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"An integrated database and a statistical analysis to evaluate quality in universities"

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1. INTRODUCTION

The evaluation of quality in the university system requires monitoring of different aspects, e.g. general satisfaction of users, teaching, services (library, student services, tutoring, web site and on-line services, etc.), the coherence of the curriculum in respect of the labour market, the successful start of a professional career, etc. Over the last few years the quality evaluation process in Italy has been undertaken in an increasingly structured framework. The first step in the quality evaluation of the University system has been mainly devoted to the construction of efficacy and efficiency indicators and to the set up of a teaching activity evaluation. More recently, by attempting to set up a complete evaluation framework, attention has been devoted to the quality of the entire higher education process and to the employability of the graduates students.

This paper describes the methodological approach undertaken by the University of Bergamo in order to analyse quality in a wide and structured framework. In addition the paper presents some results and data processing hypotheses.

Paragraph 2 describes the characteristics of the data collection methodology. The data collection phase has been carried out within a project common to nine universities (the *STELLA* project by the CILEA consortium). Using various data sources collected within the above mentioned project the authors have developed – as a prototype study – an integrated database of the Bergamo University data.

Paragraph 3 discusses some results obtained from the integrated database. Special attention is devoted to the supply and demand of jobs both during the study period and after graduation. Some descriptive statistics are given and the statistical theoretical model which is starting to be applied to study the quality performance of the university evaluation is briefly described.

At the end of the paper some concluding remarks are made.

2. DATA COLLECTION AND THE INTEGRATED DATABASE

The *STELLA* project, organized by the CILEA consortium, aggregates 9 universities[1] which have decided to collect some basic data useful for university management according to an homogeneous methodology and in a coordinated way. The availability of homogeneous data makes comparability and aggregation of the information at system level possible.

[1] Bergamo, Brescia, Milano Statale, Milano-Bicocca, Insubria, Palermo, Pavia, Pisa, Pisa Sant'Anna.

The objective of the project is the construction of the three following pillar databases.

1) The first refers to the **administrative data** of each university. This database includes most of the information available from the registrar's office of the university for administrative purposes: identificational characteristics of the student (i.e. name, address, registration code), previous studies, examinations and notes, parents' characteristics, birth date, …). Briefly speaking this database describes the student's curriculum performances and some basic socio-economic characterizations. Each university has some specific rules and formats for data definition and data storing; suitable standardization procedures were needed for creating a cross-university homogeneous database; this first database has existed since 2000.

2) The second is a survey-based database. Students at the final examination stage (degree stage) are interviewed: this is a **total survey**. It is a customer satisfaction survey aimed at evaluating the global satisfaction of the student considering the whole period he/she attended university. In addition, other information is collected, for instance regarding work and/or further studies. The survey is continuous; it was started in 2004. The questionnaire is submitted to the students via Web when they are doing their final examinations. The questionnaire is divided into four sections:

A) *General personal data*. Main topics covered are: work experiences attended and experience abroad, knowledge of computers and languages.

B) *Work* at various times (before enrolling at university, during university, at the final examinations); in this section many characteristics of jobs are collected, as well as characteristics of the job wanted by people who are looking for employment.

C) *Family characteristics*.

D) *University evaluation*. This section of the survey is based on a set of questions which represents a compulsory survey in Italy, since results are sent to the ministry of education.

The questionnaire has been prepared by the CNVSU (*National Committee for the University System Evaluation*). This part of the questionnaire is a customer satisfaction survey; students are asked to evaluate their whole university career as well as evaluate the library and other services. In addition, attention is paid to work experience before going to university, current position regarding work and if the student is satisfied with his/her job and the job they want in the future.

3) The third is also survey-based. This is a **sampling survey**, whose target population is people who graduated 15-18 months before the interview. The survey aims at collecting information about graduates' activities (work, job hunting, advanced studies[2], ...). If they are working the survey investigates many aspects related to the job and to the usefulness of university studies. It is a telephone survey that runs twice a year every year; sampling is carried out on an updated group of graduates. The survey we consider was carried out in the second semester of 2005. The sample has been extracted from the first semester 2004 graduates.

