

University Choices and Work Destinies in Italy¹

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Summary. The need to match academic education with the ‘know how’ required by the labour market may give birth to both co-operation between universities and enterprises, and to ‘flexible’ academic curricula. Students can choose from a wide range of University degrees, and within each program can choose the applicative field/major and opt for a short work experience, the internship. The feedback from the university-enterprises interaction may be observed in graduates’ job opportunities, since they constitute the third pole in a triad of changing relationship. The case of the Faculty of Statistical Sciences at the University of Milan – Bicocca, in the academic years from 1998/99 to 2002/2003, allows one to identify patterns in undergraduates’ educational strategies and poses questions as to the relationship between academic knowledge, individual expectations and actual experiences at work.

Keywords: Competences; Transition times; Non-metric individual differences.

1. Academic and entrepreneurial perspectives

The weakening self-governance of the university system, in favour of the labour market, has raised questions about the usefulness of undergraduate studies with regard to professional requirements (Ottaviani, 2004). The consequent adjustment process gave birth to experiences of co-operation between universities and enterprises, which has put into motion a process that favours some disciplinary areas.

The traditional hiatus between theoretical and applicative disciplines allows the latter a ready and flexible fine-tuning adaptation of curricula, *via* the inclu-

¹ Sections 1 and 4 were jointly written by F. Crippa and P. Mariani, Sections 2 e 3 by F. Crippa.

sion in the undergraduate education on the job experiences, hence merging the academic and the entrepreneurial perspectives.

In the creation of a professional identity, this experience widens the students' range of choices and may affect their means entering the labour market: so it is possible to calculate multiple career paths arising from specific choices, in terms of their external efficacy² (Fabbris, 2003).

Our study focuses on a particular case: in accordance with the guidelines for university/enterprises interactions, the Faculty of Statistics at the University of Milan-Bicocca includes forms of job training (*internship*) at selected companies' sites in its curricula, under both academic and corporate supervision.

Ever since the so called "3+2" reform, that started in 2001, some undergraduate credits can be acquired for periods of training no less than three months, as well as introducing students into the labour market. This is particularly relevant for statisticians, whose qualifications are still not well defined in the Italian labour force scenario, with a gap between an offer of 1,862 positions for statisticians in 2004³ and 1,287 graduates in Statistical Sciences in 2003 (Unioncamere-Ministero del lavoro e delle politiche sociali, 2004).

In order to improve its services, a first survey on the Faculty outcomes was carried out in the Academic Year (A.Y.) 2000-2001 (Martini, 1997), thereafter replicated every academic year, named 'Statisticians and Work'. In 2003, it was devoted to the Faculty graduates' work situations.

Data collection was conducted in November 2003 by means of telephone interviews regarding curricular and professional characteristic of the 300 graduates at the Faculty of Statistics, University of Milan-Bicocca from A.Y. 1988/89 to A.Y. 2002/2003, using lists of former students provided by administrative offices⁴. The response rate was 76.7%.

Each interviewee, in addition to the characteristics of his course of studies, provided information on the qualifications gained during her/his educational experience, such as internships, masters or other specialisations believed to be relevant to occupational opportunities. The occupational status at the time of the interview was classified as employed, unemployed and in search of first employment. In addition, it was pinpointed whether any kind of employment was entered into prior to graduation.

On the subject of present profession, questions focused on channels and length of job search, activity branches, whether self-employed or on a tempo-

² Average waiting times before occupation, apart possible *post lauream* experiences (such as internships), may be considered indices of external effectiveness of education (Fabbris, 2003).

³ Estimates of the Excelsior Information System.

⁴ Data collection, retrospective dating November 2003, includes more than ten cohorts and spans across a time interval with changing market conditions. Thanks to the favourable conditions of the labour market in Lombardy in these years, such sources of heterogeneity are, at least partially, mitigated.

rary contract and to what extent the academic knowledge was utilised, and level of job satisfaction.

2. From graduation to work

Descriptive summaries of the data indicate a high rate of employment, namely 89.9% of the subjects under investigation, even before graduation (37.4%) and generally with stable, long lasting contracts (60.3%). An internship was performed by approximately 50% of persons and, for about half of them, leads to a professional position, commensurate for a graduate. Furthermore, the Faculty's Internship Office is referred to often, directly, by enterprises, so that the university adds to its formative function the role of facilitator in the transition to work, representing up to 36.7% of entrants in the labour market.

