

University Studies and Employment. An Application of the Principal Strata Approach to Causal Analysis

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Summary. In this paper, we propose a methodology, based on the principal strata approach to causal inference, for assessing the relative effectiveness of two university study programmes with respect to the employment status of their graduates. The analysis relies on a parametric model fitted by maximum likelihood. In that context, we discuss some relevant modelling issues and the implications of the results for policy.

Keywords: Causal effects; Effectiveness; Employment; Principal strata.

1. Students’ propensity for employment

Traditional analyses of the effect of study programmes on employment (also called *external effectiveness analyses*) are performed on the sole basis of graduated students, neglecting the fact that the students who are able to graduate in a programme are in principle different from those who are able to graduate in another one. In other words, two programmes could select different kinds of students with specific propensity for employment.

The analysis of the employment of graduates mixes the “direct” effect of the study programme on the employment status with the “indirect” effect through the graduation status. The possibility to disentangle the two effects could be important from a political point of view. For example, if there is a direct effect on employment, then the programme with smaller effectiveness should try to adapt its contents in order to match labour market requirements.

If, instead, the occupational success of a programme is merely due to different selection criteria of the university career (e.g., one programme is more difficult than the other one and thus selects better students), the problem becomes an issue of educational policy. We should evaluate whether it is desir-

able for the society to graduate students with low ability or to allow the existence of study programmes with different difficulty levels.

To study the direct effect of programmes on employment, avoiding the possible bias caused by different graduation processes, it is necessary to envisage a joint study of graduation and employment. In this respect, a convenient framework is that of principal stratification (Frankgakis & Rubin, 2002), a development of the potential outcomes approach to causal inference (Rubin, 1974). Barnard *et al.* (2003) recently used the framework of principal stratification for the analysis of a complex randomized experiment in the educational context.

In the following, the *treatment variable* is the degree programme, while the *intermediate (post-treatment) variable* defining the principal strata is the graduation status (graduated or not). The key point is that if a student does not graduate, the *outcome variable*, that is the employment status, cannot be defined for assessing the external effectiveness of a given programme. This is an example of the so-called *censoring by death* (Zhang & Rubin, 2003).

The present analysis is limited to the comparison of two study programmes. The extension to three or more degree programmes entails some technical difficulties, but the conceptual framework would remain unaltered.

We compare the programmes of Economics and Political Science of the University of Florence, which are supposed to be similar with respect to the contents of the courses and to the job market opportunities. In the light of this similarity, the choice of a student to enrol in a programme should be weakly related to unobserved characteristics that potentially affect also graduation and employment status, so the ignorability assumption discussed later seems reasonable.

The paper is organised as follows. Section 2 describes the data, while Section 3 outlines the principal strata framework and the probabilistic structure used to model the data at hand. Section 4 describes the model fitting and shows the main results. Section 5 concludes the paper with some remarks.

2. The data

A joint analysis of the academic careers and job opportunities of university students requires the merging of two data sources: an administrative database of a cohort of freshmen and survey data on employment of the graduates belonging to that cohort. The two sources are: (i) the administrative database of the 1992 cohort of freshmen enrolled in the two programmes to be compared; and (ii) three surveys on the occupational status of the graduates of the years 1998, 1999 and 2000, respectively. The matriculation number is used to merge the datasets.

Overall, 1941 freshmen belong to the examined 1992 cohort: 1068 enrolled in Economics and 873 in Political Science.