The influence of the economic sectors for the business choice of a new hiring

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Abstract The paper aims to identify the presence of different behaviours by recruiters in the new hiring processes varying on the business economic sectors. In particular, the analysis is based on the Education-for-Labour Elicitation from Companies' Attitudes towards University Studies Project involving 471 enterprises operating in Lombardy with 15 or more employees. The preference analysis of the recruiters is carried out using Conjoint Analysis.

Key words: New graduates, Conjoint Analysis, Hiring processes, Economic Sectors.

1 Introduction

This work concerns the comprehension policies about relationships between the enterprises and universities, with reference to the labour market for the new graduates. In particular, the study is based on the multi-centre research, Education-for-Labour Elicitation from Companies' Attitudes towards University Studies (Electus) [2], a research project involving 7 Italian universities. The aims of Electus are various. Firstly, it focus on the identification of an ideal graduate profile for several job positions. Secondly, it works toward some across-the-board skills, universally

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recognized as 'best practices' for a graduate. Finally, the analysis allows to achieve differences and valuations between wage and competencies for new graduates.

The paper is organized as follows. The second section contains the presentation of the statistical method (Conjoint Analysis) and the Mariani-Mussini coefficient of economic valuation. The results of activity sectors CA is showed in the third section. Finally, conclusions and main remarks are discussed in the last part of the paper.

2 Methodology: the Conjoint Analysis and the coefficient of Economic Variation

Conjoint analysis (CA) is a technique widely used to investigate consumer choice behaviour [3]. This behaviour is measured as a function of utility. Usually three different kind of CA are present in literature: Part Worth Model, Vector Linear Model and Ideal Point Model. Since the recruiters' choices are defined on the basis of some qualitative attributes, in this study CA refers to the stated preference model used to obtain part-worth utilities. The aim of this model consists in estimating a utility function (UF) for the characteristics describing several profiles. The UF is defined as follow:

$$U_k = \sum_{s=0}^{n} \beta_s x_{sk} \tag{1}$$

where x_{0k} is equal to 1 and n is the number of all level of attributes which define the combination of a given profile, x_{sk} is the dummy variable that refers to the specific attribute level. As a result, the utility associated with k alternatives (U_k) is obtained by summing the terms $\beta_s x_{sk}$ over all attribute levels, where β_s is the partial change in U_k for the presence of the attribute level s, holding all other variable constants. Usually when CA is performed, all respondents answer to every possible profile. In this experiment the possible profiles obtained from combining every level in a full factorial fashion were so many, so it was necessary to apply an ad-hoc fractional factorial design. According to several criteria [2], an individual random sample of four profiles was administered to each respondent which had to mark them on a scale of 1 to 10. This experimental final design results both orthogonal and balanced.

Part-worth utilities of levels obtained from non-standard CA represents the starting point to re-evaluate the proposed Gross Annual Salary of the job vacancies. Secondly, economic re-evaluation will be carried out through relative importance of attributes in non-standard CA using Mariani-Mussini coefficient of economic valuation [4]. The general formulation of the coefficient is:

$$MI_{ij} = \frac{U_i - U_b}{U_b} * I_j \tag{2}$$

where U_i is the sum of part-worth utility scores associated with the profile i, U_b the sum of utility scores associated with a baseline profile and I_j is the relative importance for the attribute j.

The coefficient MI_{ij} could be also used for estimating the variation in terms of the salary associated to profile i compared to the baseline one. Given the salary associated with the baseline profile π, the coefficient of economic re-evaluation can be expressed as:

$$V_{ij} = MI_{ij} * \pi \tag{3}$$

Variations V_{ij} change in proportion of the I_j, this entails two basic considerations. Firstly, when an attribute has a very high value of importance, V_{ij} assumes higher variations. Secondly, V_{ij} concern attribute variations one at a time, that is to say profile comparisons are possible only varying an attribute, holding fixed all others. Moreover, if the baseline profile is the best/worst one, all coefficients MI_{ij} and all variations V_{ij} will be negative/positive.

