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DATA ENVELOPMENT ANALYSIS IN THE CSR EFFICIENCY MEASUREMENT (CASE STUDY)

Corporate social performance (CSP) or corporate social responsible activity (CSR) in this research is a number of corporate activities that focus on the welfare of stakeholder groups other than investors, such as charitable and community organizations, employees, suppliers, customers, and future generations. This activity is managed by ISO 26000 "Social responsibility".

Its efficiency measurement is a question for the last 30 years that is still unsolved. The aim of this paper is to show that inside the one branch and the same activity data envelopment analysis (DEA) can be implemented as a kind of frontier analysis.

Through the DEA efficiency can be measured as effect (output) divided on the input. The main problem here is to measure inputs and outputs or evaluate them. However DEA is oriented on the experience and don't need a lot of data. That is why DEA is often used in the non-profit sector such as education, health, policy and CSR as well.

This analysis makes possible to compare firms and to find the leaders. In our case study we implemented the DEA to the three banks that make a charity by involving students in business helping them to create business ideas. The inputs and outputs of such activity are in table 1.

Table 1. Sample with the banks involved in CSR

# of bank	helped students per day	inputs		number of students involved in the action (hundreds)	number of involved staff	Students per staff member (hundreds)	Relative efficiency, %	Business-plans per staff member (hundreds)
		dollars	labour-hours					
1	*2*	*4*	*5*	*3*	*6*	*7*	*8*	
# 1	10	10	2	125	18	6.94	100	2.78
# 2	8	8	4	44	16	2.75	40	1.25
#3	12	12	1,5	80	17	4.71	68	3.24
#4	5	5	1	23	11	2.09	30	1.09

Source: own elaboration

To calculate the efficiency of bank # 1, we define the objective function as:

maximize efficiency = $(u1 \times 10) / (v1 \times 10 + v2 \times 2)$

which is subject to all efficiency of other banks (efficiency cannot be larger than 1):

subject to the efficiency of bank # 1: $(u1 \times 10) / (v1 \times 10 + v2 \times 2) \leq 1$

subject to the efficiency of bank # 2: $(u1 * 8) / (v1 * 8 + v2 * 4) \leq 1$

subject to the efficiency of bank # 3: $(u1 * 12) / (v1 * 12 + v2 * 1.5) \leq 1$

subject to the efficiency of bank # 4: $(u1 * 5) / (v1 * 5 + v2 * 1) \leq 1$

and non-negativity: all u and $v \geq 0$.

To measure total CSR activity we have to analyze a lot of input factors and a lot of output factors, in this case it's easier to use ratio DEA analysis. For each bank we have a single output measure (number of students involved in the action) and a single input measure (number of staff that have been involved).

We will compare these banks and measure their performance. First we converted inputs into outputs (by taking some output measure and divide it by some input measure) – column 7. Here we can see that bank # 1 has the highest ratio, whereas # 4 has the lowest ratio of students per staff member. As bank # 1 has the highest ratio of 6.94 we secondly can compare all other banks to it and calculate their relative efficiency with respect to it. To do this we divide the ratio

for any bank by 6.94 (the value for "frontier") and multiply by 100 to convert to a percentage. This gives us column 8

The other banks do not compare well with #1, so are presumably performing less well. That is, they are relatively less efficient at using their given input resource to produce output.

Typically we have more than one input and one output. For the bank it can be number of students and number of real-business plans. As before we can use ratios just as in the case considered before of a single output and a single input. Typically we take one of the output measures and divide it by one of the input measures. Hence we will have the two ratios. For our bank example the input measure is plainly the number of staff (as before) and the two output measures are number of students and number of business-plans (column 9).

Here we can see that bank # 1 has the highest ratio of students per staff member, whereas # 3 has the highest ratio of business plans per staff member. The rest of banks do not compare so well with #1 and # 3, so are presumably performing less well. That is, they are relatively less efficient at using their given input resource (staff members) to produce outputs.

One problem with comparison via ratios is that different ratios can give a different picture. We would not be able to combine these figures into a single judgement. This problem of different ratios giving different pictures would be especially true if we were to increase the number of banks and the number of input/output measures. One way around the problem of interpreting different ratios, at least for problems involving just two outputs and a single input, is a simple graphical analysis. Suppose we plot the two ratios for each bank as below (fig. 1).

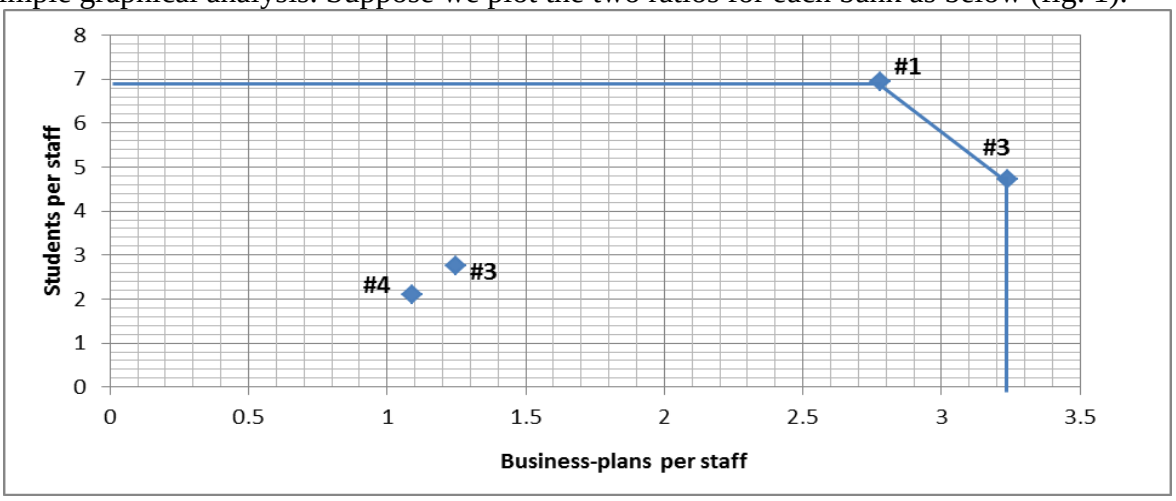

Figure 1. Graphical analysis in solution DEA problems

Source: own elaboration

The positions on the graph represented by # 1 and # 3 demonstrate a level of performance which is superior to all other banks. A horizontal line can be drawn, from the y-axis to # 1, from # 1 to # 3, and a vertical line from # 3 to the x-axis. This line is called the efficient frontier. Mathematically the efficient frontier is the convex hull of the data. The efficient frontier, derived from the examples of best practice contained in the data we have considered, represents a standard of performance that the banks not on the efficient frontier could try to achieve. So, the name „data envelopment analysis" arises the efficient frontier envelopes of all the data.

Whilst a picture is all very well a number is often easier to interpret. We say that any branches on the efficient frontier are 100% efficient (in our example, # 1 and # 3). This is not to say that the performance of # 1 and # 3 could not be improved. DEA only gives relative efficiencies - efficiencies relative to the data considered. It does not, and cannot, give you absolute efficiencies.

The point labelled Best on the efficient frontier is considered to represent the best possible performance that any bank can reasonably be expected to achieve. There are a number of ways by which # 2 for instance can move towards that point. It can reduce its input (number of staff) whilst keeping its output constant (an input target) or increase both its outputs, retaining the current personal or do some combination of the above.

So, DEA can be easy used to measure CSR activity, however it can be just in a case then all activities are the same and in the same branch of economy.