n .

$$Cw = \lambda_{\max} w$$

λ_{\max} is the eigenvalue of the comparison matrix and calculated by the formula given below:

$$\lambda_{\max} = \sum_{j=1}^n a_{ij} \frac{w_j}{w_i}$$

Here a_{ij} is the value assigned to the comparison, w_j and w_i are the weights.

Inconsistency occurs if a decision maker says A is more important than B, B is more important than C, and C is more important than A. In other words, if the following equality does not hold.

$$a_{ij}a_{jk} = a_{ik}$$

Saaty has shown that, as a result of the inconsistency, λ_{\max} is always greater than or equal to n .

$$\lambda_{\max} \geq n$$

In a case where λ_{\max} and n are close, the values of the comparison matrix become more consistent. In AHP, however, the goal is not to reach perfect consistency, but rather to use inconsistency to find the problematic areas and because of that, a certain degree of inconsistency is allowed. In this respect, the consistency

of comparison matrices is controlled with Consistency Index (CI), which is calculated with the equation below:

$$CI = \frac{\lambda_{\max} - n}{n - 1}$$

The calculated CI is used to find the consistency ratio (CR) by using the formula given below:

$$CR = \frac{CI}{RI}$$

RI is Random Index which is derived by Saaty, from a sample of randomly generated reciprocal matrices. Random indices for matrices of order one to ten can be seen in Table 2, below.

Table 2. Average Random Consistency Index

Size of Matrix (N)	Random Consistency Index (RI)
1	0
2	0
3	0.52
4	0.89
5	1.11
6	1.25
7	1.35
8	1.40
9	1.45
10	1.49

A consistency ratio of 0.10 or below is allowed in AHP. If $CR > 0.10$ then the decision maker should revise his / her judgments to improve consistency. According to this methodology, comparing more than nine alternatives at a time would be very hard for an individual. Because of this reason the random index table is prepared for matrices up to ten elements.

Another method that can be used to calculate the priority vector is Additive Normalization method. In this method, the priority vector is obtained by dividing the elements of each column of the comparison matrix, by the sum of that column (i.e. normalization of the column), then, adding the elements in each resulting row and finally dividing this sum by the number of elements in the row.

$$B_i = [b_{ij}]_{n \times 1} \quad i = 1, \dots, n$$

$$b_{ij} = \frac{a_{ij}}{\sum_{i=1}^n a_{ij}}$$

$$C = [c_{ij}]_{n \times n} \quad i = 1, \dots, n \quad j = 1, \dots, n$$

$$w_i = \frac{\sum_{j=1}^n c_{ij}}{n} \quad W = [w_i]_{n \times 1}$$

where $a_{ij} = w_i / w_j$ (value in the comparison matrix).

In a case where the pairwise comparison matrix is consistent, both the eigenvector method and the additive normalization method give the original priority vector. When the matrix is inconsistent, additive normalization method still provides accurate results.

A special form of AHP called absolute AHP is used to rank alternatives in terms of intensities of the criteria. In this form of AHP, after the priorities (or weights) of the criteria are set, intensity of each criterion (or subcriterion) is calculated by using pairwise comparison methodology once again. To get the ideal intensity, each calculated intensity is divided by the largest intensity. As an alternative is evaluated, a decision maker chooses the criteria that best describe that alternative. After that, ideal intensities of the chosen criteria are weighted by the global priorities of the criteria and alternatives are ranked by using the weighted sum of the intensities. In

this study this form of AHP is used to rank commercial companies, i.e. alternatives. As indicated in Saaty and Vargas (1991), absolute AHP is a better methodology for scoring and very useful when there is a large number of alternatives. In this methodology, adding a new alternative to the hierarchy or deleting an existing alternative does not cause rank reversal.

When it was first developed, AHP was a decision tool for individual decision making problems. However, later, it was also amended to group decision making. Different methodologies were proposed by researchers to aggregate individual judgments in group decision making environments. The first methodology for aggregation is determining pairwise comparison matrices by consensus voting (Saaty, 1989). In this methodology, group members come together to agree on a value for each comparison. Since it requires the presence of all group members, and it is time consuming, other methodologies are used to solve the disagreements within the group. These other methodologies are based on combining individual judgments with some mathematical methods.

Two widely used methods to determine group judgment are Geometric Mean Method (GMM) and Weighted Arithmetic Mean Method (WAMM). When a^1_{ij} , a^2_{ij} , ..., a^n_{ij} represent different judgments of n members of a group, the composite judgment for comparisons are calculated as;

$$\left(\prod_{k=1}^n a^k_{ij} \right)^{1/n} \text{ using GMM,}$$

$$\left(\sum_{k=1}^n w^k a^k_{ij} \right) \text{ using WAMM with a weight } w^k \text{ to } k\text{th member, or}$$

$$\frac{\left(\sum_{k=1}^n a^k_{ij} \right)}{n} \text{ using WAMM with equal weight to all the members.}$$

According to Aczel and Saaty (1983), geometric mean is appropriate for combining judgments, because it preserves reciprocal property. Basak and Saaty (1993) proposed a weighted GMM for situations, in which some group members have more influence on the decision.

Ramanathan and Ganesh (1994), evaluated the group preference aggregation methods using social choice axioms and found that GMM does not satisfy the Pareto optimality axiom¹. However, Van den Honert and Lootsma (1996) showed that this violation is not related to a problem in GMM but it is because of the nature of the final aggregation. Since the final aggregation is a compromise of all group members, individual priorities become irrelevant. Forman and Peniwati (1998) propose that, when the group is assumed to act as an individual, aggregation of individual judgments (AIJ) should be used. If the group is assumed to act as separate individuals, then using aggregation of individual priorities (AIP) is more appropriate. For AIP, either GMM or WAMM can be used. However, for AIJ, GMM is the most appropriate method.

¹ Pareto Optimality Axiom: Let A and B be two alternatives. If all the group members prefer A to B then the group decision should be in favour of A.

CHAPTER 3

LITERATURE SURVEY

This study aims to show the differences between the judgments of two departments in credit risk rating process in one of the banks in Turkey by using Analytic Hierarchy Process (AHP). In this section, a literature review about credit risk rating, AHP and AHP in risk rating are presented.

Credit Risk Rating

New techniques for credit risk management are evolving rapidly. For large banks, with a huge number of borrowers, the credit risk management process can be long and challenging. With the distilled and summarized information they provide, banks' internal rating systems ease the comparison of the risk posed by high number of borrowers. Therefore, internal credit ratings are an essential part of credit risk management in large banks. They affect credit decisions directly and also reflect the nature of the decisions. At large banks, ratings are used for a range of purposes involving; portfolio monitoring and management, capital allocation, loan pricing, and profitability analysis. As discussed by Jacobson et al (2006), the role of internal risk rating systems becomes more prominent in the Basel II Accord².

¹According to Basel II, capital adequacy should be assessed by the bank, based on the risk profile. In order to calculate the capital requirement for credit risk, two methodologies are proposed:

Every bank has a special internal rating system and identifying the correct one is not possible. Not only the design of the system but also the way it is implemented is effective in the evaluation of the correctness of the system.

As discussed in Jacobson et al (2006), ratings are generally thought of as the transforms of probability of default. To evaluate the default risk of a company, different numerical methodologies are developed in the literature. The first studies in the literature on default prediction belong to Beaver (1967) and Altman (1968). Currently, some researchers (Loffler, 2004; Altman and Rijken, 2004) argue that credit rating structures may be more complex.

Jacobson et al (2006) state that, despite of their importance, the knowledge about the structure and consistency of internal rating systems is very limited. The studies in the literature examine only the general design of the systems and suggest some new design alternatives. For instance, Treacy and Carey (1998) explain the general architecture, and operating design of internal rating systems in large US banks.

Regardless of the design and operations of the internal rating system, all credit rating assignments require a credit evaluation process. As mentioned by Yurdakul et al (2004), the process can be subjective and based on knowledge and experience, or systematic and based on decision models. In the literature, the study of Altman and Saunders (1998) focuses on the systematic processes. In the first part of their study, Altman and Saunders (1998) summarize the developments in the credit risk measurement between 1978 and 1998. In the second part, they propose a new approach to measure the risk and returns on loans and bonds. The developments

-
- i. Standard method supported by external credit assessment
 - ii. Internal Rating Systems (IRS)

Using the second methodology is subject to the approval of banking authorities. There are two types of IRS which can be utilized; Foundation Internal Rating Approach and Advanced Internal Rating Based Approach.

between 1978 and 1998 are evaluated in 3 parts. The first part, which is the period mainly relied on subjective analysis, is called “Expert Systems and Subjective Analysis”. The second part is “Accounting-Based Credit Scoring Systems”. While, in univariate accounting based systems, the decisions are made by comparing borrowers’ key accounting figures with industry norms, in multivariate accounting based systems key figures are combined and weighted to produce a credit score. If the score is less than a benchmark value the applicant is rejected. In this study Altman and Saunders mention four approaches to develop multivariate credit-scoring systems:

1. Linear Probability Model
2. Logit Model
3. Probit Model
4. Discriminant Analysis Model

According to Altman and Saunders, the dominant approach is the discriminant analysis model. The purpose of this approach is to find a linear function of accounting and market variables that best distinguishes between borrowers who can repay and those who cannot. The formula of the discrimination function in the first version of this model is presented below (Altman, 1968):

$$Z = V_1X_1 + V_2X_2 + \dots + V_nX_n$$

X_1, X_2, \dots, X_n = discriminant coefficients, and

V_1, V_2, \dots, V_n = independent variables

In the third part of the study, “Other Models of Credit Risk Measurement”, criticisms about multivariate accounting based models are presented and newer models such as risk of ruin model, option pricing models (OPM), mortality rate model, and neural network analysis are introduced.

Over the past decades, new quantitative analysis techniques were developed. The basic idea under these techniques is that, the criteria used in financial decisions have to be multidimensional. Following the acknowledgement of the multidimensional nature of financial decision problems by financial institutions, new tools such as goal programming and multi-criteria decision making are attempted in the financial decisions. Doumpos and Zopounidis (2001) proposed an approach based on the multi criteria decision aid (MCDA) method and named it Multi-Group Hierarchical Discrimination (M.H.DIS). In this study, Doumpos and Zopounidis developed a discrimination model using M.H.DIS method. In another study Doumpos et al (2002), compared the performance of M.H.DIS method with discriminant analysis, logit analysis, and probit analysis and found that this approach is an efficient tool that can be used for credit risk estimates. Berne et al (2006) applied a different multi criteria decision making model (Multi Criteria Credit Rating-MCCR) to solve the credit rating assignment process following Basel II guidelines.

Apart from the systematic decision models mentioned in the previous pages, knowledge and experience based, subjective processes were also evaluated in the literature. Bryant (2001) presented an expert system designed for agricultural loan evaluation (ALEES). In this system both quantitative and qualitative assessments are performed. However, non-financial analysis was limited because of the insufficient non-financial measures.

AHP and Its Applications

As one of the multi-criteria approaches, Analytic Hierarchy Process (AHP) is used in the literature for modeling various decision problems. Babic and Plazibat (1998) used AHP to rank firms according to their business efficiency level. In the study, AHP was used to determine the importance of criteria. For final rating, on the other hand, another multi criteria approach called PROMETHEE was used.

Multi-attribute modeling is suitable for evaluation of non-monetary values mixed with monetary ones in a problem with discrete alternative choices. (e.g. Gregory et.al., 1997; Miettinen & Hamalainen, 1996) Analytic Hierarchy Process is a specific technique within this approach. It was developed by a mathematician, Thomas L. Saaty in the 1970s, as a decision making technique to solve complex and unstructured problems with multiple attributes. AHP was applied in a variety of areas including education (Saaty, 1980. pp. 25-29), economics (Saaty, 1977), politics (Saaty & Bennett, 1977), engineering (P.R. Drake, 1998) and so on. The applicability of the AHP approach for solving socio-economic problems in which both qualitative and quantitative aspects have significant impact on the decision is well acknowledged in the literature.

In 1982, Saaty and Vargas defined the AHP as a theory for dealing with complex economic, technological, and sociopolitical problems. In 1987, Saaty explained the details of ranks, their generation and preservation in AHP. In this study, Saaty also showed the differences between absolute and relative measurement. Vargas (1990) reviewed the mechanisms of AHP and divide AHP into two stages, design and evaluation of the hierarchy. The author also introduced a forward-

backward planning process. Saaty (1990) discussed the comparability of alternatives, clustering and relative versus absolute measurements in AHP.

In the book called “Models, Methods, Concepts and Applications of the Analytic Hierarchy Process” (2001), Saaty and Vargas propose AHP as a basic approach to decision making and state that “it is designed to cope with rational and intuitive to select the best from a number of alternatives evaluated with respect to several criteria.” (p.1). In this study, fundamentals of AHP and applications of the method in different areas are presented.

As mentioned before, since its development, AHP is applied in different areas. Kuruuzum and Atsan (2001) evaluated the approach and its applications in business. Following a discussion of its conceptual framework and an illustrative case study, they discussed the applications of the process in marketing, total quality management, benchmarking, and production.

Gnanasekaran et al (2006) applied the method to supplier selection process of an automobile component manufacturing company and found that the method significantly reduces the time and effort in decision-making. Also the results of the study showed that AHP improved the team-decision making process.

Chan and Lynn (1993) applied AHP in the capital budgeting area. In this study, AHP was compared with other capital budgeting techniques and also with other multiple-attribute decision making models. The study showed that AHP is superior to these techniques and models since it incorporates qualitative and quantitative factors, improves the consistency in judgments, and is flexible.

Project selection is another area in the literature where AHP is applied. Kendrick and Saaty (2007) preferred AHP over other alternative project selection techniques because AHP uses a hierarchical structure, integrates quantitative and

qualitative considerations, enables measuring the relative importance of projects, can be applied in any organization, lends itself to sensitivity analysis and has an auditable and explicit structure.

Lin and Lin (2007) employed AHP to analyze Radio Frequency Identification (RFID) adoption decision process. In this study, AHP helped to predict possible risks and challenges when adopting RFID and provided the chance to formulate appropriate strategies to minimize them. AHP also help to assess the inter-organizational issues among different divisions within an organization.

Another area that AHP is used in is IT. Sureshchandar and Leisten (2006) developed a framework using AHP, for evaluating the criticality of software metrics. In this study, a special form of AHP, called absolute AHP, is used. In this procedure, absolute priorities or weights are assigned to different decision alternatives.

As mentioned before in Babic and Plazibat (1998), AHP is partially used in the process of ranking firms according to business efficiency. In this study, AHP is only used to rank the criteria but not the alternatives. Here, ranking the criteria means determination of the weights of the criteria. The criteria chosen for this study were debt ratio, average collection period, stock turnover, current ratio, total asset turnover, profit margin, return on assets (ROA), return on shareholders capital, sales revenue per employee, and average employee remuneration. As can be seen above, all the criteria were chosen from financial statements of the enterprises.

AHP in Risk Rating

There are a few studies in the literature about the application of AHP in risk rating and one of these studies belongs to Atan et al (2004). In this study, the

evaluation of consumer loan applicants using AHP is examined. In order to assign applicant credit scores, information in four main categories (Financial condition, collateral, personal information, and occupation) are evaluated. During the process thirteen sub-criteria under the four categories are identified and evaluated. The criteria-sub criteria hierarchy can be seen below:

1. Financial Condition

- Monthly income

- Interest Income

- Rent Income

2. Collateral

- Personal guarantee

- Mortgage

- Cash-collateral

3. Personal information

- Education

- Sex

- Marital Status

4. Occupation

- Official

- Worker

- Self employed

Another study, which uses AHP in credit decisions, belongs to Yurdakul and İç (2004). They developed a decision-making model for banks to determine the credibility of manufacturing firms. According to Yurdakul and İç, the credibility of a

manufacturing firm is proportional to the expected profit during the credit term. In this respect the AHP hierarchy in this study is designed as below:

1. Non-Financial Score

- Revenue Generation Capacity (with sub-criteria)

- Cost Control Capacity (with sub-criteria)

- Other Factors (with sub-criteria)

2. Financial Score

- Operating Efficiency and Profitability (with sub-criteria)

- Short-Term Liquidity (with sub-criteria)

- Capital Structure and Long Term Solvency (with sub-criteria)

The result of the study showed that the AHP based model is an excellent financial analysis tool for commercial banks. Although it has some difficulties and challenges such as the requirement for extensive discussions and brainstorming to determine the criteria and their relative importance, AHP can significantly improve the credit evaluation process of a bank, if it can be properly implemented.

CHAPTER 4

CURRENT CREDIT ANALYSIS STRUCTURE and PROPOSED MODEL

Current Credit Analysis Structure

Existing credit policy of the bank considered in this study is highly conservative. The main goal of the bank is to be able to serve all its customers' financial requirements, while preserving its conservative credit policy. In order to achieve this goal, the bank tries to establish a balanced and high-quality customer portfolio on the basis of existing evaluation criteria.

At the beginning of any commercial relationship, the first criterion that the bank personnel evaluate is the sector in which the company operates. According to the credit policy of the bank, some sectors are categorized as prohibited, restricted, limited, or controlled sectors. A good example for this situation is the firms in the defense sector. If the sector of a firm is in one of the above specified categories, the bank's risk appetite decreases and in some cases it becomes zero and the bank does not extend any loan to the firm.

The existing commercial credit application process begins with a report called "Credit Application" (CA). The report is prepared by relationship managers (RMs) in the Corporate Marketing department of the bank and it contains;

- A “summary” (maximum 2 pages) which includes information about the applicant and also the loan demanded by the applicant such as the amount of loan requested by the applicant, core business of the applicant, share price and external debt rating of the applicant (if there are any), ownership structure of the applicant, internal risk rating assigned to the applicant by RM, purpose of the demanded loan, repayment type of the demanded loan, and security structure of the demanded loan.
 - A “remarks” part (maximum 4 pages) which contains detailed management, competitor, financial, and operational analysis.
 - A “CA Table”, which summarizes important financial ratios and figures.
- Format of the CA report can be found in Appendix A.

In order to prepare Credit Applications, relationship managers take the updated financial tables of the customer for the last three years. After the data in the tables are entered into the computer systems of the bank, CA Tables are prepared. CA Tables are summary tables and provide a general view of the financial position of the company at first glance. If there is any deterioration directly seen in the table, RMs investigate the reason lying under this deterioration by examining financial tables and also by directly talking to the customer.

Although audited financial statements are preferred in the evaluation process, most of the time, financial statements of companies are unaudited. This is true not only for small companies, but also for some of the big companies in some periods of the year. In general, audited financial statements provide the confidence to an analyst that accounting rules are well established. In this way, the analyst can better understand the underlying factors affecting the entries. However, unaudited financial statements do not always mean that the reported data are manipulated.

After detailed analysis of financial figures and direct conversations with the customer, RM finalizes the CA preparation process and sends the CA to the Credit Evaluations department for final decision. Credit Evaluations personnel base their decisions only on the CA prepared by the RM. However, most of the time, they return to RM with questions about some points they think that are important but not mentioned in the CA. Since the Credit Evaluations department is the final decision making authority, these questions should be answered. To answer these questions, RM most of the time return to the customer once again. Although there are some cases in which CAs are approved when they are first sent to the Credit Evaluations department, generally the question-answer process occurs and causes the overall evaluation process to continue for a long time. In today's highly competitive financial markets, such a long process causes commercial customers to choose other banks for their financial requirements.

As mentioned before, while preparing a Credit Application, relationship managers propose risk ratings for their customers in the "summary" part of the application. Credit Evaluations personnel not only decide on the credit that will be extended to the customer but also decide on the risk rating that will be assigned to the customer.