3 Application

The survey was conducted in 2015 using CAWI technique. The questionnaire contained two sections: conjoint experiment for the five job positions and general information about the company (demographic questions). The survey involved 5 job positions for the new graduates, but in this paper the focus is on only two positions: HR assistant and Marketing assistant. To specify the candidates' profile, six attributes were used: Field of Study (10 levels), Degree Level (2), Degree Mark (3), English Knowledge (2), Relevant work experience (4), Willigness to Travel on Business (3). After having rated the selected profile and chosen the best one, the entrepreneurs had to propose a Gross Annual Salary for the chosen profile in order to measure the so-called 'willingness to pay' [1].

As far as the Milano-Bicocca research unit is concerned, interviewees were representatives of companies registered on the Portal of Almalaurea for recruitment and linkage, limited to the university site. Final respondents were 471.

When the attention is focused on a single job position, three different CAs are carried out corresponding to the economic sectors of the company to underline potential differences. Three activity sectors has been considered here: services to the industry, personal services and manufacturing. They represent more than 90% of the total of the statistical units.

Output from CA produces an index of importance for each attributes based on the total distribution of the part-worth utility scores. Results for importance of the graduates' competencies are shown in table 1. Variable *Field of Study* is always the most important competence for a graduate with an importance index very close to 50%. Since contributions of importance for other competencies are very residual, only part-worth utilities for Field of Study are displayed in figure 2.

Table 1 Importance Index for attributes

Job Position	**HR Assistant**			**Marketing Assistant**		
Attributes\ Activity sectors	Serv.Ind.	Pers.Serv.	Manufact.	Serv.Ind.	Pers.Serv.	Manufact.
Field of Study	55.58%	52.19%	51.03%	47.03%	57.00%	48.05%
Degree level	1.32%	0.26%	3.50%	0.16%	8.08%	2.97%
Degree Mark	8.59%	11.86%	9.40%	5.19%	7.38%	6.70%
English Knowledge	10.66%	9.44%	16.48%	22.90%	2.23%	19.31%
Relevant work experience	9.50%	17.90%	5.16%	14.78%	18.43%	12.82%
Willingness to travel	14.35%	8.35%	14.43%	9.94%	6.89%	10.14%

For both vacancies, utility scores for variable *Degree level* are very close to 0 for each position, this means that there is no substantial difference for a bachelor or a master degree for a graduate. Variable *Degree Mark* is a competency where best two levels are always preferred, so a medium-high marked degree is preferable among candidates.

For HR assistant position, *English Knowledge* and *Willingness to travel on business* show always the same level as best for each activity sector. After all, it is easy to imagine that companies prefer to employ a candidate available to travel and suitable for communication with foreigners. About *Relevant work experience*, the sectors services for industry and personal services preferred a graduate with regular experiences while for manufacturing activities it is sufficient to have an internship experience.

For Marketing assistant position, for attribute *Relevant work experience*, a graduate with regular experiences is preferred by the sectors manufacturing activities and personal services while a stage is wanted by services for industry.

The attribute *Field of Study* is more complex to analyse since it is less across-the-board and a degree in a field could result the best for a position and the worst for an other one. This is why part-worth utilities for *Field of Study* are the only displayed in graph 2.

There is big difference about a possible ranking among *Field of Study* when two different vacancies are considered. A degree in Psychology optimizes utility respectively for HR Assistant. Otherwise, economics studies represents the best profile considering Marketing Assistant. About activity sectors, two different scenarios are revealed, for HR Assistant, only the sector of personal services maximizes utility scores with a graduate in Law. Otherwise, for Marketing Assistant there is no difference between sectors, Economic studies is the best field, even if Educational Sciences is very close only for personal services sector.

Since respondents had the task to assign the profiles a Gross Annual Salary, in this paper variations of this salary about Field of Study are taking into account. This allows to make a comparison of the coefficient of economic re-evalutaion MI_{ij} and its associated variation V_{ij} through different job positions and activity sectors.