The present employment position is regarded as befitting their academic degree by 71.5% of subjects; only half of them, however, reckon their functions pertain exclusively to a degree in Statistics, whereas 45.7% think they pertain to other scientific branches, and 5% to any degree. In line with this evidence, specific competences acquired at university are linked to the requirements of the job in the opinion of 66.8% of the graduates, while for the others at least some of their competences are redundant.

As a matter of fact, descriptive statistics play a large role in routine corporate work (66.7%, multiple answers), multivariate analysis absorbs a substantial area (25.7%) while, on the contrary, statistical inference, econometrics and time series analysis are rarely used (respectively, 15.2%, 9.9% 3.9%). The gap between the material studied and effectively used does not seem to discourage newly-graduated statisticians, as they consider themselves satisfied in their professional positions, even if not enthusiastic (Table 1). Neither the graduates express an immediate goal of job improvement, being low the percentage wishing to look for a new job in the next three years (19.1%).

Table 1. Satisfaction for the current profession (graduates in Statistical Sciences at the University of Milan – Bicocca employed in November 2003, percent values)

<i>Satisfaction regarding</i>	<i>Very</i>	<i>Fair</i>	<i>A little</i>	<i>Not at all</i>
<i>career perspective</i>	16.8	53.6	19.9	9.7
<i>tasks</i>	26.8	52.0	15.7	5.6
<i>permanence in the position</i>	36.9	29.8	21.2	12.1
<i>wage</i>	18.5	55.9	18.5	7.2
<i>autonomy</i>	45.2	44.7	8.1	2.0
<i>degree of responsibilities</i>	41.1	46.2	10.7	2.0

2.1 Duration in the transition to current professions

Approximately one third of interviewees entered their present job before graduation, 36.4% of whom being employed in the same company which offered them an internship. The internship achieves the value of a substitute for the first trial months typical of many standard contracts in Italy, but free of bureaucratic and administrative red tape.

The remaining subjects were asked how long they waited since they started searching for and when they actually found employed in their current job. Search time for entering the labour market are estimated only in relation to subjects unemployed at graduation, by means of non-parametric methods for study of event history (EHA - *Event History Analysis*), applying actuarial methods (life tables) for discrete failure time variables and assuming the trimester as the time unit. One of EHA purposes⁵ is to estimate the risk of experiencing a certain event and to explain it as a function of a set of covariates (Cox, 1972, Blossfeld & Rower, 2002). In order to avoid inflated estimates, durations for current job searches exclude the military service for males and any kind of *post lauream* learning experience.

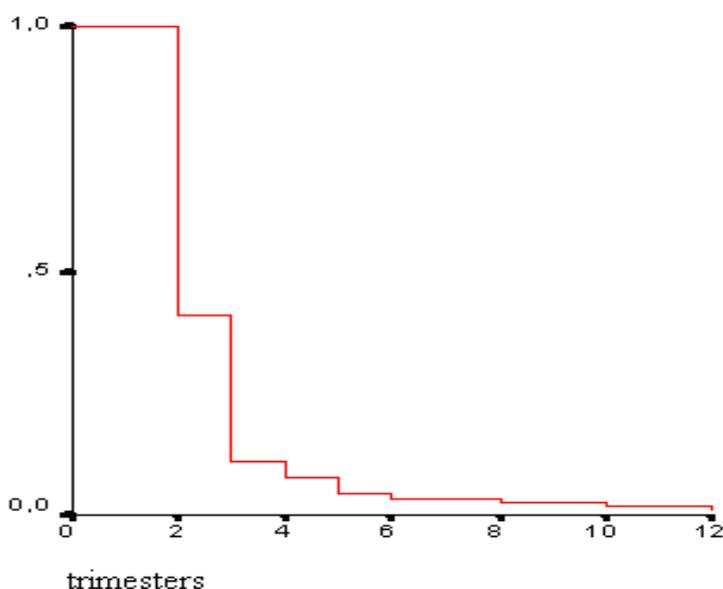


Fig. 1. Survival function in the unemployed status estimated according to the actuarial method (graduates in Statistics from the University of Milan–Bicocca unemployed at graduation)

⁵ In fact, its designation varies in relation to the disciplinary field it is applied to; henceforth it is meant as a synonymous of *hazard models*.

The economy in the metropolitan area is flourishing, with good chances of work, giving the overall survival function its expected ‘L’ shape (Figure 1). The probability of entering the current position equals 0.59 after six months, 0.80 after nine months, and 0.92 after one year, while the median time is five and a half months.