In the current structure, there are two grading systems in the bank. The first system is only based on the attributes of the commercial customer and does not take the loan and security structure demanded by the customer into consideration. The intervals and their meanings in this grading system can be seen in Table 3, on the following page:

Table 3. Existing Customer Rating System in the Bank

CUSTOMER RATING SYSTEM	
INTERVAL NAME	INTERVAL MEANING
CR1	Minimum Risk
CR2	Low Risk
CR3	Satisfactory Risk
CR4	Fair Risk
CR5	Mediocre Risk
CR6	Significant Risk
CR7	High Risk
CR8	Special Management
CR9	Default
CR10	Default

CR1 – Minimum Risk: It is the best rating that a firm can take. The company has a perfect financial position and most of the time it also has an external debt rating from a credit rating institution.

CR2 – Low Risk: The company has a very good financial position and generally has an external debt rating. Probability of default is very low.

CR3 – Satisfactory Risk: Financial position of the company is satisfactory and there is nothing bad in the situation.

CR4 – Fair Risk: Although there are some problems in the financial figures, overall financial position of the company is good. The default probability is in middle levels and it may require a frequent review process.

CR5 – Mediocre Risk: The company is in average financial position. Current situation of the company is not bad. However, since the sensitivity of the company to external developments increases, a frequent review process is required.

CR6 – Significant Risk: There is a clear weakness in the financial position of the company. Although, currently it can pay its obligations on time, external events may weaken the financial position of the company. Frequent review is required.

CR7 – High Risk: The financial position of the company continuously gets worse and this situation requires a continuous review procedure. There are some concerns about the loan repayment capacity of the firm.

CR8 – Special Management: The financial position of the company is bad, in general and repayment capacity of the company is suspicious. There are increasing concerns.

CR9 – Default: The probability of getting back whole principal and interest payment is very low. Provision procedure should start.

CR10 – Default: Collection is impossible and 100% provision is made.

Second rating system in the bank takes the loan and collateral structure into consideration, in addition to the attributes of the customer. The intervals and their meanings in this system can be seen in Table 4 below:

Table 4. Existing Exposure Rating System in the Bank

EXPOSURE RATING SYSTEM	
INTERVAL NAME	INTERVAL MEANING
ER1	Low Level Risk
ER2	Satisfactory Risk
ER3	Fair Risk
ER4	Significant Risk
ER5	High Risk
ER6	Default
ER7	Default

ER1 – Low Level Risk: The company is in a perfect financial position or the loan is a cash-collateral loan.

ER2 – Satisfactory Risk: Financial position and the repayment conditions of the company is good.

ER3 – Fair Risk: There are some minor problems in the financial position of the company. In addition, there may be a problem about the security structure, or

credit approval authority may think that there is a risk of not getting back the principal and interest.

ER4 – Significant Risk: There are continuous problems in the financial position of the company. Although the repayment capacity of the firm is satisfactory, the bank does not have enough security or late payments are expected.

ER5 – High Risk: Weak financial position, low repayment capacity, insufficient security. However, it is still expected that the loan will be wholly repaid.

ER6 – Default: Probability of getting back whole principal and interest payment is low. The bank started legal procedures to guarantee the repayment.

ER7 – Default: Principal and interest is recorded as loss. There is no chance to get the money back.

Problems In The Current Structure

Current evaluation and rating procedures in the bank considered in this study are extensively based on human judgment. None of the statistical models mentioned before are employed in the rating and evaluation process of the bank. As stated before, this is a common situation for many banks with large credit exposures. It is generally believed that, for large exposures, the accuracy of judgmental systems outweigh the costs. Actually, the main problem in the current structure of the bank is not about its judgmental basis, but about lack of weights. Although the bank has written definitions of ratings and risk factors, they are all brief and broadly worded. They do not guide decision-makers regarding the weights to assign on each factor.

Assigning weights to risk factors is not a simple process. Because, some of the risk factors are qualitative and for the quantitative factors and for their weights,

the number of combinations is very large, since they can change according to the type of assets. Instead of evaluating all combinations, decision-makers in banks prefer to use judgment, which is based on training and experience, in weighting factors. This situation is true for the bank in this study. Assigned ratings of the bank are actually the product of the bank's unwritten credit culture.

Credit culture can be defined as the understanding of the bank personnel about the standards that must be achieved in credit risk management. Maintaining a credit culture is a hard process, especially for large banks. However, once it is achieved, it provides an important competitive advantage to the bank. If banks can achieve assigning weights to risk factors, unwritten credit cultures can be identified with a systematic procedure.

Another problem about the current structure is that, as a result of lack of weights, credit evaluation process takes a long time. Relationship Managers and Credit Evaluations personnel both know the factors that are evaluated in the process. However, they do not know the weights of these factors and because of that a long question-answer period becomes a part of the evaluation process and as mentioned before, this situation causes the loss of customers.

Proposed Model

One of the aims of the proposed model is to identify the weights of the current credit evaluation and rating criteria. To reach this aim, in the first part of the study, a hierarchical structure is defined with the help of the bank's credit evaluation guidelines, literature survey, and comments of the bank staff. After that, a survey called Criteria Weight Survey is applied to the personnel working in Corporate

Marketing and Credit Evaluations departments to understand individual judgments of the personnel about the importance level of the criteria in the defined hierarchy and also to see the differences between their evaluations. By synthesizing the survey results departmental weights are found. In order to justify that the departmental weights truly reflect the perceptions of the bank's existing credit evaluation and risk rating process, six of the previously rated commercial customers' Credit Applications are re-evaluated with an AHP based approach by using forms called, Customer Evaluation Forms. As part of absolute AHP methodology, intensity scales of the criteria in the Customer Evaluation Form and the ER – CR rating scales are found with the help of another survey called, Intensity Scale Survey and in the last part of the study, AHP based ER – CR ratings are calculated and compared with the existing ratings.

To reach the second aim of the study, which is defined as identifying the effect of group decision making on the accuracy of credit risk ratings, justified Criteria Weight Survey results of the two departments are mathematically aggregated and overall bank weights assigned to rating criteria by the bank personnel are found. Since the unwritten credit culture shapes the judgments of decision-makers in the bank, these weights are evaluated as a general sign of the credit culture of the bank.

Hierarchy Design

The criteria the bank evaluates at every commercial credit application are listed below:

1. Character of the borrower
2. Purpose of utilization

3. Amount of utilization
4. Maturity and repayment type of the loan
5. Primary source of repayment
6. Secondary source of repayment-security

In order to find the right level of decomposition in the hierarchy, these criteria should be reviewed in detail. The details of the criteria are as follows:

1. Character of the borrower

For commercial customers the criterion has two parts:

- Financial operations of the firm
- Commercial operations of the firm

Financial operations of a firm can be evaluated by analyzing interim and year-end financial tables of the firm. In the bank, CA Tables provide an insight to the financial condition of the company. When it comes to commercial operations, on the other hand, many factors, including managers and shareholders of the firm, sector, and relations with the market come into consideration.

2. Purpose of utilization

Firms may need money for many different purposes such as paying overdue suppliers, making tax payments, paying maturing debt obligations, or acquiring new fixed assets. In general, loan utilizations should be used for legitimate business purposes.

3. Amount of utilization

A borrower should get enough cash to operate effectively but not too much to not spend wastefully.

4. Maturity and repayment type of the loan

A loan can be short-term working capital loan or long-term term-loan. Independent of maturity, there may be different repayment types such as a bullet principal and interest repayment at maturity or a certain time period of grace following principal and interest payments as installments.

5. Primary source of repayment

The main source of repayment is cash flow. But the source of the cash flow may be different, such as liquidation of assets, cash flow from normal operations, new equity issues, future profits, and new debt issues.

6. Secondary source of repayment – security

The risk of loss can be lowered by taking a backup support beyond normal cash flow. The type of the security can change from the assets held by the borrower to an explicit guarantee by a related firm or an important person. Here the important point is that the maturity and amount of the security should match the utilized loan.

Credit rating institutions such as Moody's, S&P and Fitch, take some of these criteria into consideration in different ways. Some of them use statistical or accounting based models, while others use market implied ratings or expert systems as rating firms. Although not every firm gets a rating from these institutions, for the ones which are rated, these ratings are also a criterion in the credit risk rating process of a bank.

On the basis of the detailed criteria analysis, the hierarchy is structured as follows:

1. Level-The goal of the decision: Defining credit risk rating
2. Level- The criteria used to evaluate alternatives:
 - a. Structure of the firm
 - b. Structure of the loan
 - c. Evaluations of credit rating institutions
3. Level- The subcriteria used to evaluate alternatives:
 - a.1. Financial operations

- a.2. Commercial operations
 - b.1. Purpose
 - b.2. Amount
 - b.3. Maturity & repayment type
 - b.4. Primary source of repayment
 - b.5. Secondary source of repayment – security
- 4. Level- The sub-subcriteria used to evaluate alternatives:
 - a.1.I. Profitability
 - a.1.II. Tangible net worth (TNW)
 - a.1.III. Financial risk
 - a.1.IV. Liquidity
 - a.1.V. Cash flow

 - a.2.I. Managers / Shareholders
 - a.2.II. Relations with the market
 - a.2.III. Sector

A visualization of the hierarchy can be seen in Figure 2 on page 36.

Although the criteria evaluated in the rating process are the same, there were different decomposition alternatives. While the first draft hierarchy was prepared, literature survey about commercial loan request evaluations and the bank's internal credit evaluation guidelines were used as primary sources. Since the goal of the study is to show the differences between the evaluations of Credit Evaluations and the Corporate Marketing department of the bank at credit risk rating process, comments of some of the personnel in both departments were taken to decide on the final criteria in the hierarchy. With the help of these comments, the hierarchy got its final structure, which reflects the policy of the bank and also perceptions of the people who work in the sector for years.

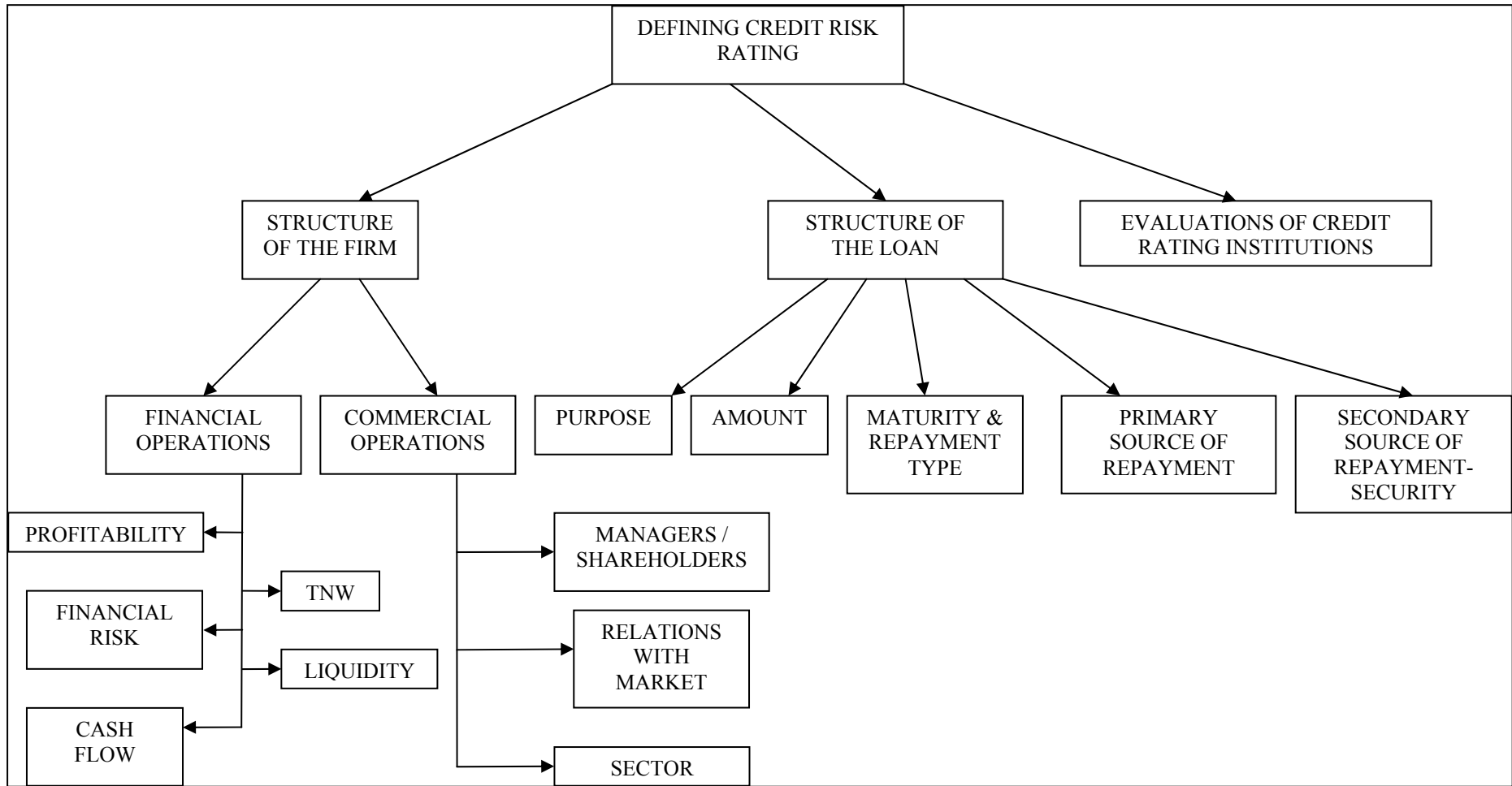


Figure 2. The AHP model designed for defining credit risk rating

The summary of the comments of the Credit Evaluations department and the Corporate Marketing department on the first hierarchy can be seen below:

Comment 1-Corporate Marketing: Cross-sell possibilities are directly related to the revenue generated from a customer. On the other hand, the aim of risk rating is to be able to measure the cost of loss to the bank. In this respect cross-sell probability should not be a criterion in the rating process.

Comment 2-Corporate Marketing: Financial analysis is the first part of the evaluation of a firm. In this respect, financial operations should be at a higher level. Nonfinancial operations of a firm are related to the commercial activities such as relations with customers and suppliers, credibility of the management, and the structure of the sector in which the company operates.

Comment 3-Corporate Marketing: Security should be taken as a first level criterion and not be a part of loan structure.

Comment 4-Credit & Risk: Security is a part of the loan structure. If it is taken as a first level criterion, it means the bank may extend a loan only for good security, independent of the structure of the borrower or the loan. This type of an approach is not applicable in the bank.

Comment 5-Credit & Risk: When the structure of the loan is evaluated, not only maturity but also the repayment type of the loan is analyzed.

When the final hierarchy was prepared most of the comments were taken into consideration. But as can be seen above comments 3 and 4 contradicted each other. In the final design of the hierarchy, the comment of Credit Evaluations department was utilized since both the literature and the bank's own credit evaluation guidelines emphasizes the same point about collateral being a *second* source of repayment not a *first* level criterion.

CHAPTER 5

ANALYSIS OF THE MODEL

In order to identify the weights given by Corporate Marketing and Credit Evaluations departments on the criteria in the analytic hierarchy model developed for this study, a Microsoft Excel based survey, called Criteria Weight Survey, is used. Survey format can be found in Appendix B. Since confidentiality is the main priority in every bank, information systems used within banks are strictly controlled and using a computer program that is not identified and not known by the IT personnel of a bank is impossible. In this respect, a generally known computer program should have been chosen to perform the survey. Microsoft Excel is one of the main computer programs used by the bank personnel for their daily activities. Because of its ease of use and familiarity to the users, Microsoft Excel was chosen as the computer software of the survey.

Selection of the Alternatives for Evaluation

To eliminate the problem of the large number of combinations of factors and weights for different type of assets some simplifying assumptions were made in the sampling process.

- In order to focus on the main evaluation criteria, firms operating in the categorized sectors mentioned before (prohibited, restricted, limited, and controlled sectors) were not taken as part of the sample.
- Firms operating in a particular sector were taken as the sample. Although, the main criteria in the evaluation process do not change a lot, weights assigned to the criteria may be different, depending on the structural differences of sectors. To give an idea, energy and construction sectors are generally based on long-term projects and to extend a loan to these sectors, cash flow projections till the end of the projects are investigated in detail by banks. On the other hand, the retail sector does not have as big and long-term projects as the energy and construction sectors. In the retail sector, trade cycle related figures such as trade creditors' payment period or stock turnover period are more important in the evaluation process. Another benefit of taking firms operating in only one sector is that, the type of assets demanded by firms in a sector are more or less the same. With this limitation in the sample, asset related weight differences are minimized. While selecting the sector, factors such as the size and importance of the sector in the portfolio of the bank, ease of information gathering, and diversity of assets demanded by the sector are taken into consideration. On the basis of these factors, firms in the automotive sector are selected in this study. In the bank considered in this study, automotive sector companies form more than 10% of the total portfolio and the sector is listed as one of the four main sectors in the portfolio of the bank. Because of some personal connections within the bank, it was easier to get information about the firms in the sector. Also automotive firms demand a variety of assets (cash and non-cash) such as working capital loans, and letter of credits.

- Only companies with unaudited financial statements are evaluated and rated.

The reasons for this type of a division are that;

- i. Evaluations based on unaudited financial statements are more risky than evaluations based on audited financial statements and in more risky cases, the importance of assigned ratings increase.
- ii. Additionally, most of the time, evaluated companies do not have audited financial statements.

Selection of Respondents

While selecting the respondents of the survey, statistical sampling was not preferred. Since it is a subjective methodology, AHP does not require a large number of experts to take part in the process. Although a small sample only provides a general idea about the issue, in the process of making important business decisions, only a small group of key personnel are sufficient. In some cases, the most important business decisions are made by only one person, the general manager. In the bank considered in this study, there is a similar decision making process. While the largest loan extension decisions are only made by the top managers of the bank (including the CEO of the bank, the head of Corporate Marketing, and the head of Credit Evaluations department), for other relatively small loan extension decisions, lower level personnel take the responsibility. However, for all types of loans, the number of people who take part in the evaluation and decision process does not exceed four. In this study, the aim was to select relevant personnel and the respondents had to meet some criteria; they should have been an effective part of the credit evaluation and rating process, they should have enough experience and knowledge about the

main evaluation and rating criteria of the bank, and about their importance. In such a case, statistical sampling would not meet the goals of the study.

The number of personnel working in the Credit Evaluations and Corporate Marketing departments of the bank is fifteen and thirty, respectively. Since the policy of the bank is to manage the commercial customer portfolio on the basis of sectors, and since only automotive sector firms are selected in this study, only the personnel familiar with automotive sector Credit Applications were selected as the respondents of the survey. In the Credit Evaluations department, the number of personnel who is familiar with the automotive sector credit applications is ten, and six of them responded to the survey. In order to meet the experience and knowledge criteria, the ones who had less than 1 year of experience were eliminated. In the Corporate Marketing department, on the other hand, fifteen people were directly related to the automotive sector credit requests and four of them did not have the required experience level. From the remaining eleven people, eight of them responded to the survey. The weights defined by a respondent from each department, are given in Appendix C, as an example.

