TARGETS AND TOOLS FOR TEACHING STATISTICS TO STUDENTS OF BUSINESS AND MARKETING

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1. Introduction

Business and marketing people need to use statistics in their work. But the available range is rather large and it is necessary to make a selection for teaching. We do not handle this problem in this paper.

The second task in teaching is to be aware that students of business and marketing are a special kind of people. They are rather extrovert and know the value of money. They want to get tools to make money. That is the most important aspect for them. Teaching should be adopted for this special kind of people requiring a rather special teaching style.

2. Targets

The targets of teaching are twofold. Firstly, to develop an ability to use statistics, including statistical inference in practical business. Secondly, to get a sold statistical and scientific base, especially ability to work with models, for post graduate studies in business. These requirements should not conflict. However, in practice both of them need a lot of time and it is impossible to concentrate on both subjects at once.

3. Tools

Starting points for good results in teaching are rather sparse. The students of business and marketing have little skills in statistical thinking; nor do they have very strong motivation. Therefore one has to do all one can to achieve good teaching results. A main task of teaching tools is to maintain motivation. A few points are the most important ones in my experience. Problems should be real problems, not hypothetical ones. They give the flavour of practical life. Teaching must be application oriented. Project working has proved to be successful. But the most important and difficult thing is that the case be handled in the frame of a statistical model. Only in this way one can hope that the student will then be able to apply his or her skill in a new situation. The relationship between the model and the reality is the central point in the interpretation of a statistical model.

In a statistical case study requirements for the problem are as follows:

- well structured

- not too complicated

- to make the obvious change to a statistical problem

and for data

- real

- not very large.

The interpretation should be a clear cut one.

4. Example

One example I have found very helpful is a case "Purchase of a vacuum cleaner". Which one to buy? It depends on two things. Your hopes and needs are important, of course, but so is the price. You want to get something for your money. But cleaners are different. What is the price of some detail in vacuum cleaners? The problem is familiar to everybody. There is a big economic significance if one's company want to buy a hundred vacuum cleaners, just for example. It is suitable for project work and it gives opportunities for many kinds of discussions. Several different statistical models for the problem are possible.

There is a lot of information concerning fifteen vacuum cleaners (Table 1). But even if there are eleven technical variables and a price variable, several technical variables covariate strongly. Each of them may not have very much specific information. Apparently there is a need to concentrate and to structure the information.

Table 1. Variables in the analysis

Brand (BRAND)
Effect (EFFECT)
Maximum suction (SUCTION)
Underpressure (PRESSURE)
Air stream (STREAM)
Dust causing (DIRTYING)
Dust extraction (CLEANING)
Cable length (CABLE)
Cable rewind (REWIND)
Suction regulation, mechanical, yes/no (REGULm)
Suction regulation, electronic, yes/no (REGULe)
Bag volume (BAG)

First a factor analysis is made. The results are in Table 2. As one can see, 79.5 percent of the total information of the eleven variables has been concentrated on three factors, **Effect, Cleaning** and **Dirtying**. It is interesting to note that there are in practice only three dimensions instead of eleven.

Table 2. Factor analysis of technical variables

	FAC1	FAC2	FAC3	COM
SUCTION	0.941	-	-	0.926
UNDERPRES	0.940	-	-	0.888
STREAM	0.870	-	-	0.827
EFFECT	0.839	-	-	0.757
REGULe	0.817	-	-	0.755
BAG	-	0.900	-	0.819
CLEANING	-	0.770	-	0.698
REWIND	-	-0.823	-	0.684
REGULm	-	-	0.847	0.888
CABLE	-	-	0.793	0.733
DIRTYING	-	-	-0.838	0.771
Variance	4.077	2.340	2.330	8.747
Variance(%)	37.0	21.3	21.2	
Cumulative variance(%)	37.0	58.3	79.5	

It is obvious that one hopes to have a vacuum cleaner which is powerful. But one also wants a cleaner with good capacity to extract dust and not throw dust out. Candidates for purchase are vacuum cleaners with high values on Effect and Cleaning factors but with low (high negative) value on Dirtying provided they are worth their price. Factor scores can apparently give valuable information for the buying decision.

Price (in Finnish marks) is now regressed against the three factors. The result is (standard errors in parenthesis)

$$\text{PRICE} = 1034 + 263\ \text{FAC1} + 46\ \text{FAC2} + 29\ \text{FAC3}$$

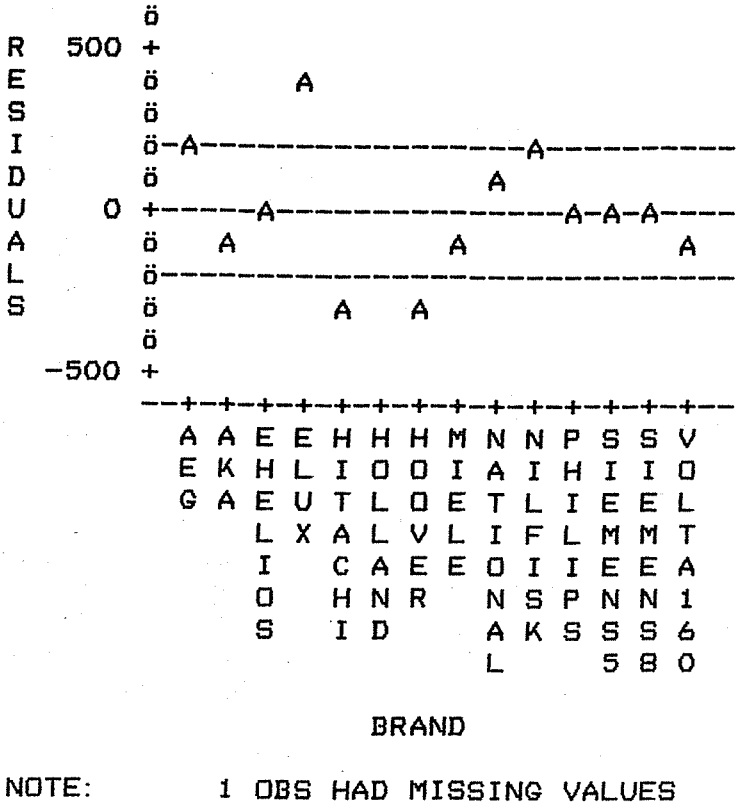
$$(56) \quad (58) \quad (58) \quad (58)$$

$$R^2 = 0.700 \qquad F(3,9) = 7.01 \qquad p = 0.009 \qquad s = 203$$

The t-value is significant only for the first factor i.e. for "Effect". Surprisingly buyers are not ready to pay for "cleaning power" and/or sellers are selling only mechanical effect, not ability to clean!

Residuals have very interesting information provided the model is correct, of course. High negative residuals are signalled for cheap vacuum cleaners and high positive residuals for expensive ones (related to properties presented by the variables). As one can see in Figure 1 there is one vacuum cleaner which has a very high positive residual. In Finland it has been sold only from door to door.

Figure 1. Residuals



NOTE: 1 OBS HAD MISSING VALUES