2.2 Educational choices and transition times

Academic titles were grouped according to both the length of the course of study (two-year and three-year diploma, and four-year ‘laurea’ programme before the ministerial reform, three-year bachelor programme afterwards⁶) and the disciplinary field (economic, demographic, or purely statistical). In each disciplinary field, students can perform an internship, whilst after graduation she/he can follow *post lauream* courses or work/study abroad.

The differential impact on the labour market, resulting from the range of undergraduate choices, may be transformed into the estimation of differential entry timing for each value of a covariate. In our case, the violation of the assumption of proportional hazard functions implies that the relative risk (the ratio of risks for two distinct values of the same covariate) is not constant in time and thus the semi-parametric Cox model may not be applied.

In order to perform such differential analysis, stratification for academic title, disciplinary field, and both has been carried out, so as to compare stratified survival tables (Blossfeld & Rohwer, 2002).

When hazard differs from one group to another, it needs not to be significantly homogeneous. The statistical test for verifying the equality of risk among strata, applied here in Gehan version, is:

$$\chi^2_{(k-1)} = \sum_{j=1}^J \frac{\omega_j [D_j - E(D_j)]^2}{\omega_j^2 \text{var}(D_j)} \quad (1)$$

where:

- j ($j=1,2,\dots,J$) is the j^{th} survival table or the j^{th} stratum,
- ω_j are weights, equal to 1 in log-rank test and to the number of subjects at risk of experiencing the event in Gehan test (or generalized Wilcoxon test),
- D_j is the observed number of entries in current professions,
- $E(D_j)$ is the expected number of entries in current professions.

Results provide evidence that the disciplinary choice renders a degree more expendable, particularly when the economic-statistics field and the purely statistical one are compared (Figure 2)⁷. No indicators are found in other direc-

⁶ At the date of the survey, the graduate courses of studies have not been introduced long enough to be concluded by any students.

⁷ Unfortunately, the demographic-social field is not directly comparable as it was the only one at the Faculty foundation and the others offered only some years later.

tions: the internship, the kind of academic title or the software sophistication generate respectively analogous effects. In replicating the survey, as well as suitable missing data treatment, it would be a great advantage to adopt specific questionnaires, such as the *Event History Calendar interviewing* (Conway, 1996) in order to exploit the information intensively.

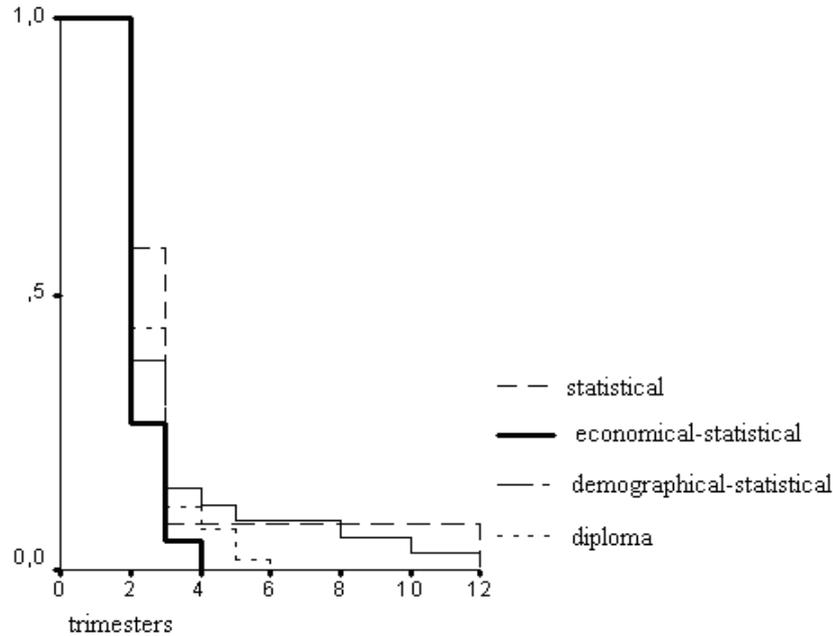


Figure 2. Survival functions in the unemployed status for each disciplinary field, estimated according to the actuarial method (graduates in Statistics from the University of Milan – Bicocca unemployed at graduation)

3. The graduate statistician in the corporate world

A global view of the qualifications and skills that newly graduated statisticians put into practise in their professional life can be achieved by means of comparative analysis, after quantifying categorical variables through ‘optimal scaling’. This procedure projects categories and qualitative scores on a continuum, in order to process quantitative data.

