The Determinants of Graduates' Placement. Analysis of Interactions Using Boolean Logit Models

Mariano Porcu, Giuseppe Puggioni, Nicola Tedesco[1]

Department of Economic and Social Sciences, University of Cagliari, Italy

Summary. In this analysis of the occupational placement of graduates, we define the role played by some covariates assembled to predict the dichotomous event occupied/unoccupied. These covariates influence the response variable singularly and jointly. This work aims to evaluate this joint effect by means of a recently developed technique known as Boolean logit. We applied an exploratory binary segmentation analysis to support the analysis.
Keywords: Graduates' placement; Segmentation analysis; Boolean regression analysis; Logit regression analysis.

1. Introduction

In the evaluation of the performances of the university educational system, the search for the determinants of the occupational placement of graduates is an important issue at stake. The issue has been approached with different methodologies (Chiandotto, 2004; Civardi & Zavarrone, 2004). An approach that appears to have an important role is the logit model, based on causal dependence between a response variable and a set of predictors. The dichotomous variable *employed*/*unemployed* is considered as dependent on a set of p predictors

$$y = f(x_1,\dots,x_p).$$

---

[1] This paper is the result of the joint research of the three authors. M. Porcu was responsible for the final editing of Sections 1, 2, 5 and 6, whereas N. Tedesco was responsible for Section 4, and G. Puggioni for Section 3. The authors wish to thank the anonymous referees for their precious suggestions.

Predictors influence the response variable singularly, and in combination with each other. Such responses outline a framework of analysis based on the conceptual category of *causal complexity*. According to Braumoeller (2003), causal complexity is a concept in which "*multiple causes interact with one other, and the way in which they interact is described by the logical operators* and *and* or".

A number of concepts can be considered as special cases of causal complexity, that is:

- multiple conjoint causation: X_1 and X_2 and X_3 produce Y;
- substitutability: X_1 or X_2 or X_3 produce Y;
- contexts: X_2 produces Y but only in the presence of X_1;
- necessary and sufficient conditions: X_1 and X_2 produce Y, either X_1 or X_2 produce Y;
- INUS conditions[2]: (X_1 and X_2) or (X_3 and X_4) produce Y.

Complex causation is a problem for the majority of standard statistical techniques. The problem is that causal complexity implies non-additivity, which arises from the cumulative process of the influence of the independent variables on the response variable. This means that the presence or absence of one independent variable mitigates (or even nullifies) the impact of another. So, from a practical point of view, the problem arises of how to "capture" causal complexity with standard statistical techniques.

A number of methodological proposals have been put forward and much attention has been paid to studying them (Frosini, 2004). With reference to the dichotomous event *employed*/*unemployed*, we observe that in several research studies it has been stated that the event could be considered as the outcome of a process of causal complexity.

2. Modelling the interactions

The logistic regression model is often used to model the probability of a certain event as a function of a set of explanatory variables. The influence of the explanatory variables on the response is considered linear on a logit scale

$$\log(\pi/(1-\pi)) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 .$$

The possible joint effects among covariates are usually taken into account by fitting the product among the variables into the model itself (Hosmer & Lemeshow, 1989):

$$\log(\pi/(1-\pi)) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3\{X_1 \times X_2\} .$$

[2] The acronym INUS, created by Mackie, defines a particular kind of causal relationship. It makes reference to "an insufficient but necessary part of a condition which is itself unnecessary but sufficient for the result" (Braumoeller, 2003).