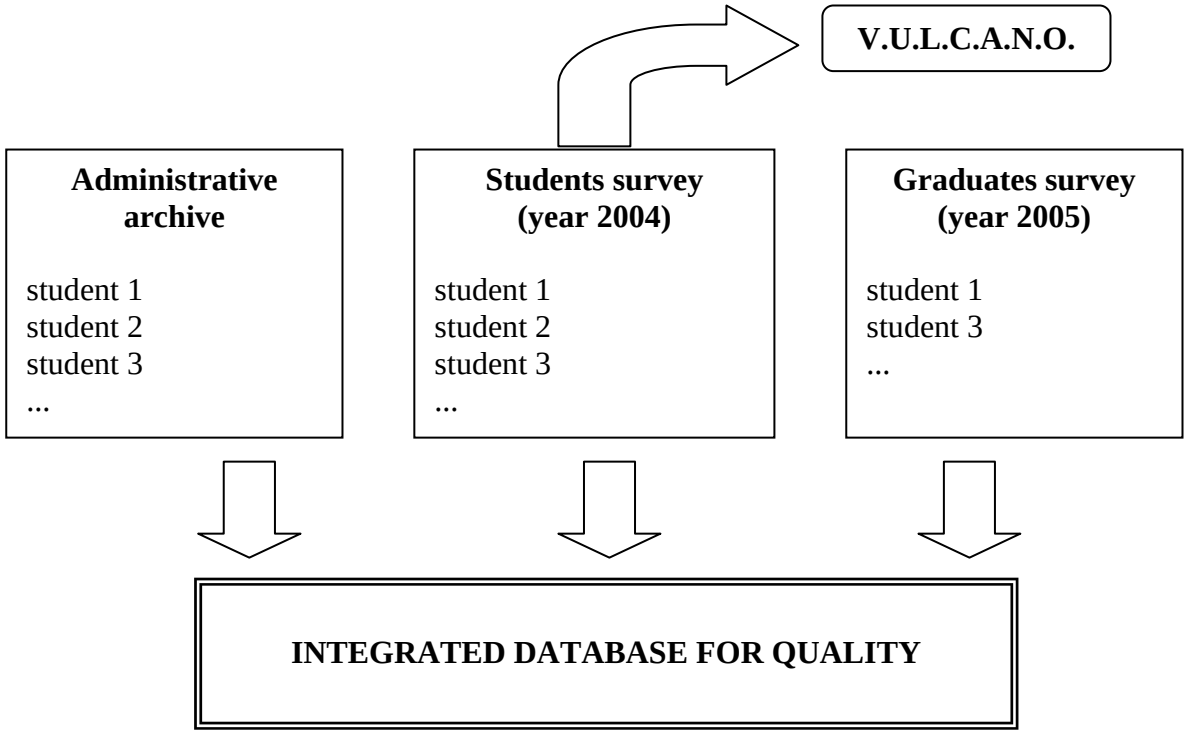
The three databases presented provide very useful information for university management and for quality evaluation since they fully describe the behaviour of the subjects as input and output of the higher education process; therefore they consider students as customers of the university. Moreover as a secondary product of the survey in point 2 (survey at final examinations) some basic information is extracted from the database (i.e. knowledge of languages, computer competence and

[2] The Italian University system is organized with a three year academic career (*Laurea triennale*); only after this period a further two year period of study can be followed (*Laurea specialistica*). Since this new law regarding the university system had only been recently applied, when we started the survey only graduates from the *Laurea triennale* were interviewed. Therefore it is possible that some graduates have not entered the labour market and are still at university following the two-year course (*Laurea specialistica*).

so on). This information is useful for building a basic curriculum for graduates. These data automatically generate a graduates' curricula database, currently available for companies, firms, etc. (V.U.L.C.A.N.O.[3]).

In the Bergamo integrated database 262 records – corresponding to the sample size of the survey on graduates (sample from graduates in the first semester of 2004) – are fully integrated. 1.402 records are partially integrated, i.e. the survey on students prior to final examinations (2004) is linked to the administrative database information.

Due to the relevance of the three databases, in our prototypal study we integrated the available information for statistical analysis purposes. The archives were matched exactly since the surveys were not anonymous. Obviously confidentiality has been assured, since data are used for statistical purposes and are presented only in an aggregated form. Graph 1 synthetizes the integrated database structure.