In order to calculate individual priority vectors (weights), the additive normalization method is used. At every stage of comparison, consistency of judgments is evaluated and respondents are informed about them. After collecting all data, the Geometric Mean Method is applied for aggregation. The Arithmetic Mean Method is used only for the financial / commercial operations comparison. Since that comparison contains only two items, the responses collected are all direct weight assignments, i.e. none of the priority synthesis methodologies are used to calculate the weights. In order to aggregate the departmental responses and reach departmental weights, AIJ methodology is used. Since personnel in a department should act as an

individual and make a compromise when reaching the final decision, using this type of a methodology is more appropriate. Aggregate results of both departments can also be found in Appendix C and a summary table of departmental weights is given in Table 5 on the following page.

Validation of the AHP Model

In order to validate that the departmental weights reflect the bank's existing credit evaluation and risk rating process, credit risk ratings of six automotive sector customers of the bank were re-calculated using the AHP methodology. As part of the validation process, six of the previously rated commercial customers' Credit Applications were used. After changing the names of the companies and erasing the internal risk rating part, the personnel in Corporate Marketing and Credit Evaluations departments were asked to evaluate the amended Credit Applications. While evaluating the CAs, they were requested to fill another Excel based evaluation form, the Customer Evaluation Form. Format of the evaluation form can be found in Appendix B. Because of the reasons mentioned at the beginning of the chapter, Microsoft Excel was also chosen as the application program of the evaluation form. To evaluate the performance of the AHP based model, previously assigned ratings of the companies are compared with newly generated ratings.

Table 5. Departmental Weights

CRITERIA	CREDIT EVALUATIONS DEPARTMENT WEIGHTS	CORPORATE MARKETING DEPARTMENT WEIGHTS
a. Structure of the Firm	57%	63%
b. Structure of the Loan	16%	22%
c. Evaluations of Credit Rating Institutions	27%	15%
a.1.Financial Operations of the Firm	54%	56%
a.2.Commercial Operations of the Firm	46%	44%
a.1.I. Profitability	11%	12%
a.1.II. Tangible Net Worth (TNW)	27%	48%
a.1.III. Financial Risk	16%	16%
a.1.IV. Liquidity	22%	13%
a.1.V. Cash Flow	23%	11%
a.2.I. Managers / Shareholders	29%	48%
a.2.II. Relations with Market	24%	20%
a.2.III. Sector	47%	32%
b.1. Purpose	27%	12%
b.2. Amount	17%	12%
b.3. Maturity and Repayment Type	14%	21%
b.4. Primary Source of Repayment	29%	35%
b.5. Secondary Source of Repayment	13%	20%

While selecting the commercial customers to use in the validation process, an important attribute of the automotive sector is taken into consideration. Firms operating in this sector can be classified in two broad categories: production firms and distribution firms. Here, distribution firms are the ones that do not have any production capacities. These firms only import and sell automobiles and other automotive sector products. On the other hand, production firms do produce cars. Although some of them have their own marketing and distribution units, generally they prefer to continue distribution related operations under different company names. In this respect, in the automotive sector, operations related to production and distribution are performed separately. As a result, firms in the same sector may have

different operational structures. In order to see the effect of this difference, in this study, three production and three distribution companies in the portfolio of the bank are evaluated. Because of confidentiality issues, detailed information about the evaluated companies cannot be presented in this study. However, to give an idea, general information is presented in Appendix D.

As mentioned before, in the credit evaluation and rating process of the bank, a Relationship Manager in the Corporate Marketing Department prepares a Credit Application, one personnel in Credit Evaluations evaluates the application and makes the final decision. The selected Credit Applications are distributed to twelve people (six of them from the Credit Evaluations department, and the remaining six of them from the Corporate Marketing department) and this group is defined as the Evaluation Group. The people in the evaluation group are the same people selected for the weight identification part. As mentioned before, while they were selected, their knowledge, experience, and also familiarity to automotive sector applications were taken into consideration.

Since the bank does not have a committee based credit evaluation process, and loan extension decisions are based on personal judgments, subjective bias in the evaluation process was a possibility in this study. To control the possibility of any subjective bias, Credit Applications of 2 companies (one production and one distribution company) are evaluated by four different decision makers (2 from Corporate Marketing department and 2 from Credit Evaluations department) and these four people are defined as the Control Group. While the people in the control group were also a part of the evaluation group, the difference was that members of the control group evaluated Credit Applications of two different firms. Judgments of the evaluation and control groups can be found in Appendix E. When the judgments

of control group are examined, it can be seen that the possibility of subjective bias was so low that it can be ignored.

Another important point about the evaluation results is that, when they are examined in detail it is obvious that all respondents evaluated the sector either “Bad” or “Not Good / Not Bad”. This is mainly because of the periods of Credit Applications chosen for the study. All CAs belong to the 2006-2007 period and the performance of automotive sector in this period was not good enough. In 2006, the automotive sector contracted by 12.2% and the contraction continued in 2007, but with a slowing trend, by 4.2%. Following the interest rate cuts at the beginning of the fourth quarter of 2007, there has been an upward movement in the sector.

In the current structure, there are two grading systems in the bank. While the CR rating is only based on customer attributes, ER ratings also take the loan and security structure into consideration. While calculating AHP based ratings, the existing structure is taken as the main framework and in this respect two type of rating – CR and ER - for each company is calculated.

Since the credit evaluation process of the bank is extensively based on human judgment, mathematical meaning of CR and ER ratings are not known in the current structure. While assigning a rating to a company, a decision maker in the bank bases his or her decision on the written definitions of risk factors and ratings and also on his or her own experience. However, at the end of an AHP-based evaluation process, a decision maker gets numerical values, which reflect CR and ER ratings. An option to find a numerical scale reflecting the existing non-numerical rating structure is to make assumptions about the numerical structure of the rating system e.g. linearity assumption. Since there is no numerical part of the existing credit evaluation process however, it would be hard to justify that the assumption totally reflects the

perceptions of the decision makers in the bank. In this study, the aim was to demonstrate the existing structure and making assumptions at this point would deteriorate the aim. On the other hand, it can be claimed that, the pairwise comparison method reflects the perceptions of the decision makers. Since the numerical values calculated at the end of the process are outputs of comparisons made by decision makers, this method would better serve the aim.

As mentioned in chapter 2 in this study, a special form of AHP called absolute AHP is used. In this type of AHP, intensities of the criteria are also calculated by using pairwise comparison methodology. Scales of intensities of the criteria in the Customer Evaluation Form are calculated by using this methodology and evaluation of a random respondent from each department and aggregate results can be found in Appendix F. In order to find the numerical values reflecting the ratings, this methodology could also be applied. Here, the most important concern was about the number of alternatives in the comparison process. In the AHP methodology, comparing more than nine alternatives at a time would be very hard for an individual. Although there were less than nine alternatives (ER1 to ER7) in the ER rating structure, the CR rating structure with ten alternatives created a problem. Actually, making 21 pairwise comparisons for ER rating scale $((7*6)/2)$, and 45 comparisons for CR rating scale $((10*9)/2)$ at a time would be very frustrating for the decision makers. In order to overcome this problem, pairwise comparison matrices are directly presented to decision makers and they are requested to fill only the parts above the main diagonals of the matrices. For the sake of simplicity, the same method is used for the criteria in the Customer Evaluation Form and four matrices are presented to decision makers at the same time within a third Excel based survey, the Intensity Scale Survey. Format of this survey can also be found in Appendix B.

Three people from Corporate Marketing Department and four people from Credit Evaluations department responded to the survey. Results can be found in Appendix F and a summary is given in Table 6 below.

Table 6. Intensity Scales

CRITERIA / ALTERNATIVES	SCALE	
N/A	0,00	
Very Good	1,00	
Good	0,62	
Not Good Not Bad	0,30	
Bad	0,15	
Very Bad	0,09	
Absolutely Proper	1,00	
Proper	0,57	
Not Proper	0,18	
Absolutely Not Proper	0,10	
ER1	1,00	0,79
ER2	0,78	0,46
ER3	0,45	0,30
ER4	0,29	0,17
ER5	0,16	0,11
ER6	0,10	0,09
ER7	0,08	0,00
CR1	1,00	0,94
CR2	0,93	0,63
CR3	0,62	0,43
CR4	0,42	0,29
CR5	0,28	0,21
CR6	0,20	0,15
CR7	0,14	0,10
CR8	0,09	0,08
CR9	0,07	0,00
CR10	0,07	0,00

In the last part of the study AHP based CR and ER ratings are calculated for six companies by using the departmental weights, judgments of evaluation group, and intensity scales of the criteria in the Customer Evaluation Form. Since ER rating takes customer attributes and loan structure into consideration, the departmental

weights of “Structure of the Firm”, “Structure of the Loan”, and “Evaluations of Credit Rating Institutions” are used exactly as they are. However, while calculating CR rating, the departmental weight of “Structure of the Loan” is not taken into consideration because CR rating is only based on customer attributes. With this type of a change, on the other hand, the sum of the remaining two departmental weights would not be equal to 100 percent and this would cause the resulting CR rating to never be equal to one. To solve this problem, new departmental weights are calculated for “Structure of the Firm” and “Evaluations of Credit Rating Institutions” criteria such that sum of the new weights will be equal to 100 percent, and old departmental weights are used as proportions e.g. new Credit Evaluations department weight of “Structure of the Firm” is calculated as $(0,57 / (0,57+0,27))$. The new departmental weights calculated with this approach can be found in Table 7, below.

Table 7. New Departmental Weights for CR Calculation

CRITERIA	CREDIT EVALUATIONS DEPARTMENT	CORPORATE MARKETING DEPARTMENT
Structure of the Firm:	81%	68%
Evaluations of Credit Rating Institutions:	19%	32%

By taking all these issues into consideration, AHP based CR and ER ratings are calculated for the six companies. The details of the calculations can be found in Appendix G and Table 8 as a summary table is given on the following page.

As can be seen in Table 8, for the six companies, the AHP based ER and CR ratings all correspond to the existing ratings. On the basis of these results, it can be said that the departmental weights calculated using AHP methodology reflect the bank’s existing credit evaluation and risk rating process.

Table 8. ER – CR Ratings of Companies

COMPANY A							
Corporate Marketing				Credit Evaluations			
AHP ER:	ER2	Proposed ER:	ER2	AHP ER:	ER3	Accepted ER:	ER3
AHP CR:	CR3	Proposed CR:	CR3	AHP CR:	CR4	Accepted CR:	CR4
AHP ER Score:	0,63			AHP ER Score:	0,44		
AHP CR Score:	0,61			AHP CR Score:	0,38		
COMPANY B							
Corporate Marketing				Credit Evaluations			
AHP ER:	ER4	Proposed ER:	ER4	AHP ER:	ER5	Accepted ER:	ER5
AHP CR:	CR6	Proposed CR:	CR6	AHP CR:	CR7	Accepted CR:	CR7
AHP ER Score:	0,28			AHP ER Score:	0,16		
AHP CR Score:	0,20			AHP CR Score:	0,09		
COMPANY C							
Corporate Marketing				Credit Evaluations			
AHP ER:	ER2	Proposed ER:	ER2	AHP ER:	ER3	Accepted ER:	ER3
AHP CR:	CR3	Proposed CR:	CR3	AHP CR:	CR4	Accepted CR:	CR4
AHP ER Score:	0,63			AHP ER Score:	0,42		
AHP CR Score:	0,55			AHP CR Score:	0,41		
COMPANY D							
Corporate Marketing				Credit Evaluations			
AHP ER:	ER3	Proposed ER:	ER3	AHP ER:	ER3	Accepted ER:	ER3
AHP CR:	CR4	Proposed CR:	CR4	AHP CR:	CR4	Accepted CR:	CR4
AHP ER Score:	0,44			AHP ER Score:	0,37		
AHP CR Score:	0,41			AHP CR Score:	0,34		

Table 8. continued.

COMPANY E							
Corporate Marketing				Credit Evaluations			
AHP ER:	ER3	Proposed ER:	ER3	AHP ER:	ER3	Accepted ER:	ER3
AHP CR:	CR4	Proposed CR:	CR4	AHP CR:	CR4	Accepted CR:	CR4
AHP ER Score:	0,44			AHP ER Score:	0,34		
AHP CR Score:	0,40			AHP CR Score:	0,29		
COMPANY F							
Corporate Marketing				Credit Evaluations			
AHP ER:	ER3	Proposed ER:	ER3	AHP ER:	ER3	Accepted ER:	ER3
AHP CR:	CR4	Proposed CR:	CR4	AHP CR:	CR4	Accepted CR:	CR4
AHP ER Score:	0,44			AHP ER Score:	0,34		
AHP CR Score:	0,41			AHP CR Score:	0,31		

Based on the justified departmental weights, common and conflicting points between the Corporate Marketing and Credit Evaluations departments of the bank, in the credit evaluation process are identified as follows:

- Structure of the firm is the most important criterion in the process of credit risk rating for both departments. However, for Credit Evaluations Department evaluations of credit rating institutions are more important than structure of the loan. While implementing the survey, it was found that, personnel in Credit Evaluations department give more importance to rating institutions' evaluation reports. They believe that the information in the reports is more reliable than the evaluations of the bank personnel, including themselves.

- While comparing financial and commercial operations of the firm, it was found that both departments give slightly more importance to the figures in financial tables.
- While evaluating the financial operations of applicant companies, tangible net worth (TNW) is the most important figure for the corporate marketing department. This figure is so important that, it gets a weight of approximately 50 percent. From Credit Evaluations departments point of view, on the other hand, the TNW figure is also the most important financial figure. However, they assign only a weight of 27% to this value. For the Credit Evaluations department, cash flow and liquidity measures of the company are as important as TNW. In general it is obvious that, Credit Evaluations department evaluate financial operations of applicant firms with a more balanced point of view.
- Another important difference between the two departments lies in the evaluation of commercial operations of firms. For the Corporate Marketing department, quality of managers and shareholders of the company is the most important criteria followed by the sector in which the company operates. However, the first thing that the personnel in Credit Evaluations Department focus on is the sector of the company.
- While evaluating the structure of the loan, the most important criterion for both departments is the primary source of repayment. However, ranking of the remaining criteria differs such that, while the second most important criteria for Credit Evaluations personnel is the purpose of the loan, personnel in the corporate marketing department believe that maturity / repayment type of the loan and secondary source of repayment are more important than purpose.

In addition to identifying the differences between the two departments, in this study the effect of group decision making on the accuracy of credit risk ratings was aimed at. In this respect, responses of both departments are aggregated together by using Geometric Mean Method and overall bank weights are identified. While aggregating all of the responses, AIJ is used once again. Although the two departments have conflicting interests and resulting conflicting evaluations about the credit risk rating criteria of the bank, from a general perspective all the personnel in the bank should act as an individual, while making a loan extension decision. In this process, both departments should make compromises. Aggregate results of all personnel can be found in Appendix C and a summary table of overall bank weights is presented in Table 9 below.

Table 9. Overall Bank Weights

CRITERIA	OVERALL BANK WEIGHTS
a. Structure of the Firm	62%
b. Structure of the Loan	19%
c. Evaluations of Credit Rating Institutions	19%
a.1.Financial Operations of the Firm	55%
a.2.Commercial Operations of the Firm	45%
a.1.I. Profitability	12%
a.1.II. Tangible Net Worth (TNW)	39%
a.1.III. Financial Risk	16%
a.1.IV. Liquidity	17%
a.1.V. Cash Flow	16%
a.2.I. Managers / Shareholders	40%
a.2.II. Relations with Market	21%
a.2.III. Sector	39%
b.1. Purpose	18%
b.2. Amount	14%
b.3. Maturity and Repayment Type	18%
b.4. Primary Source of Repayment	33%
b.5. Secondary Source of Repayment	17%

While the personnel weigh the criteria, unwritten credit culture of the bank shapes their judgments. In this respect, the overall bank weights provide a general idea about the credit culture of the bank. For instance while evaluating the commercial credit applications, the most important criteria in the bank is the structure of the firm. In the evaluation process, the importance of financial operations is slightly more than the commercial operations of the firm. In the financial analysis phase, TNW is the main figure that shapes the loan extension decisions. Following TNW are financial risk, liquidity and cash flow figures. In this bank, profitability figures are the least important indicators of financial performance. At the evaluation of commercial operations, sector and management structure are the main criteria. Finally, as part of the structure of the loan, primary source of repayment is the most important criteria, while all the remaining criteria have more or less equal importance.

CHAPTER 6

DECISION SUPPORT SYSTEM ENVIRONMENT

As indicated in Chapter 5, in order to identify and later to justify the departmental weights, Microsoft Excel based surveys and forms are used. Although these forms provided some level of flexibility and ease-of-use, they could not provide the benefits of a Decision Support System (DSS). In order to provide consolidated information, rapid response and a more user friendly reporting structure a DSS is developed with Microsoft Visual Basic 6.0. As an abbreviation of “Commercial Customer Credit Risk Rating Program”, the system is called 3C-RP and for input and output purposes it is integrated with Microsoft Excel.

As can be seen in Figure 3, the DSS environment consists of 2 main elements, namely a database and a graphical user interface, which are explained in detail below.

Database: Input and output data required to run the system are covered in the database. The database is actually a Microsoft Office Excel 2003 based workbook with six worksheets. Two of the worksheets are used to hold input data coming from personal criteria weight identification and commercial customer rating of the program. In order to calculate AHP based criteria weights and customer ratings, on the other hand, two other worksheets are employed. These two worksheets are formatted according to mathematical calculation rules of AHP. One worksheet is only used to hold previously calculated departmental weights and intensity scales and the last worksheet is used for output purposes. In this worksheet, calculation results

are formatted in graphical and tabular forms and also calculated customer ratings are held.

Graphical User Interface: The interface that provides interaction with Microsoft Excel is developed by Visual Basic programming language and it generates an easy-to-use environment for end-users. The user has the flexibility to choose his or her starting point. In the weight identification, the interface informs the user with warning messages about the consistency of their judgments at every stage and finally the end-user has the chance to compare the effect of different departmental weights on rating calculation process. Input values entered at every stage are transferred to Microsoft Excel for transaction processing and the results are displayed to the user both in graphical and tabular form.

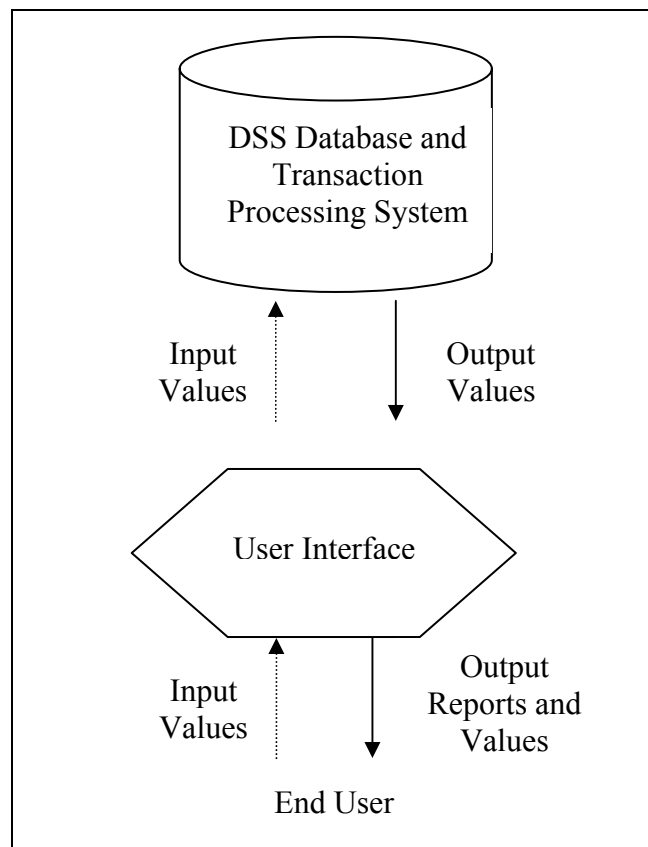


Figure 3. Decision support system environment

To illustrate the flow of activities in 3C-RP, an example is presented below.

