Paper 3371-2015

An Application of the DEA Optimization Methodology to Make More Effective and Efficient Collection Calls

Jenny Lancheros, Banco Colpatria
Catherine Nieto, Banco Colpatria

ABSTRACT

In our Management Collection Area, there was no methodology that provided the optimal number of collection calls to get the customer to make the minimum payment of his or her financial obligation. We wanted to determine the optimal number of calls using the data envelopment analysis (DEA) optimization methodology. Using this methodology, we obtained results that positively impacted the way our customers were contacted. We can maintain a healthy bank and customer relationship, keep management and collection at an operational level, and obtain a more effective and efficient portfolio recovery. The DEA optimization methodology has been successfully used in various fields. It has solved multi-criteria optimization problems, but it has not been commonly used in the financial sector, especially in the collection area.
This methodology requires specialized software, such as SAS Enterprise Guide. In this paper, we present the PROC OPTMODEL, how to formulate the optimization problem, create the SAS Code, and the process of the available data.

INTRODUCTION

Nowadays we can look at new practices that financial institutions focused on the area of Collections are highlighting a goal that for years had been forgotten. They want to have a healthy and proper relationship with the client, although it is not only because they want to recover NPLs (non-performing loans), otherwise this behavior could jeopardize the relationship with the customer.

Through various analytical tools we can determine depending on the payment behavior and the product usage, the level of portfolio risk, classifying High Risk (**HR**), Medium (**MR**) and Low (**LR**).

Currently, depending on this classification, it can be determined after how many days in arrears it is necessary to begin Collections Calls; **HR** customers are called from the second day in arrears while the **MR** customers are called from the third day in arrears and **LR** customers from the ninth day.

From this point until the customer makes the payment may be hundreds of attempts and calls, but we were unable to determine what is the optimal number of calls until the client has an updated payment according to their level of risk.

In this vein, taking into account this background, we have analyzed how to optimize the way Collection Management is being executed. The result we want to obtain is to know when is the suitable time to contact the customer and for how long should we manage the process until we receive the payment from the customer, considering the risk level.

For our model we have decided to analyze all the Bank's clients according to these features:

1. They must have at least one credit card.

2. Their current state in arrears should be between 1 and 30 days past due.

The total population that meets these assumptions is 36,779 clients.

The information available per customer on a monthly basis has to do with account balances, number of days in arrears from the beginning of the collection process, number of calls in a month.

Having already a clearer context and available inputs, we are going to explain in more detail the methodology used (DEA).

The methodology of Data Envelopment Analysis (DEA) is a technique for measuring the efficiency based on obtaining an efficient frontier from a set of observations. It is, in short, an alternative to extract information from a set of observations compared to parametric methods. It has traditionally been used to estimate the relative efficiency of a set of production units. The Data Envelopment Analysis (DEA) is originally a nonparametric procedure that uses a linear programming technique that will allow evaluation of the relative efficiency of a set of homogeneous production units.

DEA seeks to optimize the efficiency measure of each unit analyzed, in order to create an efficient frontier based on the Pareto criterion. It is necessary to take into account that perhaps one of the most widespread ideas about efficiency is the Pareto optimal, which according to a resource allocation, A is preferred over B, if and only if with the second at least one individual improves and no one gets worse. By using linear programming techniques, the DEA compares the relative efficiency of a set of units that produce similar "outputs" from a number of common "inputs".

MODELING PROCESS

Now that the general concets have been explained, in this stage we will taking into account the modeling process and the assumptions that hev to be cosiderer:

a. Inputs:

- **Ciudad**: City of Residence.
- **Numero_productos**: Numbers of credit cards.
    - **Risk**: Type of Risk (**HR**, **MR**, **LR**).
    - **Saldo**: Total Balance.

b. Outputs:

- **Day After Call**: Count of days past due until the client pay.
    - **Clientes Rec**: Is a binary variable that determines if the client was recovered
- **LLamadas Cliente:** Total of collection calls with the client (Direct Contact)

Having Clear the DEA inputs, its necesary buils independent data with the inputs and the outputs variables this information will be used in the final model code.