Graph 1. *Integrated database for quality in universities.*

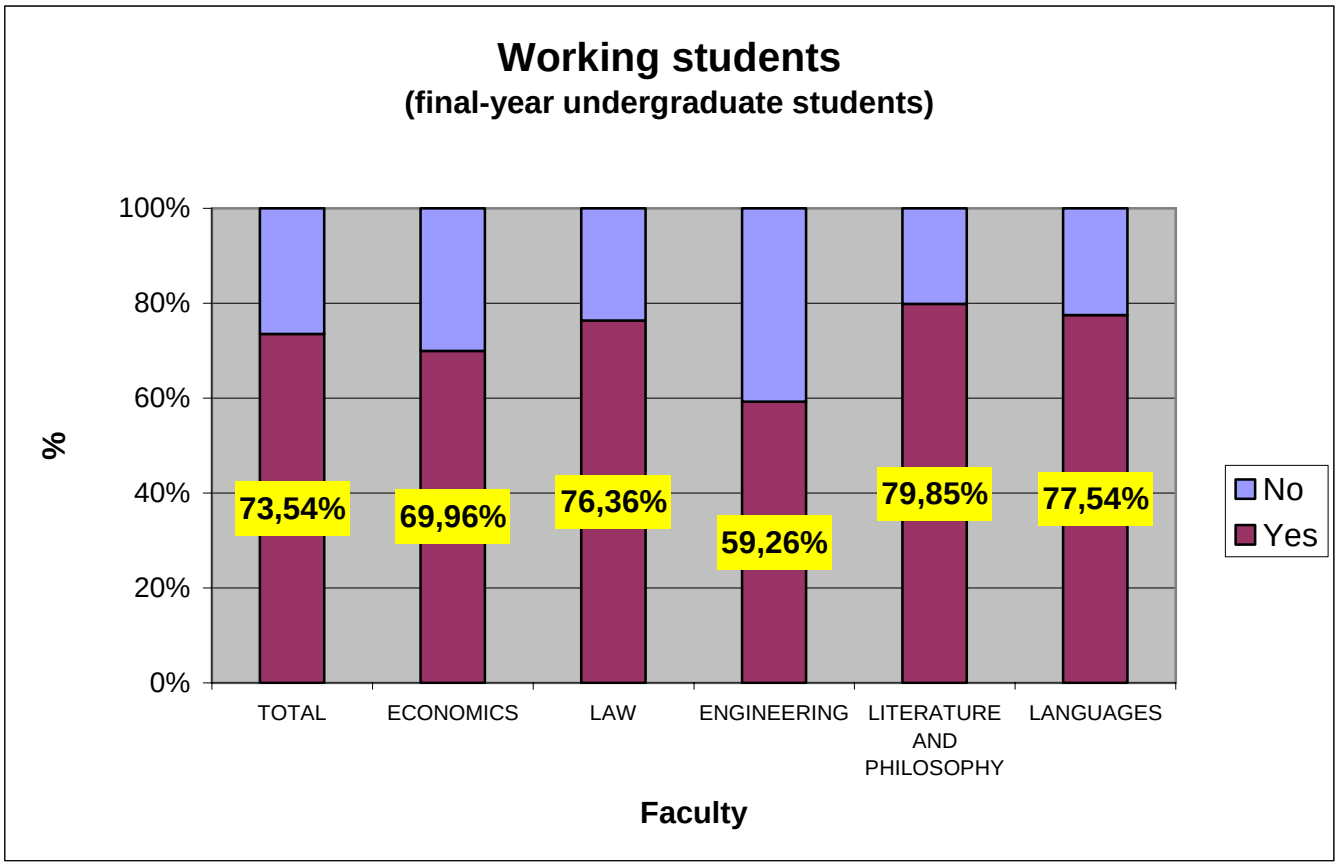
3. SOME RESULTS

The integrated database makes interesting cross tabulations possible among curricula behaviour variables and variables describing various aspects of the student's job. In this paper we do not enter into detailed analyses (see Biffignandi S., Toninelli D., in press).

Here we describe some basic results by focusing on working activity over a period of time: before registration at university till 18 months after graduation. For purposes of synthesis, we

[3] Vetrina Universitaria Laureati con Curricula per le Aziende Navigabili On-line (V.U.L.C.A.N.O.). *Database containing graduates curricula for reference by prospective employers.*

mainly analyse temporal pattern of the student's working behaviour while at university on an aggregated level without discussing data by faculty. The reader is advised that there is variability in the data categorized by faculty. As an example, some results by faculty are shown in the following graph. Taking into consideration students who are working just before they take their final examinations, high rates of working students are found in the following faculties: Law (76%), Languages (77%), Literature and Philosophy (80%). On the contrary, Economics (70%) and particularly Engineering (59%) have lower rates.



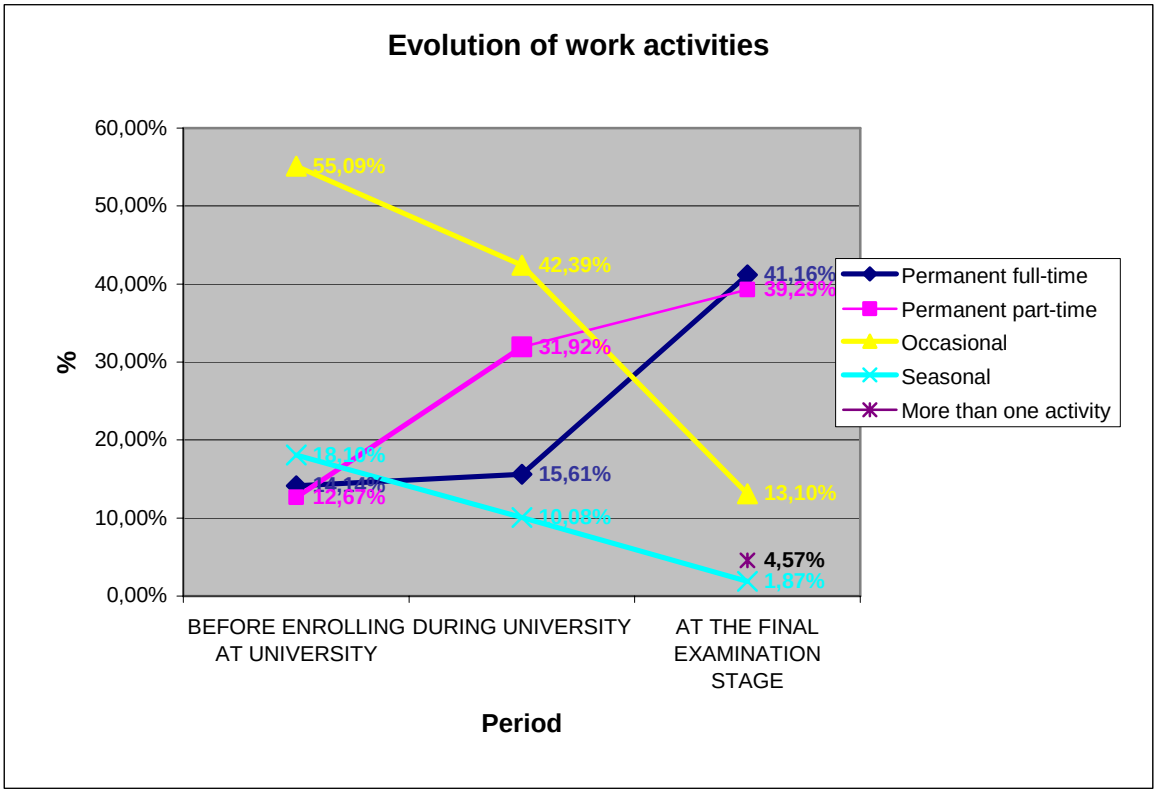
Graph 2. *Percentage of working students (by faculty).*
Source: survey on students before the final examinations (2004).