Let $\mathbf{Y}_{n \times m}$ be the observational matrix for n subjects and m variables Y_j ($j=1,2,\dots,m$). A variable assumes k_h categories ($h=1,2,\dots,K_j$). Let 1 or 0 be the value of x_{jh} , whether the i^{th} subject ($i=1,2,\dots,n$) shows or not the h^{th} value on variable Y_j . A vector x_{jh} is generated by assigning these values to a subject. Iterating this process for all K_j values of variables Y_j , the complete indicator ma-

trix X_j is obtained. Extending the procedure to all m variables, matrix $X=(X_1, X_2, \dots, X_m)$ is obtained. The scaling parameters for variable Y_j , $\phi_j=(\phi_{j1}, \phi_{j2}, \dots, \phi_{jkj})$, permit the correspondence of X_j with X^*_j as a 'scaled' value of the i^{th} subject for the j^{th} variable:

$$x^*_{ij} = \sum_h \phi_{jh} x_{ijh} \quad (2)$$

and therefore allow one to compute the individual score matrix for scaled variables $X^*=(X^*_1, X^*_2, \dots, X^*_m)$.

Certain scaling techniques can be performed while applying a multivariate statistical method, without any distributive assumptions for the variables involved. In our case, categorical principal component analysis (CATPCA) is applied to ordinal data: alternating least squares (De Leeuw *et al.*, 1976) are utilized as an optimal scaling method for the estimation of the covariance of quantified categorical data.

3.1 Just one statistician or many statisticians?

The dimensional reduction of the data provides three factors, linked to the dynamics of entering the labour market (Table 2).

The first dimension represents formal educational qualifications as determined by the academy, such as the type of title, the disciplinary field and final graduation marks. The second represents specialized competencies actually applied in an enterprise during the first years of work, in terms of knowledge, both theoretical and applicative. The two components have equal weights and

Table 2. Factor loadings^a and reliability of the model (graduates in Statistical Sciences at the University of Milano – Bicocca employed in November 2003)

<i>Aspects</i>	<i>Dimensions</i>		
	<i>1</i>	<i>2</i>	<i>3</i>
<i>Software</i>	0.376	0.815	-0.191
<i>Statistical methodology</i>	0.275	0.774	-0.160
<i>Waiting time</i>	-0.188	0.001	0.709
<i>Entry channel</i>	0.161	0.314	0.839
<i>Graduation mark</i>	0.578	0.259	0.120
<i>Academic title</i>	1.015	- 0.352	0.027
<i>Disciplinary field</i>	1.010	- 0.359	0.017
<i>Model summary: dimensions</i>	<i>Cronbach's Alfa</i>	<i>Explained variance / total variance</i>	
<i>1</i>	0.729	0.473	
<i>2</i>	0.473	0.299	
<i>3</i>	0.259	0.228	

^a Loadings refer to the quantification of each value of a variable, expressing the incidence of such quantification on the detected dimensions, in terms of linear regression. Increases in weight correspond to an increasing association with the dimension.

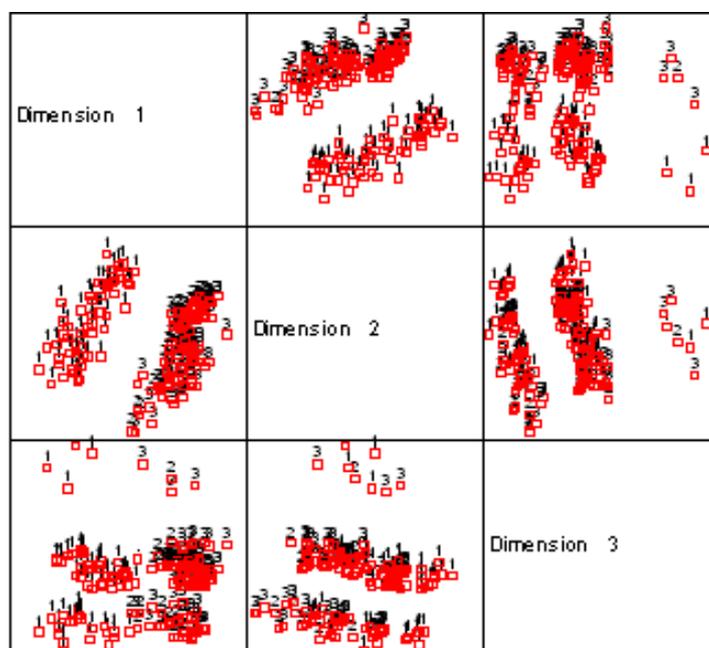


Figure 3. Graphical representation of neo statisticians (graduates in Statistics from the University of Milan – Bicocca employed at interview)