Illustrative Example

The opening screen of the program contains four buttons to provide the end-user the chance to choose its starting point. If the end user wants to rate a commercial customer directly, he or she should proceed with the first button. If the aim of the end-user is to identify his or her own evaluation criteria weights, then the second button should be chosen. The third button provides the end-user the chance to see the departmental weights directly. On its first run, the fourth button on the opening screen of 3C-RP is not enabled because this button is to show the end-user, his or her existing criteria weights in the system. Since the end-user will not have any existing weights in the system on the first run, this button is disabled. However, after the user has identified and saved his or her own criteria weights, the program starts running with four active buttons. The opening screen of 3C-RP can be seen in Figure 4.



Figure 4. Opening screen of 3C-RP

Rate a Commercial Customer

After the end-user clicks the first button, he or she is requested to specify the name of the company with an input box, as can be seen in Figure 5.

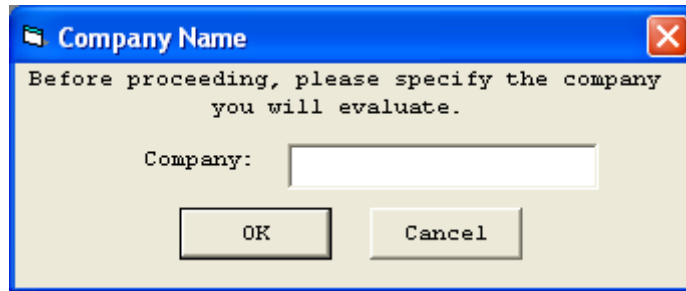


Figure 5. Input box to get the name of the company

If the user clicks "OK", without specifying the name of the company a warning message is displayed as shown in Figure 6.

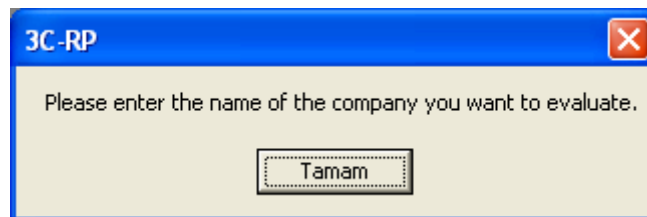


Figure 6. Warning message to fill company name

After getting the name of the company that will be evaluated, the program routes the end-user to the main evaluation screen, which can be seen in Figure 7.

Figure 7. Main evaluation screen

On the main evaluation screen, the end user chooses the most appropriate option for each evaluation criteria under “Financial Operations of the Company”, “Commercial Operations of the Company”, “Structure of the Loan”, and “Evaluations of Credit Rating Institutions” tabs. The program gives the end-user the chance to begin from any tab and also from any criteria. However, till the user fills all options, 3C-RP does not let the user see the resulting rates. As can be seen in Figure 8, when the main evaluation screen opens, the “Customer Credit Risk Rating” on the last tab is disabled and it is enabled only when the “End” button is clicked. Firstly, the “End” button checks whether all options are filled or not, and then “Customer Credit Risk Rating” is activated.

Figure 8. Main evaluation screen – disabled part

After the activation of “Customer Credit Risk Rating”, the end-user can choose the weight that he or she wants to use to evaluate the customer. As in the opening screen, on the screen individual weight is not activated on the first run of the system. When the user chooses the weight and clicks the “OK” button, calculated ER and CR ratings are presented within the related text boxes. At this point, if the user wants to examine the departmental weights, he or she can click the “Show Departmental Weights” button and see the page on Figure 9.

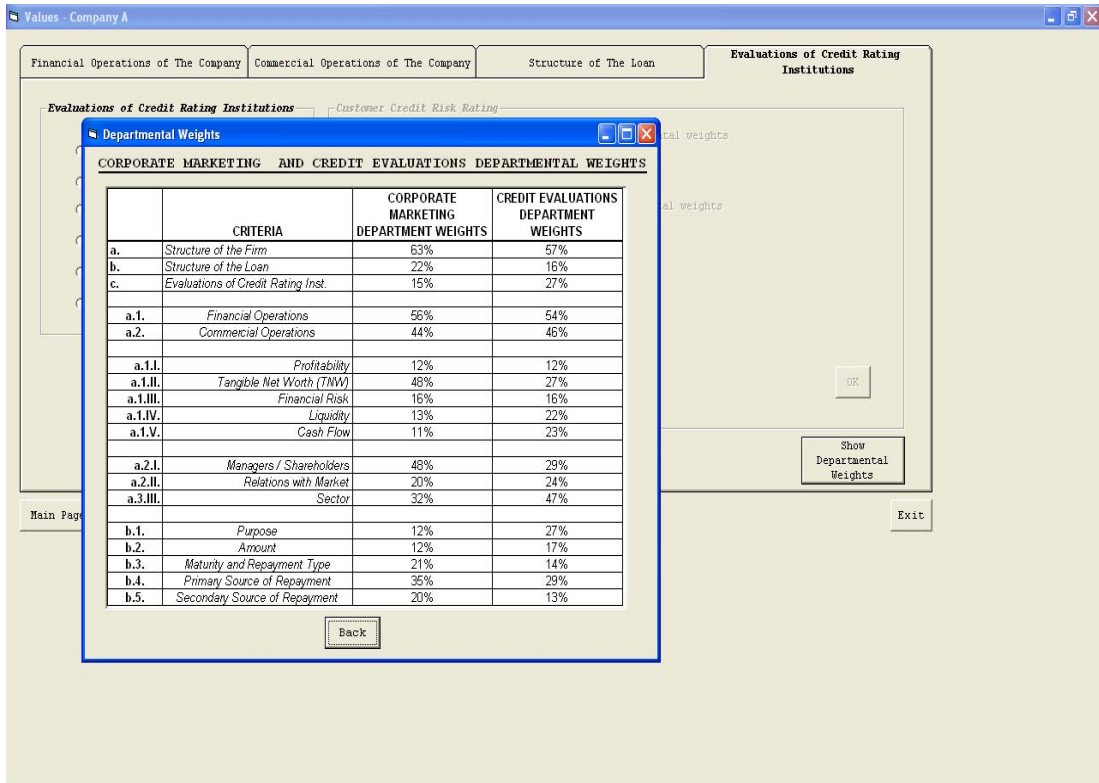


Figure 9. Screen for departmental weights.

When the user wants to exit from the program, he or she can use the “Exit” button. When he or she wants to return to the opening screen, he or she can click the “Main Page” button on the bottom left side of the evaluation screen.

Identify Evaluation Criteria Weights

Clicking the second button on the opening screen routes the end-user to the introduction screen of criteria weight identification, as can be seen in Figure 10.

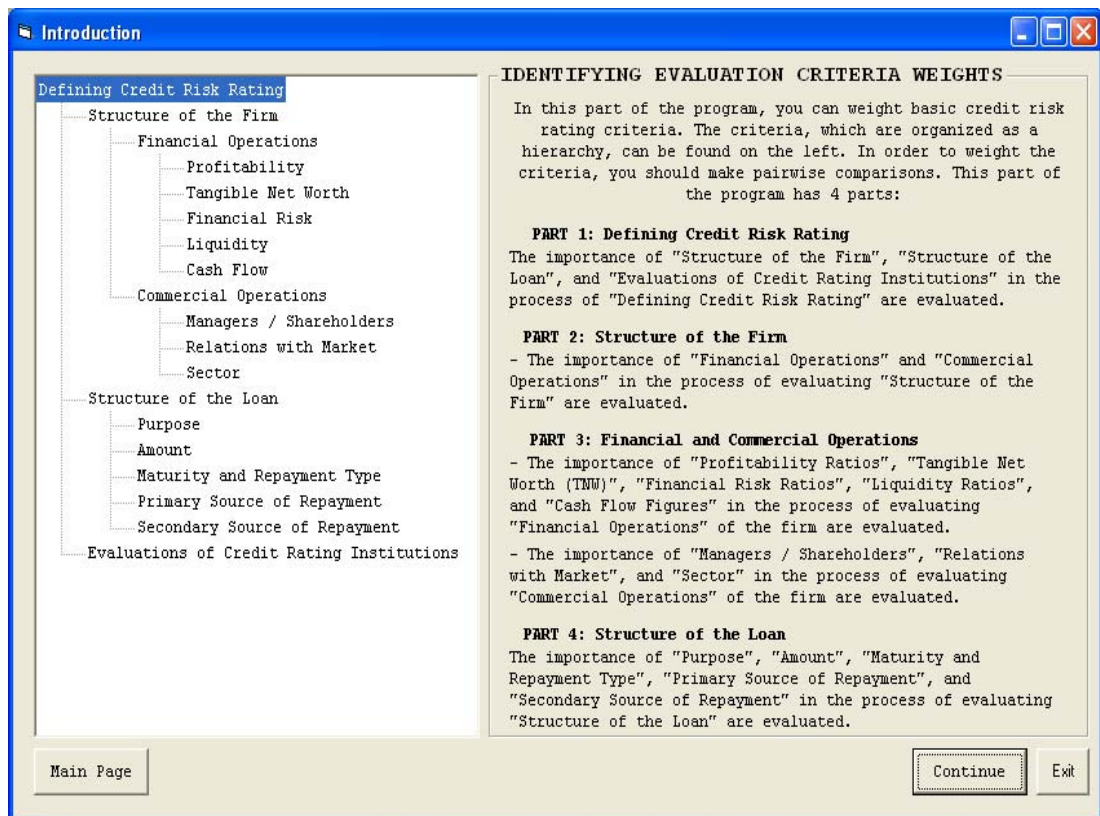


Figure 10. Introduction screen

This screen provides the user general information about the hierarchy. To continue the user clicks the “Continue” button on the bottom right side of the screen. Buttons to return to the opening screen and to end the program also exist at the bottom of the screen.

On the following screens, the user is requested to make pairwise comparisons, as can be seen in Figure 11. Until the user finishes all comparisons with a low enough consistency ratio, the “Continue” button on the bottom right side of the screen is not activated. To see the assigned weights and consistency level of the comparisons, the user should click “Show Weights” button. When there are more than three comparisons, the system also finds the most inconsistent comparison and warns the user with a dialog box, as can be seen in Figure 12.

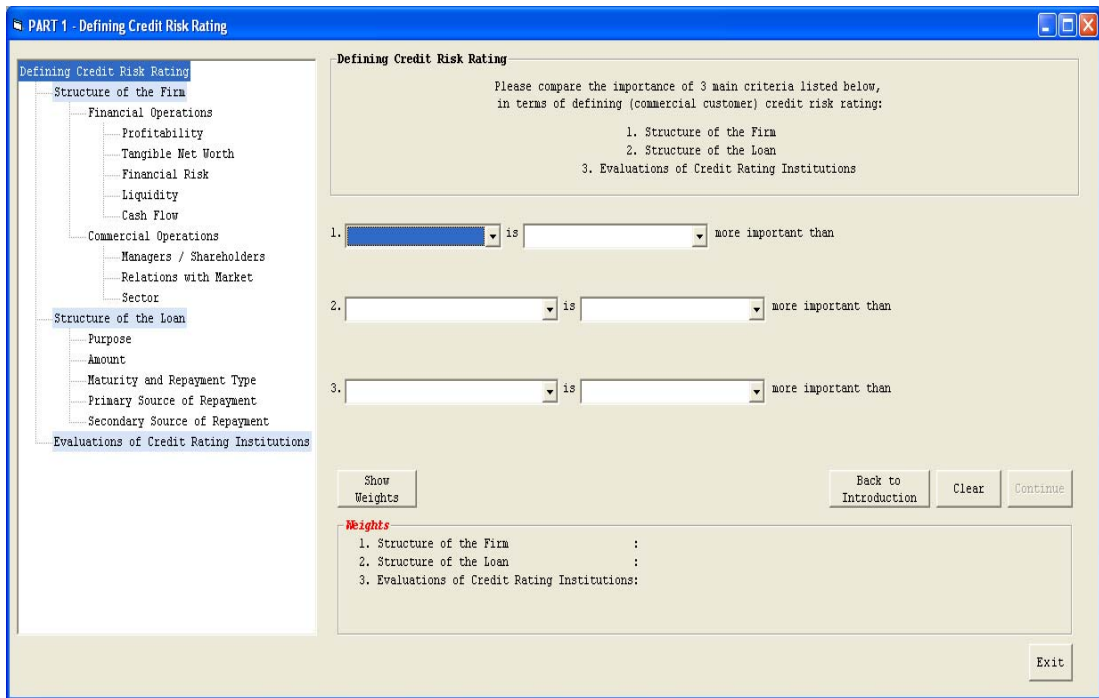


Figure 11. Part 1- Defining Credit Risk Rating

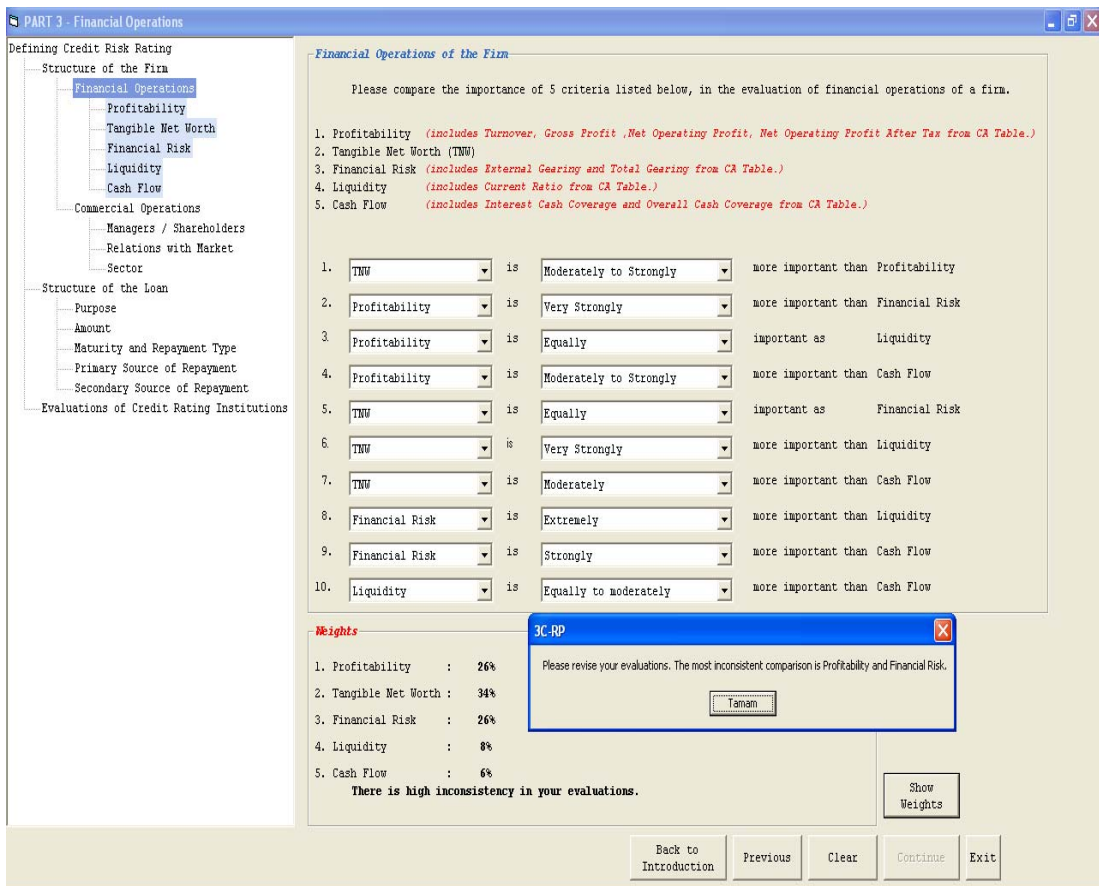


Figure 12. Inconsistency warning dialog box

The user does not make any comparisons and only assigns a ratio on one screen, as can be seen in Figure 13.

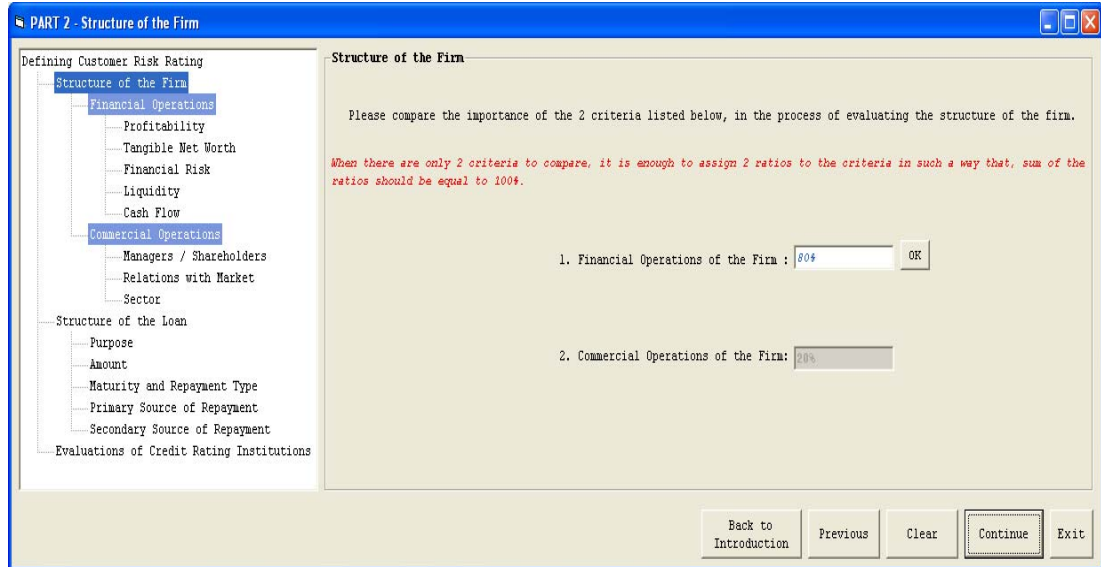


Figure 13. Rate assignment screen

In any part of the evaluation process the user can end the program by clicking the “Exit” button on the bottom right side of the screen. However, when the user wants to exit before finalizing all parts of the program, a warning message, as can be seen in Figure 14. is displayed and the user’s evaluations are not saved.

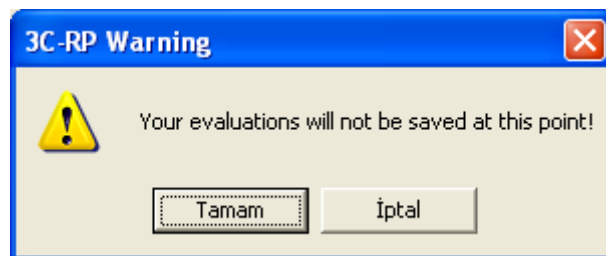


Figure 14. Warning message about saving evaluations

At the end of the comparison process the user should click “End” button. Before ending the process, however, a dialog box is displayed as can be seen in Figure 15.

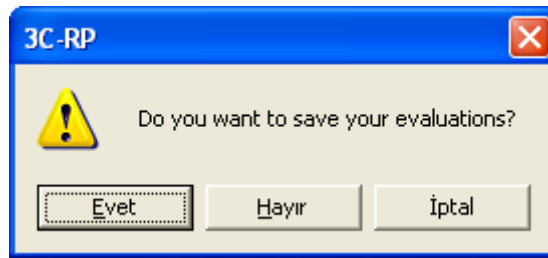


Figure 15. Dialog box for saving

If the user does not want to save the evaluations and there is no existing individual weight in the system, then a warning message is displayed to inform the user and the “End” button is disabled. The warning message can be seen in Figure 16.

