

## Using the Method of Discriminant Analysis in Bank Marketing

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### Abstract

*This article demonstrates that using multivariate discriminant analysis in bank marketing is very useful because on the one hand, it contributes to increase of sales efficiency by orienting sales to the customers who are possible interested and protecting non-interested customers and on the other hand it suggests creating products adapted to the customers' needs, in other words, selling products only to the market interested segment.*

**Keywords:** Discriminant analysis, logistic regression, marketing campaign, subprime mortgage, credit risk, rating

### 1. Introduction

The marketing process has acknowledged significant changes in the companies that dispute on the markets that are more and more competitive. One question that we are interested in, is to what extent is necessary for a company to make strategic changes and to use discriminant method in a rigorous manner? We'll demonstrate below that this approach is imperative in any contemporary market research. As Srivastava and Rego mentioned (2011), discriminant analysis (DA) is basically a classifying technique that is used for categorizing a given set of objects, individuals and entities into two (or more) groups or categories based on the characteristics or the attributes of the given data, in this way those entities receive a classification or a rating (low risk or high risk, interested or not interested). Discriminant analysis method has as a dependent variable a variable category (nominal or nonmetric), but independent variables (predictors) that are assumed to be metric, they also can be non-metric variables, such as thin or thick. Hair, Anderson, Tatham and Black (2011) mentioned that instead of DA one can use logistic regression method which is more robust and more tolerant to violations of the initial assumptions, having less assumptions to accomplish, but it is limited only to two groups to be discriminated.

Using multivariate discriminant analysis in bank marketing is a very valuable tool for at least 3 reasons:

- **Firstly**, by using DA banking institutions contribute to the avoidance of selling products to clients who cannot afford those products. It also can be argued that in this way the bank avoids losses by selling products to customers that cannot afford them;
- **Secondly**, using DA in banking, rises the success rate of marketing campaigns by including in the campaign those clients predisposed to be included in the category of "interested" in a certain product and avoiding addressing "non-interested" customers; these are the clients who are sometimes aggressed by repetitive interaction with new selling offer from the bank;
- **Thirdly**, using DA in banking contributes to the developments of new products and services and to the improvements of the existing ones so that they can be adjusted to fulfill certain needs of certain customers.

With these tentative motivations in place we can start an in depth justification of the importance of the DA in banking marketing.

### 2. Arguments

Some of these points should become clearer as we turn to the in detailed explanations of the motivations behind the use of multivariate discriminant analysis in bank marketing. The next three sections elaborate on the three above mentioned reasons.

i) The first reason: one could show that by avoiding selling products to those clients who don't afford to purchase those products is a way to avoid losses for the bank in case of selling products to customers that cannot afford them.

By not selling products to those customers that cannot afford to purchase some products, the banks protect those customers from future problems. Thus, one of the most illustrative examples is the financial crisis of US subprime mortgage loans. As mentioned by NASDAQ (2015), “subprime refers to higher the risk. These are mortgages that are issued to individuals who are often not qualified. That is, the long term monthly mortgage payment is more than their income. Often, these mortgages are issued on the expectation that the homeowners income will rise in the future. These mortgages are often made feasible by teaser rates”. The interest rate and consequently the monthly instalments are low at the beginning of the loan period (first years), and then the payment increase gradually, and finally, especially on the period of crisis, the applicant gets an impossible situation for payment of his/her instalments to the bank (NASDAQ, 2015). A new concept was introduced to characterize such the phenomenon of the impossibility of payment: *ninja loans*. Charles (2008) mentioned that “light-documentation mortgages transmuted into ‘ninja’ loans—no income, no job, no assets”. As mentioned in the Wikipedia (2015), “the term grew in usage during the 2008 financial crisis as the subprime mortgage crisis was blamed on such loans. It works on two levels – as an acronym; and allusion to the fact that *ninja loans* are often defaulted on, with the borrower disappearing like a *ninja*”. Olteanu (2004) emphasizes that, managing risk is very important in any organization and in particular in financial-banking institutions. Depending on the processes that generate it, the risk can be of various types: credit risk, liquidity risk, interest rate risk, solvability risk, operational risk, market risk and exchange risk. Frank, Massy and Morrison (1965) said that in marketing discriminant analysis and logistic regression are used in evaluating different types of customers, services and products. Discriminant analysis is useful not only to determine customers behavior, but also to evaluate the relative importance of different clients characteristics used in forecasting.