Subjects, represented in each of the first quadrant of the Cartesian plane, can be distinguished according to study programme, 1=diploma, 2= three-year bachelor, 3= four-year 'laurea'.

overlapping graphical representation, highlighting the absence of any distinction between 'theory and praxis' in the working environment. The third factor affects the network graduate statisticians use in looking for a job.

Altogether, the three dimensions adequately explain the characteristics of the employed subjects, as the value of Cronbach's alpha⁸, 0.956, demonstrates.

The projection of individual CATPCA co-ordinates on the Cartesian plane indicates the presence of two groups (Figure 3), a first one composed of strictly job-oriented diplomas, and a second one in which three-year and four-year bachelor degree are barely distinguishable. This representation pictures the first set as a sub-par academic experience, somehow of subaltern rank. Three and four-year degrees are very close to each other, hence the so-called "3+2" reform seems to have maintained the same image of the graduate statistician despite the change in duration of the programs.

Actually, the formal description of the 'laurea' corresponds to a slightly higher mastery of complex analytical and computer skills, whilst channels for entering the labour market are the same.

⁸ Cronbach's alfa is an index of internal coherence. It is based on the total eigenvalue and is referred to cardinal variable, either such in origin or scaled.

4. Conclusions

The picture painted so far suggests that students are aware of employers' expectations that they attempt to satisfy by exploiting competences gained at university. In this sense, the internship (particularly if preceding the graduation) is a useful tool for broader co-operation between the study programme and the entrepreneurial world, abetted by the reduced number of students enrolled at the Faculty of Statistics.

The multidisciplinary image of the statistician favours business and economics opportunities, with a more modest requirement in knowledge than the one university provides. Statistical techniques actually used in current job positions seem to confirm a stereotypical academic education veined by speculation that is neglected, at least initially, by enterprises.

On their side, newly graduated statisticians apparently face these situations nonchalantly, with no impact on their overall job satisfaction.

References

- BLOSSFELD H.P., ROHWER G. (2002) *Techniques of Event History Modelling*, 2nd Edition, Laurence Erlbaum associate, London.
- CONWAY M.A. (1996) Autobiographical knowledge and autobiographical memories. In: RUBIN D.C. (ed) *Remembering our Past: Studies in Autobiographical Memory*, Cambridge University Press, New York: 67-93.
- COPPI R., ERBA A. (2002) Prospettive del laureato in statistica sul mercato del lavoro, *Il giornale del SISTAN*, **20**: 14-15.
- COX D. R (1972) Regression models and life tables, *Journal of the Royal Statistical Society (B)*, **34**:187-203.
- DE LEEUW J., YOUNG F., TAKANE Y. (1976) Additive structure in qualitative data: an alternating least squares methods with optimal scaling, *Psychometrika*, **41**: 471-504.
- FABBRIS L. (2003) *Il monitoraggio occupazionale e professionale dei laureati e dei diplomati dell'Università di Padova*, Quaderno Pharos n.6/2003, Università degli studi di Padova, Padova.
- ISTAT (2001-2004) *Università-lavoro. Statistiche per orientarsi*, ISTAT, Roma.
- KIERS H.A.L. (1991) Simple structure in component analysis techniques for mixtures of qualitative and quantitative variables, *Psychometrika*, **56**: 197-212.
- MARTINI M. (1997) Quale cultura per lo sviluppo economico? *Persone e imprese*, **2-3**.
- OTTAVIANI M.G. (2004) Statistici nel mondo del lavoro. Linee guida per la progettazione di un questionario che ne rilevi le competenze nella vita professionale. In: AURELI C.E. (ed) *Strategie metodologiche per lo studio della transizione Università-lavoro*, Cleup, Padova: 311-322.
- UNIONCAMERE - MINISTERO DEL LAVORO E DELLE POLITICHE SOCIALI (1999, 2001, 2004) *Sistema informativo Excelsior*, Unioncamere, Roma.