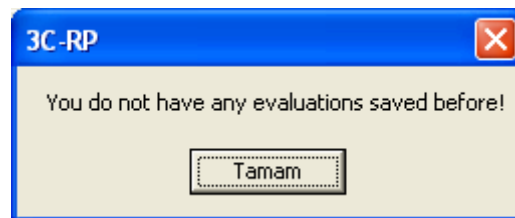


Figure 16. Warning message to inform about weight condition

If the user does not want to save the evaluations while there are previously saved weights in the system, on the other hand, existing weights are used.

After clicking the “End” button, the user is directed to the “Reports” screen, as can be seen in Figure 17. On this page the end user is given the chance to examine the results of the comparison process in five different ways. The user can choose to examine his or her evaluation results either in graphical or tabular form as can be seen in Figure 18 and Figure 19. The program also enables the user to compare his or her evaluation results with the departmental weights of the Corporate Marketing department, the Credit Evaluations department and also with overall bank weights. An example can be seen in Figure 20.

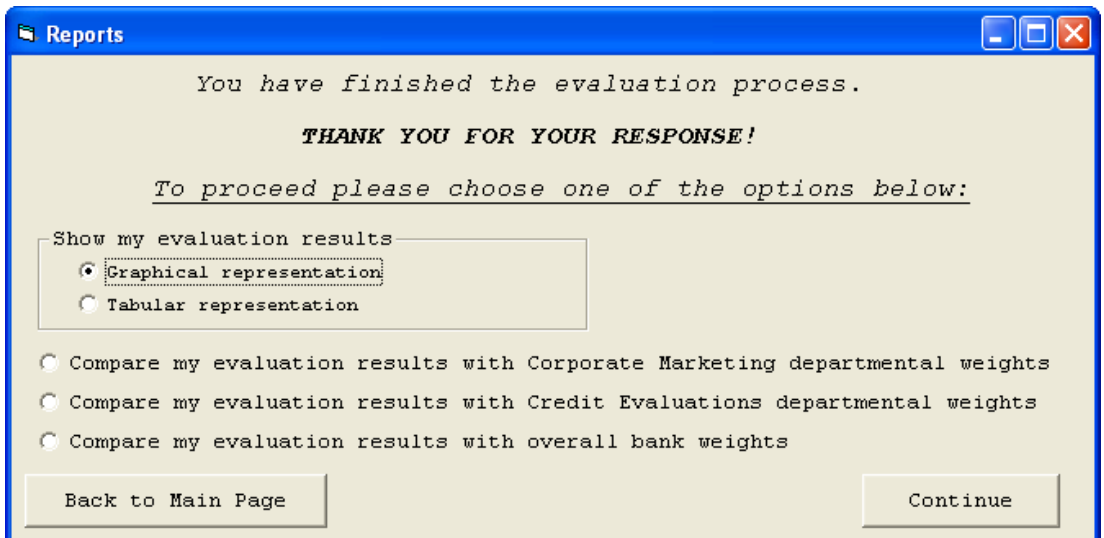


Figure 17. Reports screen

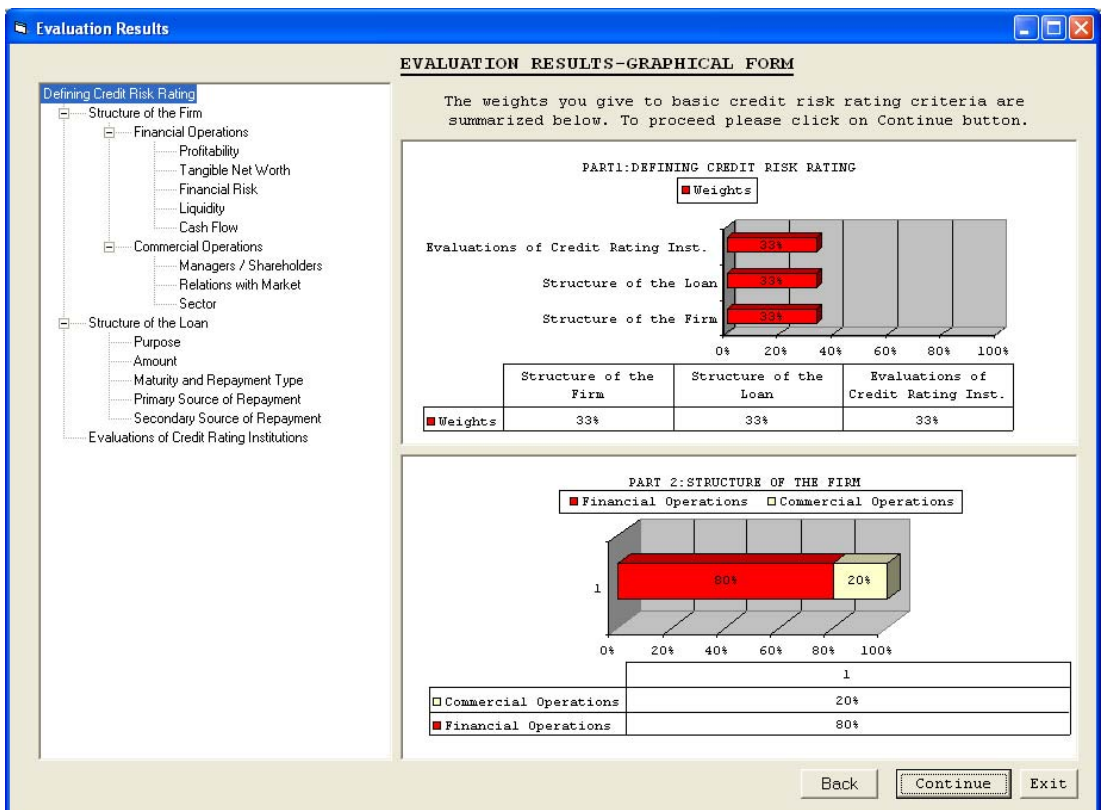


Figure 18. Evaluation results – graphical form

Evaluation Results

YOUR EVALUATION RESULTS – TABULAR FORM

	CRITERIA	MY WEIGHTS
a.	<i>Structure of the Firm</i>	33%
b.	<i>Structure of the Loan</i>	33%
c.	<i>Evaluations of Credit Rating Inst.</i>	33%
a.1.	<i>Financial Operations</i>	80%
a.2.	<i>Commercial Operations</i>	20%
a.1.I.	<i>Profitability</i>	25%
a.1.II.	<i>Tangible Net Worth (TNW)</i>	30%
a.1.III.	<i>Financial Risk</i>	21%
a.1.IV.	<i>Liquidity</i>	13%
a.1.V.	<i>Cash Flow</i>	11%
a.2.I.	<i>Managers / Shareholders</i>	49%
a.2.II.	<i>Relations with Market</i>	31%
a.3.III.	<i>Sector</i>	20%
b.1.	<i>Purpose</i>	20%
b.2.	<i>Amount</i>	20%
b.3.	<i>Maturity and Repayment Type</i>	20%
b.4.	<i>Primary Source of Repayment</i>	20%
b.5.	<i>Secondary Source of Repayment</i>	20%

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Figure 19. Evaluation results – Tabular form

Evaluation Results

YOUR EVALUATIONS VS. CORPORATE MARKETING DEPARTMENTAL WEIGHTS

	CRITERIA	CORPORATE MARKETING DEPARTMENT WEIGHTS	MY WEIGHTS
a.	<i>Structure of the Firm</i>	63%	33%
b.	<i>Structure of the Loan</i>	22%	33%
c.	<i>Evaluations of Credit Rating Inst.</i>	15%	33%
a.1.	<i>Financial Operations</i>	56%	80%
a.2.	<i>Commercial Operations</i>	44%	20%
a.1.I.	<i>Profitability</i>	12%	25%
a.1.II.	<i>Tangible Net Worth (TNW)</i>	48%	30%
a.1.III.	<i>Financial Risk</i>	16%	21%
a.1.IV.	<i>Liquidity</i>	13%	13%
a.1.V.	<i>Cash Flow</i>	11%	11%
a.2.I.	<i>Managers / Shareholders</i>	48%	49%
a.2.II.	<i>Relations with Market</i>	20%	31%
a.3.III.	<i>Sector</i>	32%	20%
b.1.	<i>Purpose</i>	12%	20%
b.2.	<i>Amount</i>	12%	20%
b.3.	<i>Maturity and Repayment Type</i>	21%	20%
b.4.	<i>Primary Source of Repayment</i>	35%	20%
b.5.	<i>Secondary Source of Repayment</i>	20%	20%

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Figure 20. Comparison screen

Show Departmental Weights and Show My Existing Criteria Weights

Last two buttons on the opening screen provide end-users the chance to examine departmental weights and their own individual weights, if there are any, loaded in the system directly. The screen view can be seen in Figure 21 and Figure 22.

CORPORATE MARKETING AND CREDIT EVALUATIONS DEPARTMENTAL WEIGHTS			
	CRITERIA	CORPORATE MARKETING DEPARTMENT WEIGHTS	CREDIT EVALUATIONS DEPARTMENT WEIGHTS
a.	Structure of the Firm	63%	57%
b.	Structure of the Loan	22%	16%
c.	Evaluations of Credit Rating Inst.	15%	27%
a.1.	Financial Operations	56%	54%
a.2.	Commercial Operations	44%	46%
a.1.I.	Profitability	12%	12%
a.1.II.	Tangible Net Worth (TNW)	48%	27%
a.1.III.	Financial Risk	16%	16%
a.1.IV.	Liquidity	13%	22%
a.1.V.	Cash Flow	11%	23%
a.2.I.	Managers / Shareholders	48%	29%
a.2.II.	Relations with Market	20%	24%
a.3.III.	Sector	32%	47%
b.1.	Purpose	12%	27%
b.2.	Amount	12%	17%
b.3.	Maturity and Repayment Type	21%	14%
b.4.	Primary Source of Repayment	35%	29%
b.5.	Secondary Source of Repayment	20%	13%

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Figure 21. Departmental weights screen

MY EXISTING CRITERIA WEIGHTS		
	CRITERIA	MY WEIGHTS
a.	Structure of the Firm	33%
b.	Structure of the Loan	33%
c.	Evaluations of Credit Rating Inst.	33%
a.1.	Financial Operations	80%
a.2.	Commercial Operations	20%
a.1.I.	Profitability	25%
a.1.II.	Tangible Net Worth (TNW)	30%
a.1.III.	Financial Risk	21%
a.1.IV.	Liquidity	13%
a.1.V.	Cash Flow	11%
a.2.I.	Managers / Shareholders	49%
a.2.II.	Relations with Market	31%
a.3.III.	Sector	20%
b.1.	Purpose	20%
b.2.	Amount	20%
b.3.	Maturity and Repayment Type	20%
b.4.	Primary Source of Repayment	20%
b.5.	Secondary Source of Repayment	20%

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Figure 22. Individual weights screen

CHAPTER 7

CONCLUSION

Showing the differences between the judgments of the personnel in the Corporate Marketing Department and the Credit Evaluations Department of a bank in Turkey in credit evaluations and risk rating process is the main aim of the thesis study. To reach this aim a descriptive and structured methodology called Analytic Hierarchy Process (AHP) was used.

The first difference that is recognized through the process is related to the importance of collateral. While the hierarchical structure is designed at the beginning of the study, it is found that collateral is perceived as a first-level criterion in the process by the personnel in the Corporate Marketing department of the bank. On the other hand, collateral is only a part of the loan structure and should not be taken as a first level criterion, according to the personnel in the Credit Evaluations department. The difference recognized in the first stage is actually a well-known phenomenon in the banking environment.

In order to show other differences, departmental weights, which are calculated and validated by using AHP, are compared with each other. While examining the differences between the judgments of the two departments, one can see that these departments evaluate the criteria defining commercial operations of a firm with different points of view. In the evaluation process, personnel in the

Corporate Marketing department give more importance to managers and shareholders. However, the most important criterion for Credit Evaluations department is the sector of the company. Actually, the reason lying under this difference can be explained by the different working styles of these two departments. As part of their marketing activities, personnel in the Corporate Marketing department have to be in close relationship with the managers of companies. On the other hand, personnel in the Credit Evaluations department do not have any direct contact with the people in companies and they also have a more general point of view in the evaluation process. Since they analyze many companies within a sector, it can be claimed that a sector-based approach shapes their judgments.

Another important conclusion that is drawn from this study is that Tangible Net Worth (TNW) is the main criteria in the bank that shapes the loan extension decisions. However, the perceived importance of this criterion is totally different between the two departments. As indicated in chapter 5, for the Corporate Marketing department TNW is so important that it gets a weight of 48 percent. Although this criterion is also the most important one for the Credit Evaluations department, it is obvious that the Credit Evaluations department has a more balanced point of view while evaluating financial operations of companies. As future work, another study can be made to understand the reasons lying behind the perceptions of the personnel in Corporate Marketing and the difference between these two departments related to the importance of TNW criteria.

By relaxing some of the simplifying assumptions mentioned in chapter 5, this study can be enhanced for future works. For instance, this study can also be made for companies operating in other sectors to see whether there are critical differences in the hierarchical structure and in the departmental weights assigned to the criteria.

As future work, the Decision Support System environment can also be enhanced with more features. For instance, a company database in which previously evaluated companies' evaluation results are held, can be integrated to the current system. Authorization mechanisms such as username and password can be added.

In general, this study provided the decision makers in the bank a guide to identify the main evaluation criteria, to transform the brief and broadly worded written definitions of ratings and risk factors into more objective numerical values, to find the weights of evaluation criteria, and to identify the unwritten credit culture with a systematic procedure.

APPENDIX A

CREDIT APPLICATION FORMAT

CREDIT APPLICATION

RELATIONSHIP NAME: Name of the customer

PURPOSE

A brief background to the requirement.

GRADE:

Present *Proposed*

ER

CR

AMOUNT AND STRUCTURE OF EXPOSURE

<u>Line</u>	<u>Facility</u>	<u>Term</u>	<u>Security</u>
1	PRODUCT 1	... days	S1
2	PRODUCT 2	... days	S1
3	PRODUCT 3	... days	S1
	Total		

SECURITY STRUCTURE

S1: Security details

REPAYMENT:

CORE BUSINESS OF RELATIONSHIP

MARKET CAPITALISATION USD ...m (as at .././...)

Current Share Price: USD ...

SHAREHOLDERS XYZ as ..%; WQR as ..%; publicly quoted ..%

COMPANY BACKGROUND / OPERATING ANALYSIS

- Short information on company's business, markets in which it operates, specific licenses, rights or agreements, ongoing / planned investment and current operations, short information on trade cycle etc.
- Material changes in management, company, markets or industry.
- Provide import / export figures for last three years.

Buyer Concentration: Yes or No (If yes, give brief details.)
(Buyer concentration exists if there is limited number of buyers from the company.)

Seller Concentration: Yes or No (If yes, give brief details.)

(Seller concentration exists if a limited number of suppliers sell raw materials to company.)

COMPETITOR ANALYSIS

Mention top 3 in the market, and provide a very short comparative analysis.

FINANCIAL ANALYSIS - Customer A financial tables as at 31st December 2007

CUSTOMER A	Dec 31, 2005	Dec 31, 2006	Dec 31, 2007
<i>USD thousands</i>	Audit-No	Audit-No	Audit-No
Turnover	327,523	278,723	194,094
Gross Profit	74,297	61,152	52,204
Net Operating Profit	32,973	11,365	-2,200
Net Profit after Tax	29,344	12,938	-1,763
Tangible Net Worth	69,192	58,480	57,960
External Gearing	0.47	0.82	1.22
Total Gearing (Leverage)	0.63	0.94	1.67
Current Ratio	2.22	1.91	1.04
Interest Cash Cover	-2.55	5.24	5.83
Net Free Cash Flow from Operations	-18,176	17,659	31,185

- Analysis done according to CA Table figures.
- Comment on debt structure and relationship with other banks.

Current Trading

Discuss most recent trading statement and if possible, comment regarding performance against plan.

RISK & MITIGANTS

Key risks facing the company and supporting, mitigating factors.

MANAGEMENT ANALYSIS

- Knowledge of management ability.
- Comment on successor issue, if applicable.

SUMMARY & RECOMMENDATION

Any conditions, customer or exposure rating changes.

APPENDIX B

EXCEL SURVEY AND FORM FORMATS

Criteria Weight Survey Format

Introduction

GENERAL INFORMATION ABOUT THE SURVEY

- This survey aims to identify your evaluations about the importance of basic customer risk rating criteria used to evaluate commercial customers with **unaudited** financial tables.
- When deciding on the basic customer risk rating criteria, **SAR Reports** are used as the primary source.
- In this survey it is assumed that, the companies that are evaluated are **not** part of sectors to which the bank has restricted or limited appetite and controlled or prohibited lending policies.
- The basic customer risk rating criteria are organized as a hierarchy, as you can see below:

- This survey has three parts:

PART 1 (Defining CRR): The importance of "Structure of the Firm", "Structure of the Loan", and "Evaluations of Credit Rating Institutions" in the process of "Defining Customer Risk Rating" are evaluated.

PART 2 (Structure of the Firm): The importance of "Financial Operations" and "Commercial Operations" in the process of evaluating "Structure of the Firm" are evaluated. The importance of "Profitability Ratios", "Tangible Net Worth (TNW)", "Financial Risk Ratios", "Liquidity Ratios", and "Cash Flow Figures" in the process of evaluating "Financial Operations" of the firm are evaluated. The importance of "Managers / Shareholders", "Relations with Market", and "Sector" in the process of evaluating "Commercial Operations" of the firm are evaluated.

PART 3 (Structure of the Loan): The importance of "Purpose", "Amount", "Maturity and Repayment Type", "Primary Source of Repayment", and "Secondary Source of Repayment" in the process of evaluating "Structure of the Loan" are evaluated.
- All the evaluations throughout the survey are performed as pairwise comparisons.

Continue

Defining Customer Risk Rating

DEFINING CUSTOMER RISK RATING

PART 1:
In the process of defining the risk rating of a commercial customer, three main criteria are evaluated:

1. Structure of the Firm
2. Structure of the Loan
3. Evaluations of Credit Rating Institutions

In this part of the survey, our aim is to understand the importance of the three criteria from your point of view.
Reminder: In your evaluations, please remember that, only customers with **unaudited** financial tables will be evaluated in this survey.

Please compare the importance of 3 main criteria listed below, in terms of **defining (corporate) customer risk rating**

Weights:

1. Structure of the Firm	66%
2. Structure of the Loan	16%
3. Evaluations of Credit Rating Institutions	19%

Your evaluations are consistent.

1. Structure of the Firm is Strongly more important Structure of the Loan

2. Structure of the Firm is Moderately more important Evaluations of Credit Rating Inst.

3. Structure of the Loan is Equally important as Evaluations of Credit Rating Inst.

Structure of the Firm

DEFINING CUSTOMER RISK RATING

PART 2:
In this part of the survey, our aim is to understand the importance of the criteria shown on the right, in the process of evaluating structure of a firm with **unaudited** financial tables.

Please compare the importance of the 2 criteria listed below, in the process of evaluating **the structure of the firm**.
When there are only 2 criteria to compare, it is enough to assign 2 ratios to the criteria in such a way that, sum of the ratios should be equal to 100%.