The value of the discriminant analysis used by banks in order to grant a loan is investigated by a number of authors, for example:

- Altman and Saunders (1998) claim that “there are at least four methodological approaches to developing multivariate credit-scoring systems: the linear probability model, the logit model, the probit model, and the discriminant analysis model”. The most useful method is discriminant analysis, and the second one is the logit analysis;
- Another author like Burns (2008) says that DA supports banks in the loan process revealing if it is risky to grant a loan to a certain applicant or not;
- In addition, Srivastava and Rego (2011) argue that there are some financial indicators that help financial institutions to decide to lend money to an entity or not.

In the analysis made by a bank in order to provide a loan to the potential borrower, a scoring matrix is used by the bank in order to decide whether to grant a loan or not. For this decision are taken into consideration the following: the overall professional experience of the loan applicant, his or her experience in the last place of work, the field activity of the applicant’s employer, the risk of bankruptcy of the employer’s company, the material guarantees provided by the potential borrower, the previous loan history of the potential debtor and other customer information. All above mentioned variables are incorporated in a scoring matrix, used by the bank to rank the loan applicant in a risk category of failure to pay the loan or not. In this way the banking institution decides to grant or not to grant the loan to the potential customer. Altman and Saunders (1998) argue that, “when using multivariate models, the key accounting variables are combined and weighted to produce either a credit risk score or a probability of default measure”. In the situation that the loan risk score achieves a rate that exceeds a reference level, a loan candidate is refused by the bank or the bank performs supplementary analysis. Using discriminant analysis in loan inquiry protects not only the banks by having losses due to failure to pay, but also protects individuals and companies from financial bankruptcy, by taking loans that they cannot afford. The role of marketing and rating methods used to classify clients in a certain group are very important in credit risk evaluation, because by using market research and specific scoring methods, this leads to an important analysis of the potential debtor profile, on the basis of which the bank decides to lend money or not to the potential borrower. In the arguments below we will see that we can extend the discriminant analysis to sales campaigns, orientating them towards those customers that are more likely to reflect the pattern of customers that own the specific product that the bank intends to sell in their campaign.

ii) The second reason: discriminant analysis used in banks contributes to **the rise of the success rate of marketing campaigns** by including in the campaign those clients predisposed to be included in the category of “interested” about a certain product and by avoiding addressing the non-interested customers that are often aggressed by repetitive interaction.

Making use of discriminant analysis in banks is very useful because selecting those clients that are interested in buying a product and are eligible in terms of banking procedures is the first step in managing efficient sales campaigns. Designing a model that allows the bank to **identify those customers who do not have a certain product, but they are more likely to have it** (they can have the pattern of the customers that have that specific product), can be done by using DA or logistic regression methods and the internal data of the financial institution in discussion. There is strong evidence for the usefulness of the discriminant analysis in bank marketing.<sup>1</sup> by using the discriminant analysis. The equation model (1.1) I proposed has been generated by using the public data from building companies that were active in 2009, this data was obtained from the official site of the Romanian Ministry of Finance (<http://www.mfinante.ro>) and it is shown in the table 1-1. In this research not all discriminant analysis assumptions were fulfilled (independent variables normality was not accomplished). However, the fact that there was no fulfillment of the “normality” condition or that the hypothesis of normality was not confirmed is not an earth shattering problem for the final results; this does not mean that the final results is not trustworthy (Rojas-LeBouef and Slate, 2011).

$$Z = (0.07184611 \times \text{Dept Management}) + (-1.04755271 \times \text{Income Return}) + (0.21224483 \times \text{Asset Rotation}) + (0.00000170 \times \text{Receivables}) + (-0.00000060 \times \text{Total Expenses}) - 0.73792656 \quad (1.1)^2$$

The above mentioned model designed by using the 2009 sample applied on the 2010 sample generates a hit ratio of 84.3%. Using the above function (1.1) with the 2011 samples results in a hit ratio of 74.2%. So, even after 2 years the model generated by using discriminant analysis has a 24.2% better prediction than by chance. The above mentioned findings show that applying the discriminant analysis to the financial data of the companies that are active in the construction industry, permits, on the one hand, to identify those companies that could have financial problems in the near future, and on the other hand allow to select the financial indicators that have the most powerful discrimination among the viable companies (companies that do not have financial problems) and those firms having financial difficulties. This approach permits to concentrate the sales campaigns to the companies that do not have financial problems in the near future. Thus, the sales marketing campaigns targeting only successful companies become more efficient, will have less campaign costs, and the bank will attract companies that will not create problems on the short term.

iii) The third reason: discriminant analysis contributes to development of new products and to the adaptation of the existing ones to certain categories of customers.