Considering now the temporal dynamic at aggregated university level, 1.031 students worked before graduation. 85,7% of them were already working when they started university; 98,2% worked during the whole period of their university studies.

These data confirm two interesting facts:

a) people who already have a job and decide to study for a degree tend to keep their job;
b) students are entering the labour market even during their studies: this probably explains why the percentage of working students increases by 12.4%.

Within this general pattern, the role of various typologies of activities from the input stage to the output phase changes. Graph 3 shows the dynamics of the activity typologies over a period of time.



Graph 3. *Work activity typologies at different times (before registration at the university, during university, at the final examination stage). Source: survey on students before the final examination (2004).*

Full time jobs have approximately the same weight at the before-enrolment stage and during university; they tend to increase at the graduation stage. This result confirms that in the university system a quota of students is represented by students who decide to graduate for career purposes and therefore they do not leave their job for university studies. This behaviour does obviously not favour attendance of university courses and intensive study.

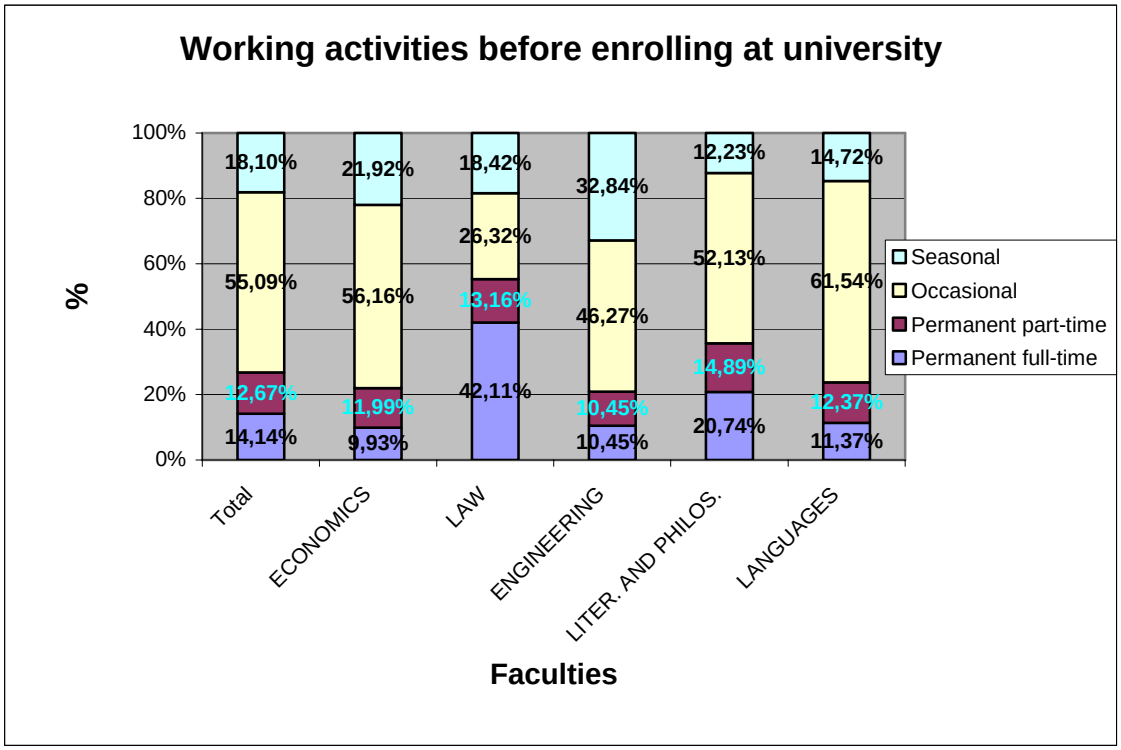
At the degree stage the percentage of students who are in full-time work more than doubles: in comparison to pre-university and during university the quota is about 15% while at graduation it is 41,2%. It appears that students try to enter the labour market on a regular basis as soon as possible, without waiting for graduation.

A relevant role and a positive trend is found for the permanent part-time activities: this type of contract increases from a percentage equal to 12,67% to 39,29% at the graduation stage. This typology of working activities is continuously growing since it is a good compromise between having a permanent job and some time for studying.