1. Financial Operations of the Firm	<input type="text" value="60,00%"/>	← Please fill this cell.
2. Commercial Operations of the Firm	<input type="text" value="40,00%"/>	
TOTAL:	<input type="text" value="100,00%"/>	

Please compare the importance of 5 criteria listed below, in the evaluation of **financial operations of a firm with unaudited financial tables**.

Weights:

1. Profitability	15%
2. TNV	28%
3. Financial Risk	22%
4. Liquidity	19%
5. Cash Flow	16%

Your evaluations are consistent.

When deciding on the criteria in this part, **SAR Table** is used as the primary source and the ratios and figures in SAR Table are grouped as follows:

Str. of the Firm is Moderately more important than Profitability

Structure of the Firm

File Edit View Insert Format Tools Data Window Help

A B C D E F G H I J K L M N O P Q R

31 Please compare the **importance** of 5 criteria listed below, in the evaluation of **financial operations of a firm**

32 **with unaudited financial tables.**

33

Weights:

34 1. Profitability 15%

35 2. TNW 28%

36 3. Financial Risk 22%

37 4. Liquidity 19%

38 5. Cash Flow 16%

39 **Your evaluations are consistent.**

40

41 1. TNW is Moderately more important than Profitability

42

43 2. Profitability is Equally important as Financial Risk

44

45 3. Profitability is Equally important as Liquidity

46

47 4. Profitability is Equally important as Cash Flow

48

49

50

51

52 5. TNW is Equally to moderately more important than Financial Risk

53

54

55 6. TNW is Equally important as Liquidity

56

57

58 7. TNW is Equally important as Cash Flow

59

60

61

62 8. Financial Risk is Equally important as Liquidity

63

64

65 9. Financial Risk is Moderately more important than Cash Flow

66

67

68 10. Liquidity is Equally important as Cash Flow

69

70

71

When deciding on the criteria in this part, **SAR Table** is used as the primary source and the ratios and figures in SAR Table are grouped as follows:

Profitability:

- Turnover
- Gross Profit
- Net Operating Profit
- Net Operating Profit After Tax

TNW:

- Tangible Net Worth

Financial Risk:

- External Gearing
- Total Gearing

Liquidity:

- Current Ratio

Cash Flow:

- Interest Cash Coverage
- Overall Cash Coverage

Show Weights Clear

Str. of The Firm /

File Edit View Insert Format Tools Data Window Help

A B C D E F G H I J K L M N O P Q R

67

68 10. Liquidity is Equally important as Cash Flow

69

70

71

Show Weights Clear

72

73 Please compare the **importance** of 3 criteria listed below, in the evaluation of **commercial operations of the firm.**

74

Weights:

75 1. Managers / Shareholders 43%

76 2. Relations with Market 43%

77 3. Sector 14%

78 **Your evaluations are consistent.**

79

80

81 1. Relations with Market is Equally important as Managers / Shareholders

82

83

84 2. Managers / Shareholders is Moderately more important than Sector

85

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88 3. Relations with Market is Moderately more important than Sector

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Values evaluated under the three criteria are as follows:

Managers / Shareholders:

- Ownership Structure
- Shareholders' Property Holdings / Business Experience / Reliability
- Managers' Education / Business Experience / Reliability

Relations with Market:

- Number of Suppliers, Customers, Competitors
- Trade Debtors' Collection Period
- Stock Turnover Period
- Trade Creditors' Payment Period

Sector:

- Growth Potential
- Financial Indicators
- Profitability
- Level of Competition

Show Weights Clear

Back to Introduction Previous Next

Str. of The Firm /

Structure of the Loan

DEFINING CUSTOMER FIRM RATING

STRUCTURE OF THE FIRM

- FINANCIAL OPERATIONS
 - PROFITABILITY
 - FINANCIAL SIZE
 - CASH FLOW
- COMMERCIAL OPERATIONS
 - IFW
 - LIQUIDITY
- MANAGERS/SHAREHOLDERS
- RELATIONS WITH MARKET
- SIC CODE

STRUCTURE OF THE LOAN

- PURPOSE
- AMOUNT
- MATURITY & REPAYMENT TYPE
- PRIMARY SOURCE OF REPAYMENT
- SECONDARY SOURCE OF REPAYMENT

EVALUATION OF CREDIT RATING INSTITUTION

PART 3:
In the last part of our survey, we aim to understand the importance of the five main criteria, listed on the right, in the process of evaluating the structure of the loan.

Please compare the importance of 5 main criteria listed below, in the process of evaluating the structure of the loan.

Criteria	User Weightings
1. Purpose	11%
2. Amount	11%
3. Maturity and Repayment Type	25%
4. Primary Source of Repayment	33%
5. Secondary Source of Repayment	20%

Your evaluations are consistent.

- Purpose is Equally to moderately more important than Amount
- Maturity and Repayment Type is Moderately more important than Purpose
- Primary Source of Repayment is Moderately to Strongly more important than Purpose
- Secondary Source of Repayment is Moderately more important than Purpose
- Maturity and Repayment Type is Equally to moderately more important than Amount

4. Primary Source of Repayment	33%
5. Secondary Source of Repayment	20%

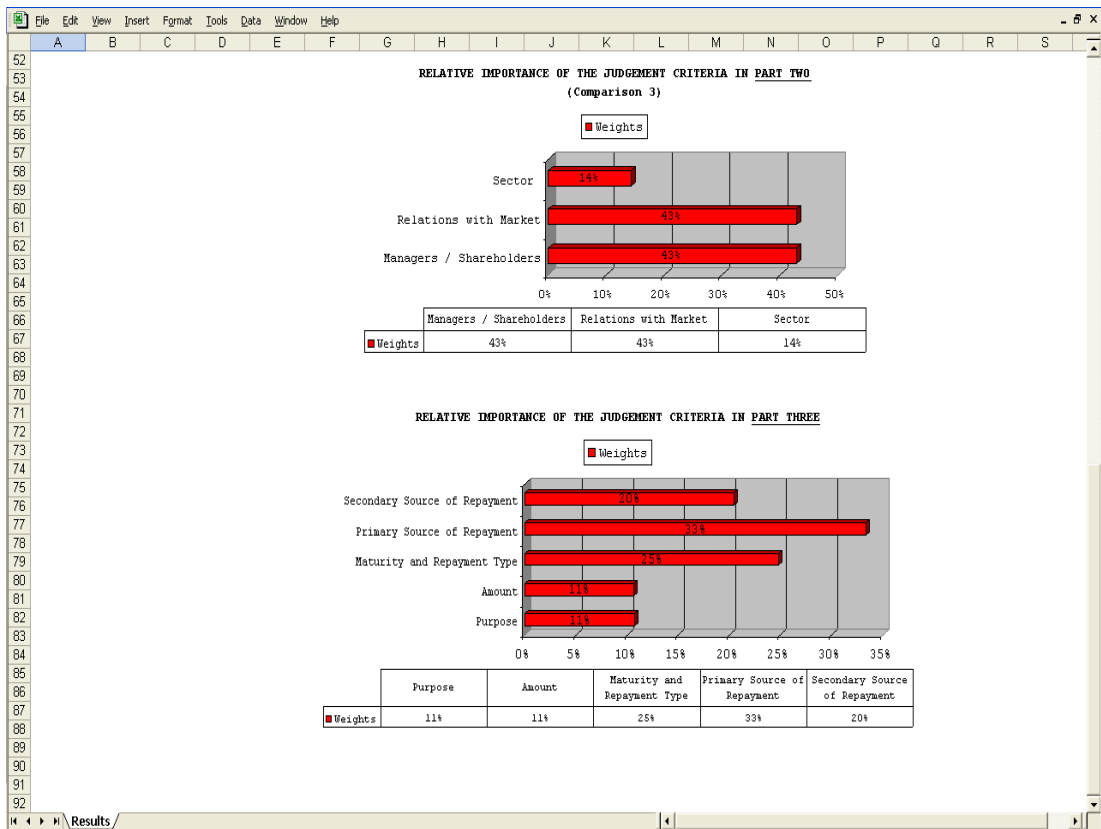
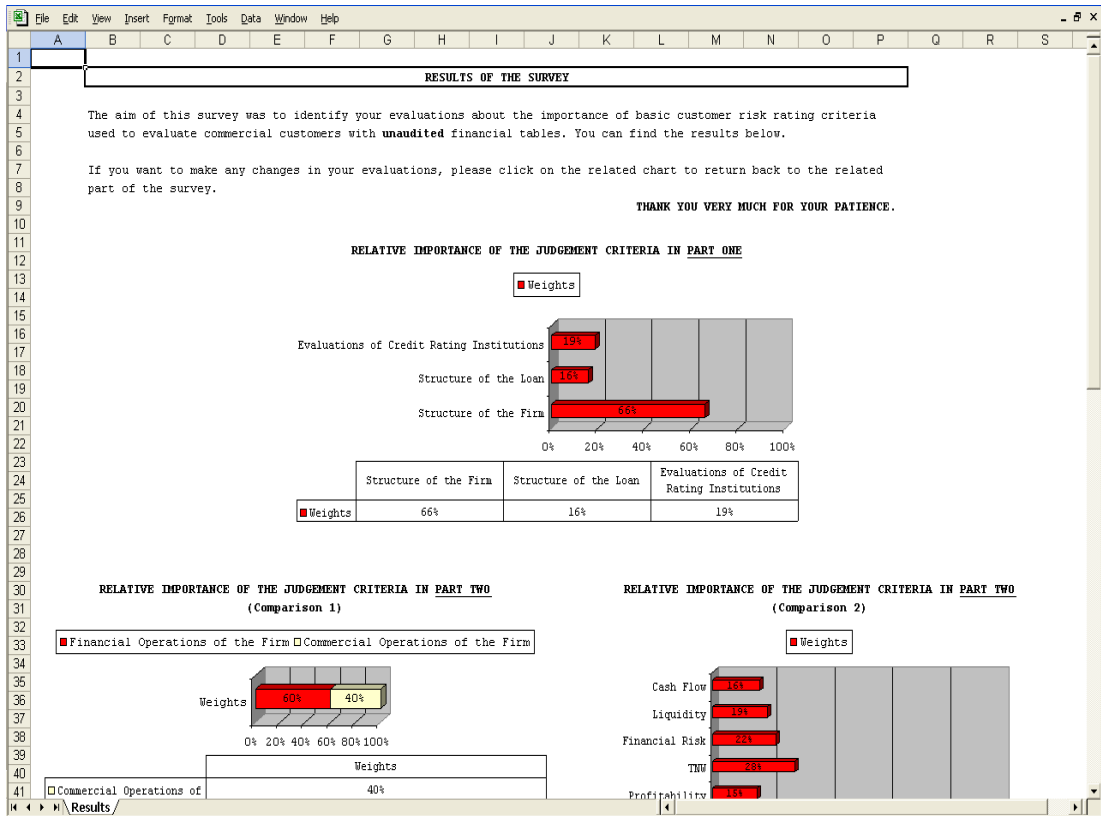
Your evaluations are consistent.

- Purpose is Equally to moderately more important than Amount
- Maturity and Repayment Type is Moderately more important than Purpose
- Primary Source of Repayment is Moderately to Strongly more important than Purpose
- Secondary Source of Repayment is Moderately more important than Purpose
- Maturity and Repayment Type is Equally to moderately more important than Amount
- Primary Source of Repayment is Equally to moderately more important than Amount
- Secondary Source of Repayment is Equally to moderately more important than Amount
- Maturity and Repayment Type is Equally important as Primary Source of Repayment
- Maturity and Repayment Type is Equally important as Secondary Source of Repayment
- Primary Source of Repayment is Moderately more important than Secondary Source of Repayment

Show Weights Clear

Back to Introduction Previous End

Results



Customer Evaluation Form Format

FINANCIAL OPERATIONS

If the company do not have any financial tables, please check the box below.

Do not have financial tables

Profitability N/A Very Bad Bad Not Good / Not Bad Good Very Good

Tangible Net Worth N/A Very Bad Bad Not Good / Not Bad Good Very Good

Financial Risk N/A Very Bad Bad Not Good / Not Bad Good Very Good

Liquidity N/A Very Bad Bad Not Good / Not Bad Good Very Good

Cash Flow N/A Very Bad Bad Not Good / Not Bad Good Very Good

COMMERCIAL OPERATIONS

Managers / Shareholders N/A Very Bad Bad Not Good / Not Bad Good Very Good

Relations with Market N/A Very Bad Bad Not Good / Not Bad Good Very Good

Sector N/A Very Bad Bad Not Good / Not Bad Good Very Good

STRUCTURE OF THE LOAN

Purpose: Absolutely Proper Proper Not Proper Absolutely Not Proper

Amount: Absolutely Proper Proper Not Proper Absolutely Not Proper

Maturity and Repayment Type: Absolutely Proper Proper Not Proper Absolutely Not Proper

Primary Source of Repayment: Absolutely Proper Proper Not Proper Absolutely Not Proper

Secondary Source of Repayment (SSR) Absolutely Proper Proper Not Proper Absolutely Not Proper

EVALUATIONS OF CREDIT RATING INSTITUTIONS

Agency Rating: N/A Very Bad Bad Not Good / Not Bad Good Very Good

Intensity Scale Survey Format

CUSTOMER EVALUATION FORM:

	Very Good	Good	Not Good	Bad	Very Bad
Very Good	1.00	3.00	5.00	7.00	8.00
Good	0.33	1.00	3.00	5.00	6.00
Not Good			1.00	3.00	4.00
Bad	0.14	0.20	0.33	1.00	2.00
Very Bad	0.13	0.17	0.25	0.50	1.00

Consistency: **Ok!**

	Abs. Proper	Proper	Not Proper	Abs. Not Proper
Abs. Proper	1.00	2.00	4.00	5.00
Proper	0.50	1.00	4.00	5.00
Not Proper			1.00	2.00
Abs. Not Proper	0.20	0.20	0.50	1.00

Consistency: **Ok!**

ER - CR SCALE:

	ER1	ER2	ER3	ER4	ER5	ER6	ER7
ER1	1.00	2.00	3.00	4.00	5.00	6.00	7.00
ER2	0.50	1.00	3.00	4.00	5.00	6.00	7.00
ER3	0.33	0.33	1.00	2.00	4.00	5.00	6.00
ER4	0.25	0.25	0.50	1.00	4.00	5.00	6.00
ER5	0.20	0.20	0.25	0.25	1.00	2.00	3.00
ER6	0.17	0.17	0.20	0.20	0.50	1.00	2.00
ER7	0.14	0.14	0.17	0.17	0.33	0.50	1.00

Consistency: **Ok!**

	CR1	CR2	CR3	CR4	CR5	CR6	CR7	CR8	CR9	CR10
CR1	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00	9.00
CR2	0.50	1.00	2.00	4.00	5.00	6.00	7.00	8.00	9.00	9.00
CR3	0.33	0.50	1.00	2.00	3.00	4.00	5.00	6.00	7.00	7.00
CR4	0.25	0.25	0.50	1.00	2.00	3.00	4.00	5.00	6.00	6.00
CR5	0.20	0.20	0.33	0.50	1.00	3.00	4.00	5.00	6.00	6.00
CR6	0.17	0.17	0.25	0.33	0.33	1.00	2.00	3.00	4.00	4.00
CR7	0.14	0.14	0.20	0.25	0.25	0.50	1.00	2.00	3.00	3.00
CR8	0.13	0.13	0.17	0.20	0.20	0.33	0.50	1.00	2.00	2.00
CR9	0.11	0.11	0.14	0.17	0.17	0.25	0.33	0.50	1.00	1.00
CR10	0.11	0.11	0.14	0.17	0.17	0.25	0.33	0.50	1.00	1.00

Consistency: **Ok!**

APPENDIX C

CRITERIA WEIGHT SURVEY RESULTS

Credit Evaluations Department

Respondent 1:

Comparison Matrix 1:

	Structure of the Firm	Structure of the Loan	Evaluations of Credit Rating Institutions	Weights
Structure of the Firm	1,00	5,00	3,00	0,66
Structure of the Loan	0,20	1,00	1,00	0,16
Evaluations of Credit Rating Institutions	0,33	1,00	1,00	0,19

lambda max:	3,03
-------------	------

Consistency Ratio:	0,03
--------------------	------

Comparison Matrix 2:

	Profitability	TNW	Financial Risk	Liquidity	Cash Flow	Weights
Profitability	1	0,33	1	1	1	0,15
TNW	3	1	2	1	1	0,28
Financial Risk	1	0,5	1	1	3	0,22
Liquidity	1	1	1	1	1	0,19
Cash Flow	1	1	0,33	1	1	0,16

lambda max:	5,36
-------------	------

Consistency Ratio:	0,08
--------------------	------

Comparison Matrix 3:

	Managers / Shareholders	Relations with Market	Sector in which the company is operating	Weights
Managers / Shareholders	1	1	3	0,43
Relations with Market	1	1	3	0,43
Sector in which the company is operating	0,33	0,33	1	0,14

lambda max:	3,00
-------------	------

Consistency Ratio:	0,00
--------------------	------

Comparison Matrix 4:

	Purpose	Amount	Maturity and Repayment Type	Primary Source of Repayment	Secondary Source of Repayment	Weights
Purpose	1	2	0,33	0,25	0,33	0,11
Amount	0,5	1	0,5	0,5	0,5	0,11
Maturity and Repayment Type						
Primary Source of Repayment	3	2	1	1	1	0,25
Secondary Source of Repayment	4	2	1	1	3	0,33
Secondary Source of Repayment	3	2	1	0,33	1	0,20

lambda max:	5,31
-------------	------

Consistency Ratio:	0,07
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Comparison Matrix 5:

Financial Operations	60%
Commercial Operations	40%

Corporate Marketing Department

Respondent 1:

Comparison Matrix 1:

	Structure of the Firm	Structure of the Loan	Evaluations of Credit Rating Institutions	Weights
Structure of the Firm	1	5	8	0,74
Structure of the Loan	0,2	1	3	0,19
Evaluations of Credit Rating Institutions	0,13	0,33	1	0,08

lambda max:	3,04
-------------	------

Consistency Ratio:	0,04
--------------------	------

Comparison Matrix 2:

	Profitability	TNW	Financial Risk	Liquidity	Cash Flow	Weights
Profitability	1	0,11	0,2	0,25	3	0,06
TNW	9	1	5	9	9	0,60
Financial Risk	5	0,2	1	2	5	0,19
Liquidity	4	0,11	0,5	1	3	0,11
Cash Flow	0,33	0,11	0,2	0,33	1	0,04

lambda max:	5,44
-------------	------

Consistency Ratio:	0,10
--------------------	------

Comparison Matrix 3:

	Managers / Shareholders	Relations with Market	Sector in which the company is operating	Weights
Managers / Shareholders	1	2	0,33	0,22
Relations with Market	0,5	1	0,17	0,11
Sector in which the company is operating	3	6	1	0,67

lambda max:	3,00
-------------	------

Consistency Ratio:	0,00
--------------------	------

Comparison Matrix 4:

	Purpose	Amount	Maturity and Repayment Type	Primary Source of Repayment	Secondary Source of Repayment	Weights
Purpose	1	0,33	0,13	0,14	3	0,07
Amount	3	1	0,2	0,33	5	0,14
Maturity and Repayment Type	8	5	1	3	6	0,49
Primary Source of Repayment	7	3	0,33	1	5	0,26
Secondary Source of Repayment	0,33	0,2	0,17	0,2	1	0,04

lambda max:	5,44
-------------	------

Consistency Ratio:	0,10
--------------------	------

Comparison Matrix 5:

Financial Operations	85%
Commercial Operations	15%

Credit Evaluations Department-Aggregate Results

Comparison Matrix 1:

	Structure of the Firm	Structure of the Loan	Evaluations of Credit Rating Institutions	Weights
Structure of the Firm	1,00	3,69	2,14	0,57
Structure of the Loan	0,27	1,00	0,57	0,15
Evaluations of Credit Rating Institutions	0,47	1,76	1,00	0,27

lambda max:	3,00		Consistency Ratio:	0,00
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Comparison Matrix 2:

	Profitability	TNW	Financial Risk	Liquidity	Cash Flow	Weights
Profitability	1,00	0,31	0,57	0,62	0,49	0,11
TNW	3,20	1,00	2,09	0,92	1,00	0,27
Financial Risk	1,76	0,48	1,00	0,73	0,77	0,16
Liquidity	1,62	1,08	1,36	1,00	0,93	0,22
Cash Flow	2,04	1,00	1,29	1,07	1,00	0,23

lambda max:	5,06		Consistency Ratio:	0,02
-------------	------	--	--------------------	------

Comparison Matrix 3:

	Managers / Shareholders	Relations with Market	Sector in which the company is operating	Weights
Managers / Shareholders	1,00	1,18	0,64	0,29
Relations with Market	0,85	1,00	0,48	0,24
Sector in which the company is operating	1,56	2,08	1,00	0,47

lambda max:	3,00		Consistency Ratio:	0,00
-------------	------	--	--------------------	------

Comparison Matrix 4:

	Purpose	Amount	Maturity and Repayment Type	Primary Source of Repayment	Secondary Source of Repayment	Weights
Purpose	1,00	1,98	1,65	0,97	1,92	0,27
Amount	0,51	1,00	1,18	0,74	1,40	0,17
Maturity and Repayment Type	0,61	0,85	1,00	0,52	0,89	0,14
Primary Source of Repayment	1,03	1,35	1,91	1,00	3,17	0,29
Secondary Source of Repayment	0,52	0,71	1,12	0,32	1,00	0,13

lambda max:	5,06
----------------	------

Consistency Ratio:	0,02
-----------------------	------

Comparison Matrix 5:

Financial Operations	54%
Commercial Operations	46%

Corporate Marketing Department-Aggregate Results

Comparison Matrix 1:

	Structure of the Firm	Structure of the Loan	Evaluations of Credit Rating Institutions	Weights
Structure of the Firm	1,00	3,24	3,85	0,63
Structure of the Loan	0,31	1,00	1,69	0,22
Evaluations of Credit Rating Institutions	0,26	0,59	1,00	0,15

lambda max: 3,01

Consistency Ratio: 0,01

Comparison Matrix 2:

	Profitability	TNW	Financial Risk	Liquidity	Cash Flow	Weights
Profitability	1,00	0,32	0,77	0,76	1,13	0,12
TNW	3,12	1,00	3,47	4,38	3,82	0,48
Financial Risk	1,30	0,29	1,00	1,35	1,52	0,16
Liquidity	1,32	0,23	0,74	1,00	1,15	0,13
Cash Flow	0,88	0,26	0,66	0,87	1,00	0,11

lambda max: 5,04

Consistency Ratio: 0,01

Comparison Matrix 3:

	Managers / Shareholders	Relations with Market	Sector in which the company is operating	Weights
Managers / Shareholders	1,00	2,29	1,59	0,48
Relations with Market	0,44	1,00	0,57	0,20
Sector in which the company is operating	0,63	1,76	1,00	0,32

lambda max: 3,00

Consistency Ratio: 0,00

Comparison Matrix 4:

	Purpose	Amount	Maturity and Repayment Type	Primary Source of Repayment	Secondary Source of Repayment	Weights
Purpose	1,00	0,86	0,55	0,40	0,66	0,12
Amount	1,16	1,00	0,57	0,34	0,60	0,12
Maturity and Repayment Type	1,81	1,76	1,00	0,63	1,01	0,21
Primary Source of Repayment	2,53	2,93	1,59	1,00	1,94	0,35
Secondary Source of Repayment	1,52	1,68	0,99	0,52	1,00	0,20

lambda max:	5,01
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Consistency Ratio:	0,00
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Comparison Matrix 5:

Financial Operations	56%
Commercial Operations	44%

Overall Bank Results

Comparison Matrix 1:

	Structure of the Firm	Structure of the Loan	Evaluations of Credit Rating Institutions	Weights
Structure of the Firm	1,00	3,42	2,99	0,62
Structure of the Loan	0,29	1,00	1,06	0,19
Evaluations of Credit Rating Institutions	0,33	0,94	1,00	0,19

lambda max: 3,00

Consistency Ratio: 0,00

Comparison Matrix 2:

	Profitability	TNW	Financial Risk	Liquidity	Cash Flow	Weights
Profitability	1,00	0,32	0,67	0,70	0,79	0,12
TNW	3,16	1,00	2,79	2,25	2,15	0,39
Financial Risk	1,48	0,36	1,00	1,04	1,14	0,17
Liquidity	1,44	0,44	0,96	1,00	1,05	0,17
Cash Flow	1,27	0,46	0,88	0,95	1,00	0,16

lambda max: 5,01

Consistency Ratio: 0,00

Comparison Matrix 3:

	Managers / Shareholders	Relations with Market	Sector in which the company is operating	Weights
Managers / Shareholders	1,00	1,72	1,08	0,40
Relations with Market	0,58	1,00	0,53	0,22
Sector in which the company is operating	0,93	1,89	1,00	0,39

lambda max: 3,00

Consistency Ratio: 0,00

Comparison Matrix 4:

	Purpose	Amount	Maturity and Repayment Type	Primary Source of Repayment	Secondary Source of Repayment	Weights
Purpose	1,00	1,23	0,88	0,58	1,04	0,18
Amount	0,81	1,00	0,78	0,48	0,86	0,15
Maturity and Repayment Type	1,13	1,29	1,00	0,58	0,96	0,18
Primary Source of Repayment	1,72	2,10	1,72	1,00	2,39	0,33
Secondary Source of Repayment	0,96	1,16	1,05	0,42	1,00	0,17

lambda max:	5,02
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Consistency Ratio:	0,00
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Comparison Matrix 5:

Financial Operations	55%
Commercial Operations	45%

APPENDIX D

GENERAL INFORMATION ABOUT COMPANIES

1. Name of the Company : Company A
Incorporation Year : 1980
Area of Operation : Automobile production
2006 Year-end Turnover : USD 286 mio.
2. Name of the Company : Company B
Incorporation Year : 1953
Area of Operation : Agricultural machinery production
2006 Year-end Turnover : USD 443 mio.
3. Name of the Company : Company C
Incorporation Year : 1968
Area of Operation : Automobile production
2006 Year-end Turnover : USD 600 mio.
4. Name of the Company : Company D
Incorporation Year : 1960
Area of Operation : Automobile distribution
2006 Year-end Turnover : USD 280 mio.
5. Name of the Company : Company E
Incorporation Year : 1998
Area of Operation : Automobile distribution
2006 Year-end Turnover : USD 35 mio.
6. Name of the Company : Company F
Incorporation Year : 1989
Area of Operation : Automobile distribution
2006 Year-end Turnover : USD 110 mio.

APPENDIX E

JUDGMENTS OF EVALUATION AND CONTROL GROUPS

Judgments of Evaluation Group

	COMPANY A		COMPANY B		COMPANY C	
	Corporate Marketing	Credit Evaluations	Corporate Marketing	Credit Evaluations	Corporate Marketing	Credit Evaluations
Financial Operations:						
<i>Profitability:</i>	Good	Good	Good	NG / NB	Very Good	Good
<i>TNW:</i>	Very Good	Good	NG / NB	Bad	Good	Good
<i>Financial Risk:</i>	Good	Good	Bad	Very Bad	Good	Good
<i>Liquidity:</i>	Good	Good	Bad	Bad	Good	Good
<i>Cash Flow:</i>	Good	Good	Bad	Very Bad	Good	Good
Commercial Operations:						
<i>Managers / Shareholders:</i>	Very Good	Very Good	Very Bad	Very Bad	Very Good	Very Good
<i>Relations with Market:</i>	Good	Good	NG / NB	Bad	Good	Good
<i>Sector:</i>	NG / NB	Bad	NG / NB	Bad	NG / NB	NG / NB
Structure of the Loan:						
<i>Purpose:</i>	Abs. Proper	Abs. Proper	Proper	Proper	Abs. Proper	Proper
<i>Amount:</i>	Proper	Proper	Proper	Not Proper	Abs. Proper	Proper
<i>Maturity and Repayment Type:</i>	Abs. Proper	Abs. Proper	Proper	Proper	Abs. Proper	Proper
<i>Primary Source of Repayment:</i>	Proper	Proper	Proper	Proper	Abs. Proper	Proper
<i>Secondary Source of Repayment:</i>	Proper	Proper	Proper	Proper	Proper	Not Proper
Evaluations of Credit Rating Inst:	N/A	N/A	N/A	N/A	N/A	N/A

	COMPANY D		COMPANY E		COMPANY F	
	Corporate Marketing	Credit Evaluations	Corporate Marketing	Credit Evaluations	Corporate Marketing	Credit Evaluations
Financial Operations:						
<i>Profitability:</i>	Good	NG / NB	Good	Good	Good	Good
<i>TNW:</i>	Good	Good	Good	Good	Good	Good
<i>Financial Risk:</i>	NG / NB	NG / NB	NG / NB	Bad	NG / NB	Bad
<i>Liquidity:</i>	NG / NB	Good	Good	Good	NG / NB	Bad
<i>Cash Flow:</i>	NG / NB	Good	NG / NB	NG / NB	NG / NB	NG / NB
Commercial Operations:						
<i>Managers / Shareholders:</i>	Good	Good	Good	Good	Good	Very Good
<i>Relations with Market:</i>	Good	Good	NG / NB	Good	Good	Good
<i>Sector:</i>	NG / NB	NG / NB	NG / NB	Bad	NG / NB	NG / NB
Structure of the Loan:						
<i>Purpose:</i>	Proper	Proper	Proper	Proper	Proper	Proper
<i>Amount:</i>	Proper	Proper	Proper	Proper	Proper	Not Proper
<i>Maturity and Repayment Type:</i>	Proper	Proper	Proper	Proper	Proper	Proper
<i>Primary Source of Repayment:</i>	Proper	Proper	Proper	Proper	Proper	Proper
<i>Secondary Source of Repayment:</i>	Proper	Not Proper	Proper	Proper	Proper	Proper
Evaluations of Credit Rating Inst:						
Evaluations of Credit Rating Inst:	N/A	N/A	N/A	N/A	N/A	N/A

Judgments of Control Group

	COMPANY D-Control		COMPANY C-Control	
	Corporate Marketing	Credit Evaluations	Corporate Marketing	Credit Evaluations
Financial Operations:				
<i>Profitability:</i>	Good	Good	Good	Very Good
<i>TNW:</i>	Good	Good	Very Good	Good
<i>Financial Risk:</i>	NG / NB	Bad	Good	Good
<i>Liquidity:</i>	NG / NB	Good	Good	Good
<i>Cash Flow:</i>	Good	Good	Good	Good
Commercial Operations:				
<i>Managers / Shareholders:</i>	Good	Good	Good	Good
<i>Relations with Market:</i>	NG / NB	NG / NB	Good	Good
<i>Sector:</i>	NG / NB	NG / NB	NG / NB	Bad
Structure of the Loan:				
<i>Purpose:</i>	Proper	Proper	Abs. Proper	Abs. Proper
<i>Amount:</i>	Abs. Proper	Abs. Proper	Proper	Abs. Proper
<i>Maturity and Repayment Type:</i>	Proper	Abs. Proper	Abs. Proper	Proper
<i>Primary Source of Repayment:</i>	Proper	Abs. Proper	Abs. Proper	Abs. Proper
<i>Secondary Source of Repayment:</i>	Proper	Not Proper	Proper	Not Proper
Evaluations of Credit Rating Inst:				
Evaluations of Credit Rating Inst:	N/A	N/A	N/A	N/A

APPENDIX F

INTENSITY SCALE SURVEY RESULTS

Credit Evaluations Department

Respondent 1:

Comparison Matrix 1:

	Very Good	Good	Not Good - Not Bad	Bad	Very Bad	Priority Vectors
Very Good	1,00	2,00	5,00	7,00	9,00	0,44
Good	0,50	1,00	5,00	7,00	9,00	0,34
Not Good - Not Bad	0,20	0,20	1,00	4,00	6,00	0,14
Bad	0,14	0,14	0,25	1,00	2,00	0,05
Very Bad	0,11	0,11	0,17	0,50	1,00	0,03

lambda max 1:	5,30	consistency ratio 1:	0,07
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Comparison Matrix 2:

	Abs. Proper	Proper	Not Proper	Abs. Not Proper	Priority Vectors
Abs. Proper	1,00	3,00	7,00	9,00	0,57
Proper	0,33	1,00	5,00	7,00	0,29
Not Proper	0,14	0,20	1,00	3,00	0,09
Abs. Not Proper	0,11	0,14	0,33	1,00	0,04

lambda max 2:	4,17	consistency ratio 2:	0,06
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Comparison Matrix 3:

	ER1	ER2	ER3	ER4	ER5	ER6	ER7	Priority Vectors
ER1	1,00	2,00	4,00	5,00	6,00	7,00	8,00	0,36
ER2	0,50	1,00	3,00	4,00	5,00	6,00	7,00	0,25
ER3	0,25	0,33	1,00	4,00	5,00	6,00	7,00	0,18
ER4	0,20	0,25	0,25	1,00	2,00	3,00	5,00	0,09
ER5	0,17	0,20	0,20	0,50	1,00	2,00	4,00	0,06
ER6	0,14	0,17	0,17	0,33	0,50	1,00	2,00	0,04
ER7	0,13	0,14	0,14	0,20	0,25	0,50	1,00	0,03

lambda max 3:	7,50	consistency ratio 3:	0,06
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Comparison Matrix 4:

	CR1	CR2	CR3	CR4	CR5	CR6	CR7	CR8	CR9	CR10	Priority Vectors
CR1	1,00	1,00	3,00	4,00	5,00	6,00	7,00	8,00	9,00	9,00	0,25
CR2	1,00	1,00	2,00	4,00	5,00	6,00	7,00	8,00	9,00	9,00	0,24
CR3	0,33	0,50	1,00	3,00	4,00	5,00	6,00	7,00	8,00	8,00	0,17
CR4	0,25	0,25	0,33	1,00	3,00	4,00	5,00	6,00	7,00	7,00	0,11
CR5	0,20	0,20	0,25	0,33	1,00	3,00	3,00	4,00	6,00	6,00	0,08
CR6	0,17	0,17	0,20	0,25	0,33	1,00	2,00	3,00	5,00	5,00	0,05
CR7	0,14	0,14	0,17	0,20	0,33	0,50	1,00	2,00	4,00	4,00	0,04
CR8	0,13	0,13	0,14	0,17	0,25	0,33	0,50	1,00	2,00	2,00	0,02
CR9	0,11	0,11	0,13	0,14	0,17	0,20	0,25	0,50	1,00	1,00	0,02
CR10	0,11	0,11	0,13	0,14	0,17	0,20	0,25	0,50	1,00	1,00	0,02

lambda max 4:	10,81	consistency ratio 4:	0,06
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Corporate Marketing Department

Respondent 1:

Comparison Matrix 1:

	Very Good	Good	Not Good - Not Bad	Bad	Very Bad	Priority Vectors
Very Good	1,00	3,00	5,00	7,00	8,00	0,50
Good	0,33	1,00	3,00	5,00	6,00	0,26
Not Good - Not Bad	0,20	0,33	1,00	3,00	4,00	0,13
Bad	0,14	0,20	0,33	1,00	2,00	0,06
Very Bad	0,13	0,17	0,25	0,50	1,00	0,04

lambda max 1:	5,19	consistency ratio 1:	0,04
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Comparison Matrix 2:

	Abs. Proper	Proper	Not Proper	Abs. Not Proper	Priority Vectors
Abs. Proper	1,00	2,00	4,00	5,00	0,47
Proper	0,50	1,00	4,00	5,00	0,34
Not Proper	0,25	0,25	1,00	2,00	0,11
Abs. Not Proper	0,20	0,20	0,50	1,00	0,07

lambda max 2:	4,09	consistency ratio 2:	0,03
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Comparison Matrix 3:

	ER1	ER2	ER3	ER4	ER5	ER6	ER7	Priority Vectors
ER1	1,00	2,00	3,00	4,00	5,00	6,00	7,00	0,33
ER2	0,50	1,00	3,00	4,00	5,00	6,00	7,00	0,27
ER3	0,33	0,33	1,00	2,00	4,00	5,00	6,00	0,16
ER4	0,25	0,25	0,50	1,00	4,00	5,00	6,00	0,13
ER5	0,20	0,20	0,25	0,25	1,00	2,00	3,00	0,06
ER6	0,17	0,17	0,20	0,20	0,50	1,00	2,00	0,04
ER7	0,14	0,14	0,17	0,17	0,33	0,50	1,00	0,03

lambda max 3:	7,47	consistency ratio 3:	0,06
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Comparison Matrix 4:

	CR1	CR2	CR3	CR4	CR5	CR6	CR7	CR8	CR9	CR10	Priority Vectors
CR1	1,00	2,00	3,00	4,00	5,00	6,00	7,00	8,00	9,00	9,00	0,28
CR2	0,50	1,00	2,00	4,00	5,00	6,00	7,00	8,00	9,00	9,00	0,23
CR3	0,33	0,50	1,00	2,00	3,00	4,00	5,00	6,00	7,00	7,00	0,15
CR4	0,25	0,25	0,50	1,00	2,00	3,00	4,00	5,00	6,00	6,00	0,10
CR5	0,20	0,20	0,33	0,50	1,00	3,00	4,00	5,00	6,00	6,00	0,09
CR6	0,17	0,17	0,25	0,33	0,33	1,00	2,00	3,00	4,00	4,00	0,05
CR7	0,14	0,14	0,20	0,25	0,25	0,50	1,00	2,00	3,00	3,00	0,04
CR8	0,13	0,13	0,17	0,20	0,20	0,33	0,50	1,00	2,00	2,00	0,03
CR9	0,11	0,11	0,14	0,17	0,17	0,25	0,33	0,50	1,00	1,00	0,02
CR10	0,11	0,11	0,14	0,17	0,17	0,25	0,33	0,50	1,00	1,00	0,02

lambda max 4:	10,61	consistency ratio 4:	0,05
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Aggregate Results

Comparison Matrix 1:

	Very Good	Good	Not Good - Not Bad	Bad	Very Bad	Priority Vector	Normalized Priority Vector
Very Good	1,00	2,52	4,36	6,05	7,45	0,46	1,00
Good	0,40	1,00	3,65	5,08	6,19	0,29	0,62
Not Good - Not Bad	0,23	0,27	1,00	2,90	4,52	0,14	0,30
Bad	0,17	0,20	0,34	1,00	2,67	0,07	0,15
Very Bad	0,13	0,16	0,22	0,37	1,00	0,04	0,09

lambda max 1:	5,26	consistency ratio 1:	0,06
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Comparison Matrix 2:

	Abs. Proper	Proper	Not Proper	Abs. Not Proper	Priority Vector	Normalized Priority Vector
Abs. Proper	1,00	2,63	5,80	7,53	0,54	1,00
Proper	0,38	1,00	4,77	6,32	0,31	0,57
Not Proper	0,17	0,21	1,00	2,52	0,10	0,18
Abs. Not Proper	0,13	0,16	0,40	1,00	0,05	0,10

lambda max 2:	4,13	consistency ratio 2:	0,05
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Comparison Matrix 3:

	ER1	ER2	ER3	ER4	ER5	ER6	ER7	Priority Vector	Normalized Priority Vector
ER1	1,00	1,64	3,54	4,69	6,08	7,23	8,24	0,35	1,00
ER2	0,61	1,00	2,95	4,09	5,27	6,53	7,54	0,27	0,78
ER3	0,28	0,34	1,00	2,34	3,93	5,37	6,38	0,16	0,45
ER4	0,21	0,24	0,43	1,00	2,58	3,89	5,07	0,10	0,29
ER5	0,16	0,19	0,25	0,39	1,00	2,00	3,13	0,06	0,16
ER6	0,14	0,15	0,19	0,26	0,50	1,00	1,81	0,04	0,10
ER7	0,12	0,13	0,16	0,20	0,32	0,55	1,00	0,03	0,08

lambda max 3:	7,32	consistency ratio 3:	0,04
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Comparison Matrix 4:

	CR1	CR2	CR3	CR4	CR5	CR6	CR7	CR8	CR9	CR10	Priority Vector	Normalized Priority Vector
CR1	1,00	1,22	2,95	4,09	4,97	6,09	6,98	7,98	8,70	8,85	0,26	1,00
CR2	0,82	1,00	2,67	3,96	4,84	5,85	6,98	7,98	8,70	8,85	0,24	0,93
CR3	0,34	0,37	1,00	2,48	3,80	4,81	5,95	6,96	7,83	7,98	0,16	0,62
CR4	0,24	0,25	0,40	1,00	2,25	3,65	4,66	5,67	6,38	6,68	0,11	0,42
CR5	0,20	0,21	0,26	0,45	1,00	2,03	2,95	3,96	4,91	5,24	0,07	0,28
CR6	0,16	0,17	0,21	0,27	0,49	1,00	2,03	3,26	4,13	4,26	0,05	0,20
CR7	0,14	0,14	0,17	0,21	0,34	0,49	1,00	2,00	3,13	3,13	0,04	0,14
CR8	0,13	0,13	0,14	0,18	0,25	0,31	0,50	1,00	1,81	1,92	0,02	0,09
CR9	0,11	0,11	0,13	0,16	0,20	0,24	0,32	0,55	1,00	1,10	0,02	0,07
CR10	0,11	0,11	0,13	0,15	0,19	0,23	0,32	0,52	0,91	1,00	0,02	0,07

lambda max 4:	10,61	consistency ratio 4:	0,05
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APPENDIX G

AHP BASED ER-CR RATINGS

Company A

CORPORATE MARKETING						
	Judgment	Intensity Scale	ER Multiplier	AHP ER Score	CR Multiplier	AHP CR Score
<i>Profitability</i>	Good	0,62	0,04	0,03	0,05	0,03
<i>TNW</i>	Very Good	1	0,17	0,17	0,22	0,22
<i>Financial Risk</i>	Good	0,62	0,06	0,03	0,07	0,04
<i>Liquidity</i>	Good	0,62	0,05	0,03	0,06	0,04
<i>Cash Flow</i>	Good	0,62	0,04	0,02	0,05	0,03
<i>Managers / Shareholders</i>	Very Good	1	0,13	0,13	0,17	0,17
<i>Relations with Market</i>	Good	0,62	0,06	0,03	0,07	0,04
<i>Sector</i>	NG / NB	0,3	0,09	0,03	0,11	0,03
<i>Purpose</i>	Abs. Proper	1	0,03	0,03		
<i>Amount</i>	Proper	0,57	0,03	0,02		
<i>Maturity and Repayment Type</i>	Abs. Proper	1	0,05	0,05		
<i>Primary Source of Repayment</i>	Proper	0,57	0,08	0,04		
<i>Secondary Source of Rep.</i>	Proper	0,57	0,04	0,03		
<i>Evaluations of Credit Rating Institutions</i>	N/A	0	0,15	-	0,19	-
TOTAL:			1,00	0,63	1,00	0,61

Company A

CREDIT EVALUATIONS						
	Judgment	Intensity Scale	ER Multiplier	AHP ER Score	CR Multiplier	AHP CR Score
<i>Profitability</i>	Good	0,62	0,03	0,02	0,04	0,02
<i>TNW</i>	Good	0,62	0,08	0,05	0,10	0,06
<i>Financial Risk</i>	Good	0,62	0,05	0,03	0,06	0,05
<i>Liquidity</i>	Good	0,62	0,07	0,04	0,08	0,04
<i>Cash Flow</i>	Good	0,62	0,07	0,04	0,08	0,04
<i>Managers / Shareholders</i>	Very Good	1	0,08	0,08	0,09	0,09
<i>Relations with Market</i>	Good	0,62	0,06	0,04	0,07	0,05
<i>Sector</i>	Bad	0,15	0,12	0,02	0,15	0,02
<i>Purpose</i>	Abs. Proper	1	0,04	0,04		
<i>Amount</i>	Proper	0,57	0,03	0,02		
<i>Maturity and Repayment Type</i>	Abs. Proper	1	0,02	0,02		
<i>Primary Source of Repayment</i>	Proper	0,57	0,05	0,03		
<i>Secondary Source of Rep.</i>	Proper	0,57	0,02	0,01		
<i>Evaluations of Credit Rating Institutions</i>	N/A	0	0,27	-	0,32	-
TOTAL:			1,00	0,44	1,00	0,38

Company B

CORPORATE MARKETING						
	Judgment	Intensity Scale	ER Multiplier	AHP ER Score	CR Multiplier	AHP CR Score
<i>Profitability</i>	Good	0,62	0,04	0,03	0,05	0,03
<i>TNW</i>	NG / NB	0,3	0,17	0,05	0,22	0,07
<i>Financial Risk</i>	Bad	0,15	0,06	0,01	0,07	0,01
<i>Liquidity</i>	Bad	0,15	0,05	0,01	0,06	0,01
<i>Cash Flow</i>	Bad	0,15	0,04	0,01	0,05	0,01
<i>Managers / Shareholders</i>	Very Bad	0,09	0,13	0,01	0,17	0,02
<i>Relations with Market</i>	NG / NB	0,3	0,06	0,02	0,07	0,02
<i>Sector</i>	NG / NB	0,3	0,09	0,03	0,11	0,03
<i>Purpose</i>	Proper	0,57	0,03	0,02		
<i>Amount</i>	Proper	0,57	0,03	0,02		
<i>Maturity and Repayment Type</i>	Proper	0,57	0,05	0,03		
<i>Primary Source of Repayment</i>	Proper	0,57	0,08	0,04		
<i>Secondary Source of Rep.</i>	Proper	0,57	0,04	0,03		
<i>Evaluations of Credit Rating Institutions</i>	N/A	0	0,15	-	0,19	-
TOTAL:			1,00	0,28	1,00	0,20

Company B

CREDIT EVALUATIONS						
	Judgment	Intensity Scale	ER Multiplier	AHP ER Score	CR Multiplier	AHP CR Score
<i>Profitability</i>	NG / NB	0,3	0,03	0,01	0,04	0,01
<i>TNW</i>	Bad	0,15	0,08	0,01	0,10	0,01
<i>Financial Risk</i>	Very Bad	0,09	0,05	0,00	0,06	0,01
<i>Liquidity</i>	Bad	0,15	0,07	0,01	0,08	0,01
<i>Cash Flow</i>	Very Bad	0,09	0,07	0,01	0,08	0,01
<i>Managers / Shareholders</i>	Very Bad	0,09	0,08	0,01	0,09	0,01
<i>Relations with Market</i>	Bad	0,15	0,06	0,01	0,07	0,01
<i>Sector</i>	Bad	0,15	0,12	0,02	0,15	0,02
<i>Purpose</i>	Proper	0,57	0,04	0,02		
<i>Amount</i>	Not Proper	0,18	0,03	0,00		
<i>Maturity and Repayment Type</i>	Proper	0,57	0,02	0,01		
<i>Primary Source of Repayment</i>	Proper	0,57	0,05	0,03		
<i>Secondary Source of Rep.</i>	Proper	0,57	0,02	0,01		
<i>Evaluations of Credit Rating Institutions</i>	N/A	0	0,27	-	0,32	-
TOTAL:			1,00	0,16	1,00	0,09

Company C

CORPORATE MARKETING						
	Judgment	Intensity Scale	ER Multiplier	AHP ER Score	CR Multiplier	AHP CR Score
<i>Profitability</i>	Very Good	1	0,04	0,04	0,05	0,05
<i>TNW</i>	Good	0,62	0,17	0,10	0,22	0,13
<i>Financial Risk</i>	Good	0,62	0,06	0,03	0,07	0,04
<i>Liquidity</i>	Good	0,62	0,05	0,03	0,06	0,04
<i>Cash Flow</i>	Good	0,62	0,04	0,02	0,05	0,03
<i>Managers / Shareholders</i>	Very Good	1	0,13	0,13	0,17	0,17
<i>Relations with Market</i>	Good	0,62	0,06	0,03	0,07	0,04
<i>Sector</i>	NG / NB	0,3	0,09	0,03	0,11	0,03
<i>Purpose</i>	Abs. Proper	1	0,03	0,03		
<i>Amount</i>	Abs. Proper	1	0,03	0,03		
<i>Maturity and Repayment Type</i>	Abs. Proper	1	0,05	0,05		
<i>Primary Source of Repayment</i>	Abs. Proper	1	0,08	0,08		
<i>Secondary Source of Rep.</i>	Proper	0,57	0,04	0,03		
<i>Evaluations of Credit Rating Institutions</i>	N/A	0	0,15	-	0,19	-
TOTAL:			1,00	0,63	1,00	0,55

Company C

CREDIT EVALUATIONS						
	Judgment	Intensity Scale	ER Multiplier	AHP ER Score	CR Multiplier	AHP CR Score
<i>Profitability</i>	Good	0,62	0,03	0,02	0,04	0,02
<i>TNW</i>	Good	0,62	0,08	0,05	0,10	0,06
<i>Financial Risk</i>	Good	0,62	0,05	0,03	0,06	0,04
<i>Liquidity</i>	Good	0,62	0,07	0,04	0,08	0,05
<i>Cash Flow</i>	Good	0,62	0,07	0,04	0,08	0,05
<i>Managers / Shareholders</i>	Very Good	1	0,08	0,08	0,09	0,09
<i>Relations with Market</i>	Good	0,62	0,06	0,04	0,07	0,05
<i>Sector</i>	NG / NB	0,3	0,12	0,04	0,15	0,04
<i>Purpose</i>	Proper	0,57	0,04	0,02		
<i>Amount</i>	Proper	0,57	0,03	0,02		
<i>Maturity and Repayment Type</i>	Proper	0,57	0,02	0,01		
<i>Primary Source of Repayment</i>	Proper	0,57	0,05	0,03		
<i>Secondary Source of Rep.</i>	Not Proper	0,18	0,02	0,00		
<i>Evaluations of Credit Rating Institutions</i>	N/A	0	0,27	-	0,32	-
TOTAL:			1,00	0,42	1,00	0,41

Company D

CORPORATE MARKETING						
	Judgment	Intensity Scale	ER Multiplier	AHP ER Score	CR Multiplier	AHP CR Score
<i>Profitability</i>	Good	0,62	0,04	0,03	0,05	0,03
<i>TNW</i>	Good	0,62	0,17	0,10	0,22	0,13
<i>Financial Risk</i>	NG / NB	0,3	0,06	0,02	0,07	0,02
<i>Liquidity</i>	NG / NB	0,3	0,05	0,01	0,06	0,02
<i>Cash Flow</i>	NG / NB	0,3	0,04	0,01	0,05	0,01
<i>Managers / Shareholders</i>	Good	0,62	0,13	0,08	0,17	0,11
<i>Relations with Market</i>	Good	0,62	0,06	0,03	0,07	0,04
<i>Sector</i>	NG / NB	0,3	0,09	0,03	0,11	0,03
<i>Purpose</i>	Proper	0,57	0,03	0,02		
<i>Amount</i>	Proper	0,57	0,03	0,02		
<i>Maturity and Repayment Type</i>	Proper	0,57	0,05	0,03		
<i>Primary Source of Repayment</i>	Proper	0,57	0,08	0,04		
<i>Secondary Source of Rep.</i>	Proper	0,57	0,04	0,03		
<i>Evaluations of Credit Rating Institutions</i>	N/A	0	0,15	-	0,19	-
TOTAL:			1,00	0,44	1,00	0,41

Company D

CREDIT EVALUATIONS						
	Judgment	Intensity Scale	ER Multiplier	AHP ER Score	CR Multiplier	AHP CR Score
<i>Profitability</i>	NG / NB	0,3	0,03	0,01	0,04	0,01
<i>TNW</i>	Good	0,62	0,08	0,05	0,10	0,06
<i>Financial Risk</i>	NG / NB	0,3	0,05	0,01	0,06	0,02
<i>Liquidity</i>	Good	0,62	0,07	0,04	0,08	0,05
<i>Cash Flow</i>	Good	0,62	0,07	0,04	0,08	0,05
<i>Managers / Shareholders</i>	Good	0,62	0,08	0,05	0,09	0,06
<i>Relations with Market</i>	Good	0,62	0,06	0,04	0,07	0,05
<i>Sector</i>	NG / NB	0,3	0,12	0,04	0,15	0,04
<i>Purpose</i>	Proper	0,57	0,04	0,02		
<i>Amount</i>	Proper	0,57	0,03	0,02		
<i>Maturity and Repayment Type</i>	Proper	0,57	0,02	0,01		
<i>Primary Source of Repayment</i>	Proper	0,57	0,05	0,03		
<i>Secondary Source of Rep.</i>	Not Proper	0,18	0,02	0,00		
<i>Evaluations of Credit Rating Institutions</i>	N/A	0	0,27	-	0,32	-
TOTAL:			1,00	0,37	1,00	0,34

Company E

CORPORATE MARKETING						
	Judgment	Intensity Scale	ER Multiplier	AHP ER Score	CR Multiplier	AHP CR Score
<i>Profitability</i>	Good	0,62	0,04	0,03	0,05	0,03
<i>TNW</i>	Good	0,62	0,17	0,10	0,22	0,13
<i>Financial Risk</i>	NG / NB	0,3	0,06	0,02	0,07	0,02
<i>Liquidity</i>	Good	0,62	0,05	0,03	0,06	0,04
<i>Cash Flow</i>	NG / NB	0,3	0,04	0,01	0,05	0,01
<i>Managers / Shareholders</i>	Good	0,62	0,13	0,08	0,17	0,11
<i>Relations with Market</i>	NG / NB	0,3	0,06	0,02	0,07	0,02
<i>Sector</i>	NG / NB	0,3	0,09	0,03	0,11	0,03
<i>Purpose</i>	Proper	0,57	0,03	0,02		
<i>Amount</i>	Proper	0,57	0,03	0,02		
<i>Maturity and Repayment Type</i>	Proper	0,57	0,05	0,03		
<i>Primary Source of Repayment</i>	Proper	0,57	0,08	0,04		
<i>Secondary Source of Rep.</i>	Proper	0,57	0,04	0,03		
<i>Evaluations of Credit Rating Institutions</i>	N/A	0	0,15	-	0,19	-
TOTAL:			1,00	0,44	1,00	0,40

Company E

CREDIT EVALUATIONS						
	Judgment	Intensity Scale	ER Multiplier	AHP ER Score	CR Multiplier	AHP CR Score
<i>Profitability</i>	Good	0,62	0,03	0,02	0,04	0,02
<i>TNW</i>	Good	0,62	0,08	0,05	0,10	0,06
<i>Financial Risk</i>	Bad	0,15	0,05	0,01	0,06	0,01
<i>Liquidity</i>	Good	0,62	0,07	0,04	0,08	0,05
<i>Cash Flow</i>	NG / NB	0,3	0,07	0,02	0,08	0,03
<i>Managers / Shareholders</i>	Good	0,62	0,08	0,05	0,09	0,06
<i>Relations with Market</i>	Good	0,62	0,06	0,04	0,07	0,05
<i>Sector</i>	Bad	0,15	0,12	0,02	0,15	0,02
<i>Purpose</i>	Proper	0,57	0,04	0,02		
<i>Amount</i>	Proper	0,57	0,03	0,02		
<i>Maturity and Repayment Type</i>	Proper	0,57	0,02	0,01		
<i>Primary Source of Repayment</i>	Proper	0,57	0,05	0,03		
<i>Secondary Source of Rep.</i>	Proper	0,57	0,02	0,01		
<i>Evaluations of Credit Rating Institutions</i>	N/A	0	0,27	-	0,32	-
TOTAL:			1,00	0,34	1,00	0,29

Company F

CORPORATE MARKETING						
	Judgment	Intensity Scale	ER Multiplier	AHP ER Score	CR Multiplier	AHP CR Score
<i>Profitability</i>	Good	0,62	0,04	0,03	0,05	0,03
<i>TNW</i>	Good	0,62	0,17	0,10	0,22	0,13
<i>Financial Risk</i>	NG / NB	0,3	0,06	0,02	0,07	0,02
<i>Liquidity</i>	NG / NB	0,3	0,05	0,01	0,06	0,02
<i>Cash Flow</i>	NG / NB	0,3	0,04	0,01	0,05	0,01
<i>Managers / Shareholders</i>	Good	0,62	0,13	0,08	0,17	0,11
<i>Relations with Market</i>	Good	0,62	0,06	0,03	0,07	0,04
<i>Sector</i>	NG / NB	0,3	0,09	0,03	0,11	0,03
<i>Purpose</i>	Proper	0,57	0,03	0,02		
<i>Amount</i>	Proper	0,57	0,03	0,02		
<i>Maturity and Repayment Type</i>	Proper	0,57	0,05	0,03		
<i>Primary Source of Repayment</i>	Proper	0,57	0,08	0,04		
<i>Secondary Source of Rep.</i>	Proper	0,57	0,04	0,03		
<i>Evaluations of Credit Rating Institutions</i>	N/A	0	0,15	-	0,19	-
TOTAL:			1,00	0,44	1,00	0,41

Company F

CREDIT EVALUATIONS						
	Judgment	Intensity Scale	ER Multiplier	AHP ER Score	CR Multiplier	AHP CR Score
<i>Profitability</i>	Good	0,62	0,03	0,02	0,04	0,02
<i>TNW</i>	Good	0,62	0,08	0,05	0,10	0,06
<i>Financial Risk</i>	Bad	0,15	0,05	0,01	0,06	0,01
<i>Liquidity</i>	Bad	0,15	0,07	0,01	0,08	0,01
<i>Cash Flow</i>	NG / NB	0,3	0,07	0,02	0,08	0,03
<i>Managers / Shareholders</i>	Very Good	1	0,08	0,08	0,09	0,09
<i>Relations with Market</i>	Good	0,62	0,06	0,04	0,07	0,05
<i>Sector</i>	NG / NB	0,3	0,12	0,04	0,15	0,04
<i>Purpose</i>	Proper	0,57	0,04	0,02		
<i>Amount</i>	Not Proper	0,18	0,03	0,00		
<i>Maturity and Repayment Type</i>	Proper	0,57	0,02	0,01		
<i>Primary Source of Repayment</i>	Proper	0,57	0,05	0,03		
<i>Secondary Source of Rep.</i>	Proper	0,57	0,02	0,01		
<i>Evaluations of Credit Rating Institutions</i>	N/A	0	0,27	-	0,32	-
TOTAL:			1,00	0,34	1,00	0,31

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