The decision taken by a banking institution to develop the present products and to develop new products for the market, is based on a comprehensive analysis of the market, customers, clients’ purchasing behaviors, price of the product and competition. As mentioned by Orzan (2007) the actions required for developing a new product are parts of the renewal process. The starting point of these activities is represented by the analysis of the organisation’s strategy, based on the general objectives of the company, and developing specific marketing objective, by using the process of searching for ideas for new products. Developing products require a very good understanding of the targeted customers’ behaviour. For example, by using data obtained from a survey or a focus-group, it is possible to explain the characteristics of the proposed product and the decision to buy or not that product. The mentioned investigation<sup>3</sup> of DA in banking marketing used another selection of customers, a part of the eligible customers to buy a credit card were considered belonging to 2 groups: one the group of “interested” customers (which already have a credit card from the bank) and the other group “not-interested” ones.

<sup>1</sup> The usefulness of DA in bank marketing is fully worked out in my Using of rating methods in the marketing of banking products, PhD thesis (waiting publication), Popescu, B.B. (2015)

<sup>2</sup> Popescu, B.B. (2015). Utilizarea metodelor de rating în marketingul produselor bancare [Using of rating methods in banking products marketing]. PhD. thesis (waiting publication)

<sup>3</sup> Popescu, B.B. (2015). Utilizarea metodelor de rating în marketingul produselor bancare [Using of rating methods in banking products marketing]. PhD. thesis (waiting publication)

The next step was to create using discriminant analysis a model used to discriminate eligible customers in 2 classes "interested" and "not-interested" to purchase a credit card from the bank. Thus banks can use this proposed model, to analyze if the "not-interested" customers are possible interested customers to buy another product, for example another credit card having different characteristics that are suitable to their specific needs, because as demonstrated in the model these clients which have a certain pattern do not find in the bank's offer an attractive product that meets their requirements. In order to develop banking products it is necessary to research the competition products and to identify the product's characteristics that determine the customers to choose a certain product or service. So, in this scenario, discriminant analysis contributes to illuminate the most important product's attributes that are needed by customers in order to take the decision to purchase the product.

As mentioned by Hair (2009), discriminant analysis can be used to predict the success or failure of a new product. Starting from Hair's example (2009) from a company that sells householding equipments, banks before improving the existent products or developing a new one, such as a credit card, could make a survey in order to determine the pattern of the customers that would buy the product and the pattern of those clients that would not buy the new product. In this respect, the customers are asked to evaluate through questionnaires or interviews (to give a rank) on a scale from 1 to 10 (1 being the worst and 10 being the best rank) each attribute (characteristic) of the proposed product (such as: loan limit, grace period, administration fees, cash withdrawal charges, etc.). They will also be asked if they would like to buy the product or not. By using the discriminant analysis the banks can design a model that will reveal the main attributes of the product that determine customers to purchase a specific product (in the above mentioned example, a credit card).

### **3. Conclusions**

As demonstrated by different authors, the discriminant approach is the key for solving various problems because it contributes to avoid selling products to clients that cannot afford them and this approach will protect not only the customers of the bank, but the bank itself, by avoiding losses in case of default if the clients are not able to pay back the loans. Discriminant analysis contributes to increase the success rate of marketing campaigns, by including in the campaign only those clients predisposed to be included in the category of interested in a certain product and avoid in this way to offer a product to non-interested clients that are often aggrieved by this approach. Discriminant analysis helps banks to develop new products and services and to improve the existing ones, so that the products can be adjusted to encounter certain needs of certain customers. If the bank discovers that it does not have the right product to meet specific customers' needs, then bank should adjust its products accordingly, in order to avoid losing business. In conclusion, discriminant analysis is essential tool to be used by any bank, because it answers to various concerns that the managers and the people cooperating with a bank may encounter

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**Table1-1: Samples of Companies between 2008-2012**

<b>Year</b>	<b>Company Number</b>	<b>Companies operating next year</b>	<b>Companies in default next year</b>
2008	53	47	6
2009	58	47	11
2010	51	47	4
2011	66	47	19