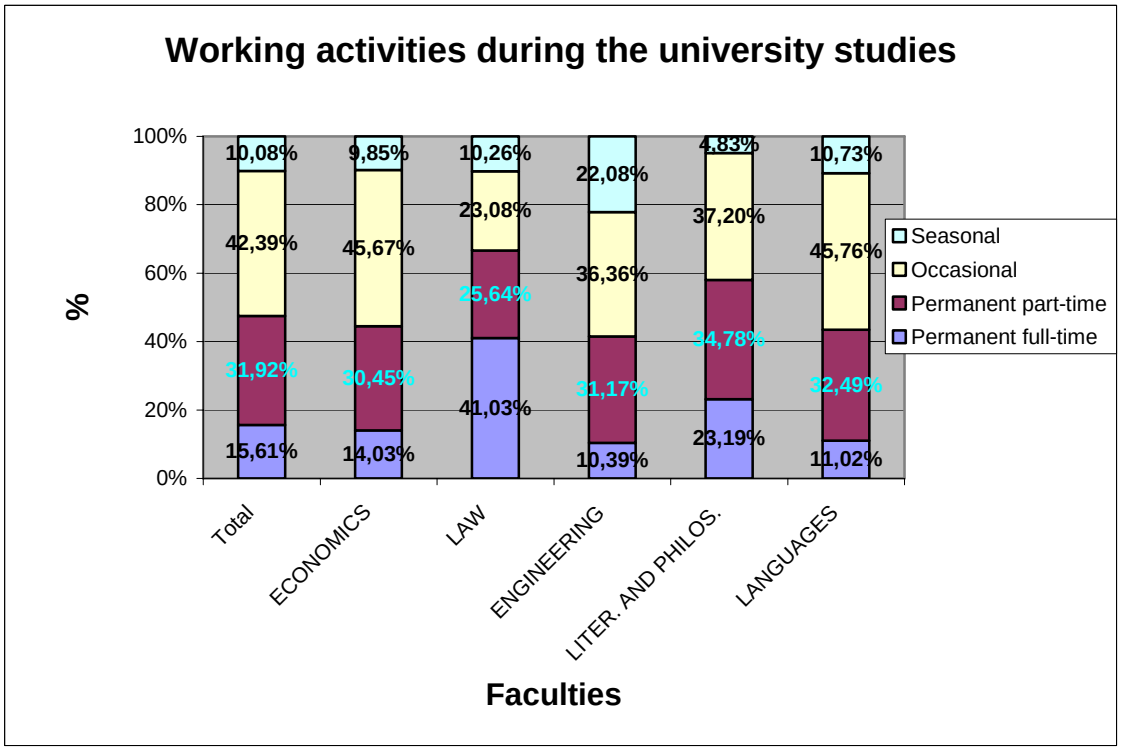
Studying the data of Graph 3 in depth, the relevance of occasional contracts is decreasing (from 55,09% before starting university, to 42,39% during university and to 13% just before taking the final examinations). A similar pattern is found in seasonal activities (from 18,1% to 10,08%, to 1,87%). The type of activities carried out at various stages of the higher education career shows differences if we consider the data by faculty (Graphs 4, 5 and 6).

The faculty of Economics registers quite a high weight for occasional contracts (56,16% before entering university, 45,67% during university); Law registers a relevant weight of full time permanent contracts (42,11% before university, 41,03% during university). Engineering shows quite an important percentage of seasonal workers; the percentage decreases during the university course (from 32,84% to 22,08%). As regards humanistic faculties, Literature and Philosophy shows a relevant percentage of permanent part-time contracts, probably due to teaching activities (20,74%

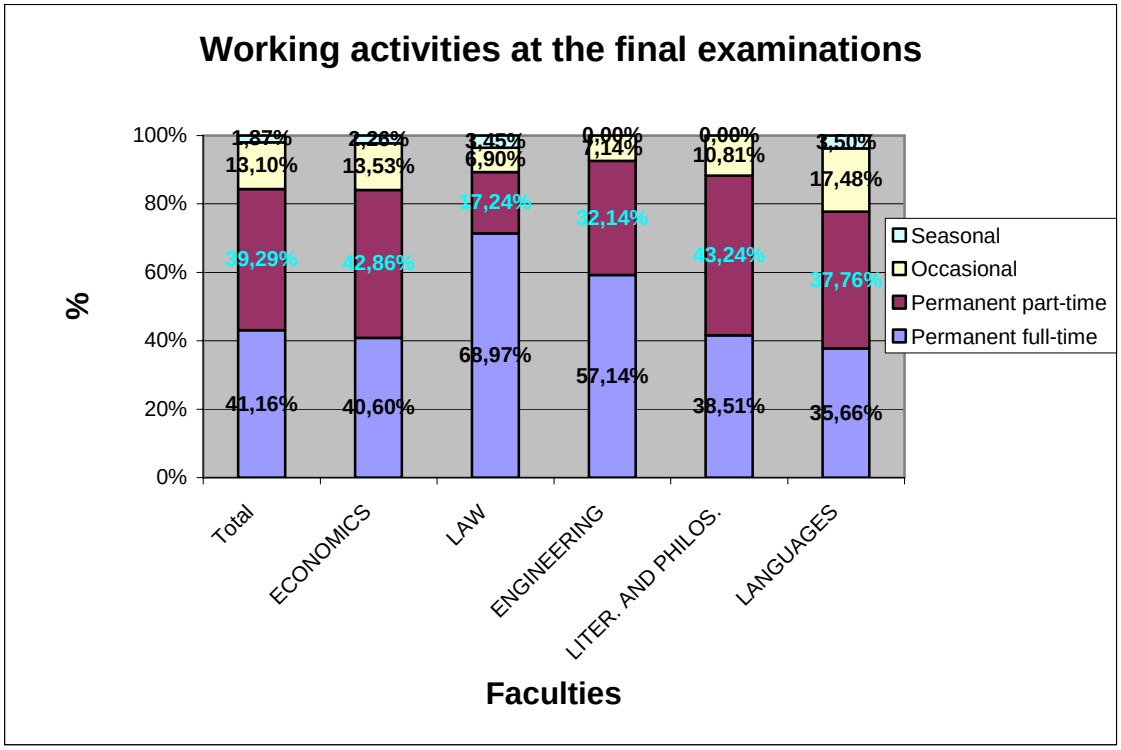
before university, 23,19% during university). Occasional contracts are especially high in the Languages faculty (61,54% before university and 45,76% during university).