In this application, baseline profile is the best profile which optimizes the total utility, so U_b is the sum of the highest part-worth utilities (plus an intercept) for each

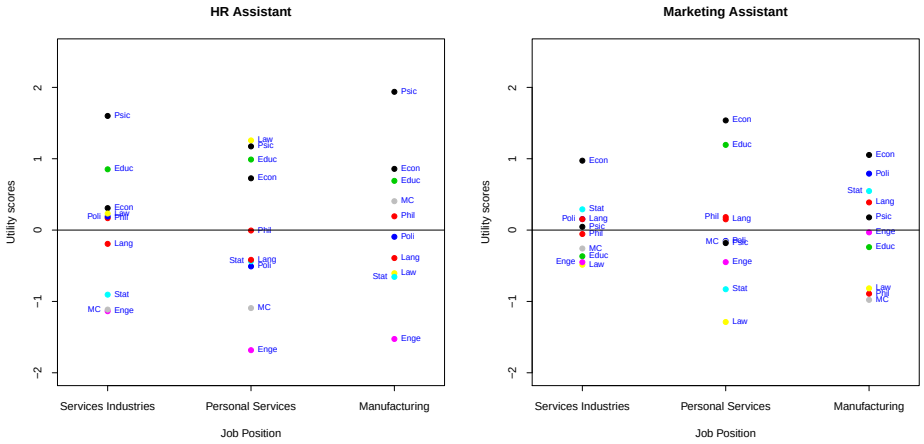

Fig. 1 Part-worth utilities for HR and Marketing assistant for field of study

attribute j. This means that all MI_{ij} coefficients and all variations V_{ij} are negative. Table 2 shows M_{ij} coefficients of economic re-evaluation for Field of Study, as expected each $M_{ij} \leq 0$ and $M_{ij} = 0$ only in correspondence of the best Field of Study for vacancy.

Table 2 M_{ij} coefficients for Field Field of Studyof Study

Job Position	**HR Assistant**			**Marketing Assistant**		
Attributes\ Activity sectors	Serv.Ind.	Pers.Serv.	Manufact.	Serv.Ind.	Pers.Serv.	Manufact.
Philosophy and literature	−10.65%	−8.41%	−10.35%	−8.06%	−11.38%	−14.51%
Educational sciences	−10.00%	−1.78%	−7.40%	−10.51%	−2.88%	−9.64%
Political science/ Sociology	−10.48%	−11.76%	−12.06%	−6.42%	−14.18%	−1.95%
Economics	−9.60%	−3.54%	−6.41%	−%	−%	−%
Law	−10.16%	−%	−15.09%	−11.44%	−23.72%	−13.94%
Statistics	−18.62%	−11.28%	−15.39%	−5.35%	−19.87%	−3.77%
Industrial engineering	−20.34%	−19.58%	−20.55%	−11.15%	−16.68%	−8.10%
Mathematics/ Computer sciences	−20.17%	−15.65%	−13.90%	−9.66%	−14.28%	−15.14%
Psychology	−%	−0.55%	−%	−7.27%	−14.44%	−6.53%
Foreign languages	−13.33%	−11.15%	−13.82%	−6.43%	−11.64%	−4.96%

Comparing the job positions, Field of Study and activity sectors, there is almost a reduction of about a 10% for all graduates different from Psychology for a HR assistant in service for industries. Variations are smaller in personal services sector with minimal differences between Law and Psychology graduates. About Marketing assistant position, M_{ij} coefficients are higher in companies belonging to personal services activity. Otherwise, in manufacturing sector most of the variations are limited to less than 10%.

4 Conclusions

The article proposes the use of a non-standard Conjoint Analysis in detecting different behaviours by recruiters in the new hiring processes varying on the business economic sectors using data from the Electus project. Moreover, a new evaluation of the Gross Annual Salary is proposed using the Mariani-Mussini index derived from utility scores. Analysis involves 2 different job positions, HR and Marketing Assistant and 3 activity sectors, services to the industry, personal services and manufacturing. Results show how all graduates' competencies are across-the-board, except for *Field of Study*. English knowledge, medium or high level for degree mark, relevant or stage work experience and willingness to travel are the most important required attributes for a graduate. About *Field of Study*, a degree in Psychology or Law is most attractive for entrepreneurs searching for a HR assistant. Otherwise, a graduate in Economics is preferred for a Marketing assistant position. The use of economic evaluation index shows reduction from ideal profile bigger than 10% for services industry sector for HR assistant and personal services for Marketing assistant.

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