DATA inputs ;

```
SET    ESCENARIOS;
KEEP POSICION CIUDAD numero_productos RISK SALDO TOTAL_CLIENTES;
RUN;

DATA outputs;
SET    ESCENARIOS;
KEEP POSICION    DAY_AFTER_CALL CLIENTES_REC LLAMADAS_CLIENTE;
RUN;

data var_inputs;
input variable $32.;
datalines;
CIUDAD
numero_productos
RISK
SALDO
TOTAL_CLIENTES
;run;
data var_outputs;
input variable $32.;
datalines;
DAY_AFTER_CALL
CLIENTES_REC
LLAMADAS_CLIENTE
;run;

/*DEA MODEL*/

proc optmodel ;
        set <str> inputs;
        set <str> outputs;
        set <str> escenarios;

        num X {escenarios,inputs};
        num Y {escenarios,outputs};
        str h;
        num efficient{escenarios};
        num pesos{escenarios};

        var lambda {escenarios}>=0;
        var teta>=0;

        read data work.var_inputs into inputs=[variable];
        read data work.var_outputs into outputs=[variable];

        read data inputs into escenarios=[POSICION] {i in inputs} <X [POSICION,i] =col(i)>;
        read data outputs into escenarios=[POSICION] {j in outputs} <Y [POSICION,j] =col(j)>;
```

```
        max eficiencia = teta    ;
        con input {i in inputs}: sum{p in escenarios} lambda[p]*X[p,i] <= X[h,i];
        con output {j in outputs}: sum{p in escenarios} lambda[p]*Y[p,j] >= teta*Y[h,j];

        do h= escenarios;
        solve;
        efficient[h]= 1/teta.sol;
        end;

        print efficient;
run;
quit;
```

RESULTS

In this section are presented the experimental results after runnng the model on the selected population, in the sample the process expend two hours.

The result is summarized in the follow table, as mentionated earlier the result is presentes by the type of Risk.

RISK	MAX CALLS	MEAN CALLS
A	8	6
M	6	4
P	3	3

Table 1. DEA Model Result

CONCLUSIONS

Along this paper we have been submitted the objetive that though a optimization methodology known as data envelopment analysis (DEA) can determine the number of collections calls that the Collections Area slould be made taking into account the type of Risk until this make the payment.

clients with Hight Risk (**HR**) will receive 8 calls ultil the client will make the payment, also clients with Medium Risk (**MR**) will receive 6 calls ultil the client will do the payment and finally our best clients will receive only 3 calls so more the this number will occur discomfort.

In this order this results show us:

1. We have a efficient risk Clasification, the risk segmentation goes in orden of the current portolio Behaviour.

2. Depending of the type of Risk the client will be contacted by the Collection Area. the number of calls have monotnocity respct to the Risk Level.

3. Having the optimal number of calls we can focus more efficiently our collection management.

REFERENCES

Lacheros, J.; Nieto, A. (2015): "An Application of the DEA Optimization Methodology to Make More Effective and Efficient Collection Calls". SAS Global Forum.

SAS Institute Inc. (2013): SAS Help and documentation, Proc Optmodel. Cary, United States of America: SAS Institute.

SAS Institute Inc. (2013) "Building and Solving Optimization Model with SAS/OR". Cary, United States of America: SAS Institute.

Álvarez, A. (2001): “Concepto y medición de la eficiencia productiva” capitulo nº 1: La medición de la eficiencia y la productividad. Pirámide. Madrid.
Banker, R.D.; Charnes, A. y Cooper, W.W. (1984): “Some Models for Estimating Technical and Scale Inefficiencies in Data Envelopment Analysis”, Management Science, nº 30(9).

Charnes, A.; Cooper, W.W.; Swarts, J. y Thomas, D.A. (1989): “An introduction to Data Envelopment analysis with some of their models and its uses”, Research in Governmental and Nonprofit Accounting, n° 5.

CONTACT INFORMATION

Your comments and questions are valued and encouraged. Contac he authors at:

Name: Jenny Lancheros
Enterprise: Banco Colpatria of the Scotiabank Group.
City: Bogota, Colombia.
Phone: (+57) 3044178993
E-mail: lanchej@colpatria.com

Name: Catherine Nieto
Enterprise: Banco Colpatria of the Scotiabank Group.
City: Bogota, Colombia.
Phone: (+57) 3213223330
E-mail: nietoa@colpatria.com