Graph 4. *Working activities before enrolment: distribution of typologies by faculty. Source: survey on students before final examinations (2004).*



Graph 5. *Working activities during university: distribution of typologies by faculty. Source: survey on students before final examinations (2004).*



Graph 6. *Working activities at final examinations: distribution of typologies by faculty. Source: survey on students at final examinations (2004).*

Gap analysis is a useful indicator for comparing the role of various types of contracts over time. Tab. 1 compares (in percentage points) differences between the weight of each contract typology before enrolment and during university; Tab. 2 compares the latter situation to the final examination stage.

GAP ANALYSIS: *BEFORE ENROLMENT and DURING UNIVERSITY*

	Total	*ECONOMICS*	*LAW*	*ENGINEERING*	*LITERATURE / PHILOSOPHY*	*LANGUAGES*
Permanent full-time	1,47	4,10	-1,08	-0,06	2,44	-0,35
Permanent part-time	19,25	18,46	12,48	20,72	19,89	20,11
Occasional	-12,70	-10,49	-3,24	-9,91	-14,93	-15,78
Seasonal	-8,02	-12,07	-8,16	-10,76	-7,40	-3,98
Total permanent	20,72	22,56	11,40	20,66	22,33	19,76

Tab. 1. *Gap (percentage points) by contract typology and faculty: comparison between before enrolling and during university. Source: students at final examinations survey (2004).*

Permanent activities are increasing of about 20-22 percentage points (excepted Law, which increase is equal to 11.4 percentage points). The result is probably affected by the situation before enrolment (55,27% is the weight of permanently occupied people before enrolment).

Tab. 2 measures the differences occurring during university. The quota of students working permanently increases by about 33 percentage points at the end of university. The increase is especially high in the Engineering faculty (47,73 points), since students of this faculty have to study

hard during university and only at the end of their course can look for and take up employment. On the contrary, the role of permanent contracts shows only a slight increase (+19,54 points) in Law as previously it was particularly high.

GAP ANALYSIS: *DURING UNIVERSITY and BEFORE FINAL EXAMINATIONS*

	Total	ECONOMICS	LAW	ENGINEERING	LITERATURE / PHILOSOPHY	LANGUAGES
Permanent full-time	25,55	26,57	27,94	46,75	15,33	24,65
Permanent part-time	7,38	12,41	-8,40	0,97	8,46	5,28
Occasional	-29,29	-32,14	-16,18	-29,22	-26,39	-28,28
Seasonal	-8,21	-7,60	-6,81	-22,08	-4,83	-7,24
Total permanent	32,93	38,98	19,54	47,73	23,79	29,92

Tab. 2. *Gap (in percentage points) by contract typology and faculty: comparison between during the studies period and at final examination stage. Source: survey on students at final examination survey (year 2004).*

Looking at post-laureate survey data, the shift to more stable occupational status is evident. 18 months after graduation the distribution of occupational typologies is greatly concentrated in full time (77,8%); part-time occupation (18,8%) is the second most important type of occupation, whereas unstable jobs are rare.

Graduates work typology	%
Full time	**77,8%**
Part-time	**18,8%**
Occasional	**2,1%**
More than one job	**1,4%**
TOTAL	**100,0%**

Tab. 3. *Graduates working activity 18 months post-laureate. Source: graduates survey (2005).*

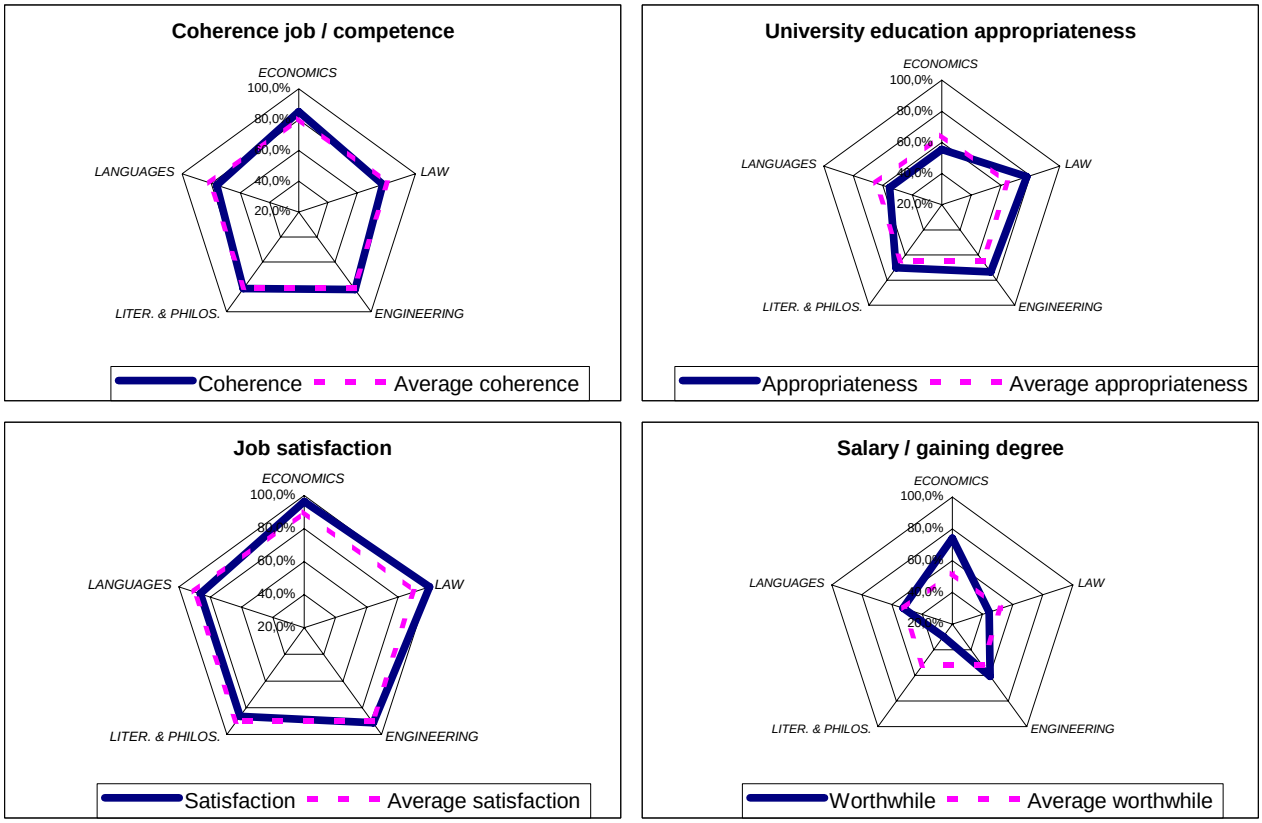
Note that about 60% of graduates (*Laurea triennale*) enter the labour market, whereas about 40% continue their studies (*Laurea specialistica*).

The survey data permit the analysis of some aspects of satisfaction. In order to synthetize some basic results, we analyse the radar graphics by faculty (Graphs 7, 8, 9 and 10).

These graphs show how the degree of job satisfaction differs from faculty to faculty. Four aspects connected to graduates job satisfaction are studied (only graduates in employment are considered): coherence between job and professional competence learned at university, appropriateness of a university education to their jobs, current job satisfaction, the need for a degree. The radar graphs show the percentages of interviewees who answered positively or were satisfied regarding the above mentioned topics.

"Job coherence-competence" and "job satisfaction" differ only slightly by faculty. Students of Economics and Law are the exception: they are slightly more satisfied with their jobs. The "global satisfaction" degree is high: between 86% and 100% of the students interviewed, depending on the faculty. The level of coherence between their competence and job is also very satisfactory: between 76 and 85% of the graduates answered positively. The graphs show variability between faculties and some contrasting satisfaction results especially regarding appropriateness of competence and a

university education. Quite a high level of dissatisfaction appears for salaries with high variability between faculties. Positive evaluation on salaries and the effect of gaining a degree ranges from 29% of the interviewees (Literature and Philosophy students) to 74% (Economics students).



Graphs 7-8-9-10. *Percentages of graduate satisfaction.*
Coherence between job and competence; university education appropriateness;
job satisfaction; salary vs gaining degree worthwhile?
Source: graduate survey (2005).

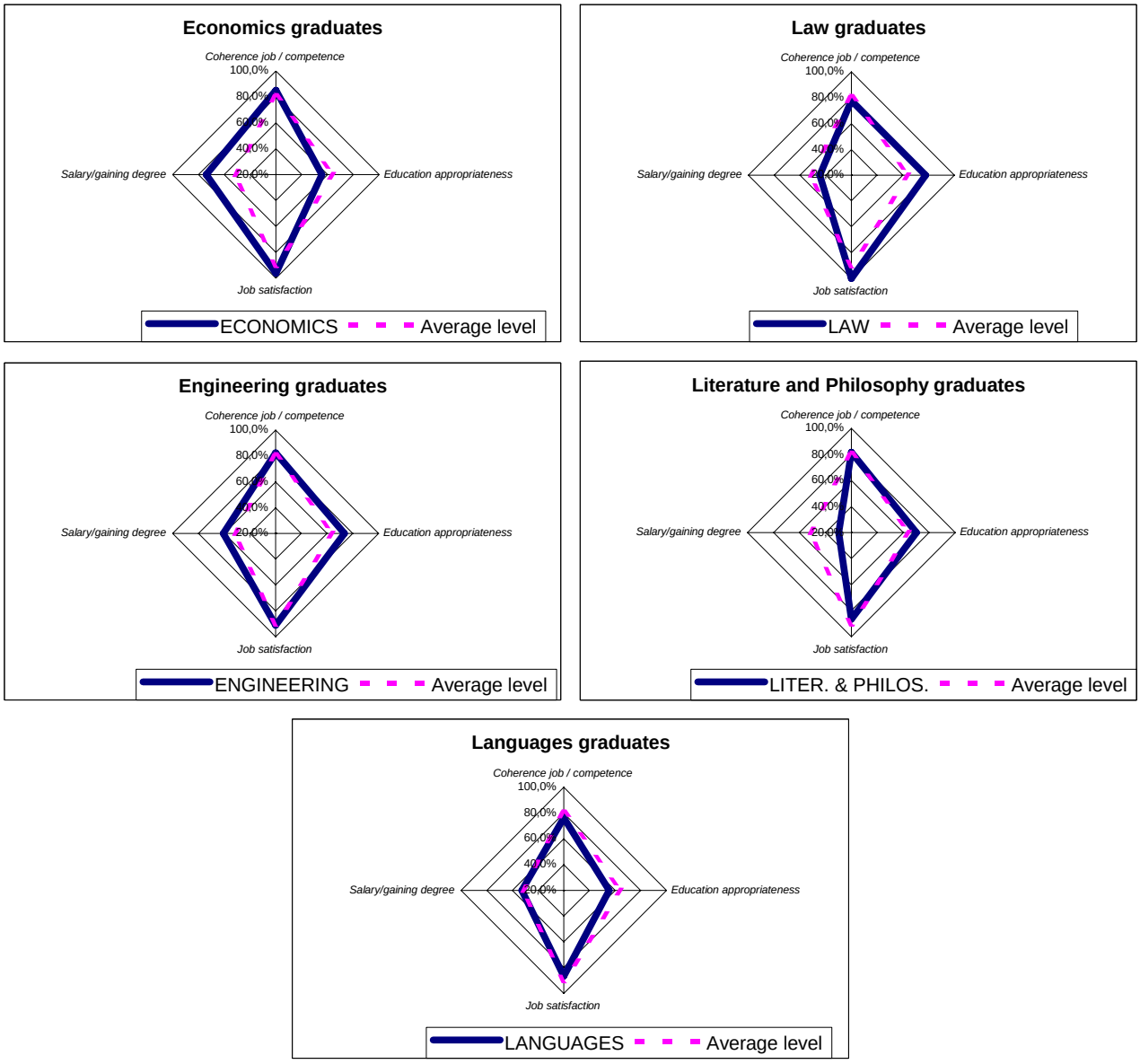
The analysis of customer satisfaction (in this case graduates, both for descriptive results and identification of an explicative model of satisfaction behaviour) requires more articulated data processing. In our research we adopted the following steps of analysis:

a) a graphical descriptive analysis by faculty which aims at highlighting strengths and weaknesses;
b) statistical modelling of a wide set of variables included in the integrated database. The modelling takes into account the full working path of the graduates and some socio-economic and study performance characteristics.

Regarding point a), Graphs 11-12-13-14-15 show the four above mentioned satisfaction variables by faculty.

These graphs allow an immediate comparison of major satisfaction and dissatisfaction points. Salaries appear to be a generalized item of weakness. This weakness is especially serious for Law and Literature; on the contrary, quite a good level of satisfaction appears for Economics. If we look at the other items, the dissatisfaction of the students in Economics on the educational appropriateness appears in contrast with the satisfaction level of the other points. This is probably due to the specific skills of the jobs of graduates 18 months after graduation.

These results confirm the need for modelling satisfaction by using a set of explicative variables.



Graphs 11-12-13-14-15. *Percentage of graduates who are satisfied (by faculty). Coherence between job and competence; university education appropriateness; job satisfaction; salary vs gaining degree worthwhile?. Source: graduate survey (2005)*

Regarding point b), the hypothesis is that satisfaction can depend both on the education process itself and on the individual characteristics of the subjects (socio-economic and school performance variables). The results in terms of satisfaction for different items can be associated with composition of the people interviewed in terms of gender, jobs, pre-university studies, examination results, family background and so on. Therefore, using the integrated database we decided to apply a multilevel logistic model (Goldstein H., 1995; Goldstein H., Healy M. J. R., 1995; Rabash J., Goldstein H., 1994; Snijders T. A. B., Bosker R. J., 1999).

Results of more detailed descriptive statistics based on the integrated database as well as the modelling results are discussed in Biffignandi S., Toninelli D. (in press, 2006).

4. CONCLUDING REMARKS

The prototypal integrated database represents an original and interesting infrastructure for describing and modelling satisfaction causes and finding out information for continuous quality improvement and better competitiveness of the university. This database integrates the elements of students satisfaction and their social-economic profiles and curricula (obtained from the university administration archives) together with the results of the survey on job opportunities for graduates and their placing in the work-place.

The whole set of information is provided according to a harmonized data collection procedure, which assures data comparability across statistical sources and among the universities involved in the STELLA project.

The analysis and modelling carried out on the University of Bergamo shows interesting results for the management and competitiveness of the university. The prototypal database integration, if extended to the other universities, will allow modelling satisfaction and quality aspects (such as job performance) at the university system level (at least for the part of the system which is represented by the universities involved in the project[4]).

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[4] About 24,000 students in each semester graduated from the 9 universities taking part in the project.