

Career opportunities and training satisfaction among Ph.d. graduates: Application of an index for ordinal data according to the stochastic dominance approach

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Abstract This paper describes a research conducted on Ph.d. Doctors of the Pavia University. We applied to the data collected through a web survey, a new non parametric index, for ordinal variables, able to compare the different macro areas regarding the general satisfaction of the graduates. The final purpose of our analysis is producing indicators that allow the institutional boards responsible of the organization of teaching activities to formulate evaluations on the quality of Ph.d. courses.

Key words: Academic evaluation, stochastic dominance approach, web surveys.

1 Introduction

The evaluation of the University education effectiveness is becoming a useful government tool for the university to improve the quality of services offered to students. Since few years the Pavia University NuV (Evaluation Committee) promotes a survey to evaluate career opportunities and training satisfaction among Ph.d. graduates (Campostrini, 2010; Bianchetti, 2006) in order to support the decision-making process to reorganize doctorate programs and allocate resources among Ph.d. schools. This paper presents the results of a survey conducted in 2009 interviewing Ph.d.

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Doctors, who achieved the title in the previous year: we propose an index to measure Ph.d. graduates satisfaction according to the stochastic dominance approach.

2 Method

2.1 *The survey*

The survey was conducted through a CAWI (Computer Assisted Web Interviewing). Ph.d. graduates were interviewed after a reasonable amount of time, at least twelve months, since the conclusion of their doctorate programs to gather their “considered” opinions and to be able also to appraise their working careers. A one-year period was chosen because the respondents still have a clear memory of their experience and, at the same time, the period is long enough to study the first effects of the Ph.d. programme on working activity. This is the third survey, continuing the ones conducted in 2008 and 2007, and therefore constitutes a systematic approach to Ph.d. evaluation. The principal goal of the investigation has been to trace an evaluation of the formative experience and to pick up information on the working careers that characterized the period following the title attainment. We propose a statistical evaluation of the Ph.d. Doctor experience through the application of a Stochastic Dominance Index on the ordinal variables of a questionnaire. Through the web-based questionnaire we collected the Ph.d. graduates’ opinions on different macro areas: a) teaching activity satisfaction (quantity, quality, level of in-depth study, teacher competence, overall satisfaction); b) research activity satisfaction (quantity, quality level of support, overall satisfaction) c) working activity satisfaction (type and conditions of the found job, time to get a job, salary, overall satisfaction); d) overall satisfaction for the Ph.d. (wish to repeat the experience, satisfaction in comparison to the initial expectations). All the aspects were measured through a four or ten level ordinary scales. Where possible we maintained the same typology of questions, with the purpose to get interesting comparisons of trends, from 2007 to 2009. The web survey has been conducted in the period that goes from the end of June to the end of October 2009. The Doctors were contacted through three different strategies: e-mail, and therefore text messages (SMS) and a personal phone call. In the first months of the investigation, up to September, the answers were collected particularly after the launchings of e-mails and SMS, but the general answer rate reached only 43.7%. We contacted by telephone those people who had not yet compiled the questionnaire, inviting them to furnish a valid e-mail through which they received the link for the on line questionnaire. This type of strategy was fundamental to reach the final responding rate: 84%, which means 169 Doctors, on 201. The on-line questionnaire was easily comprehensible, few intrusive and inexpensive, nevertheless, among the used tools, the e-mail resulted few incisive to reach high answer rates. This is entirely however predictable, in fact international scientific literature underlines the possibility to have low answer rates, if sending only

e-mails. In this type of investigations the quality of contacts is fundamental, therefore in the future an effort could be useful to build a database of contacts with one or more reliable e-mails, frequently used by the Doctors.

2.2 Methodological proposal

In terms of students' demands, we point out the focus on the factors that can result tied up to the general satisfaction of the didactics. The items introducing low levels of satisfaction or criticism, can be therefore valued in terms of risk factors in comparison to the general satisfaction, in parallel with what happens in our Athenaeum for the evaluation of the didactics. Big part of the observed judgment differences, in fact, are attributable to some characteristics of the frequented doctorate that seem influencing in a substantial way the opinion expressed by the research Doctors. It's possible therefore to effect an analysis in disjunctive or compensating way: the presence of a determined risk factor can affect the general satisfaction, or contrarily some critical factors can be compensated by other factors introducing positive evaluations and excellences.

In order to obtain a new index, useful to aggregate different modalities in a single evaluation, for the analysis of ordinal questionnaire data, we first considered different heterogeneity and homogeneity indexes, such as Gini, Leti, Shannon, Heterogeneity-concentration indexes and the Concentration ratio (see e.g. Leti, 1965).

Gini index:

$$G = 1 - \sum_{i=1}^k f_i^2 \quad (1)$$

Leti index of heterogeneity:

$$L = \left[\prod_{i=1}^K f_i^{f_i} \right]^{-1} \quad (2)$$

Shannon Index of entropy:

$$H = - \sum_{i=1}^K f_i \log f_i \quad (3)$$

Heterogeneity-concentration Index:

$$M = \sum_{i=1}^{k-1} (k-1) f_i \quad (4)$$

Concentration ratio:

$$g = 1 - \frac{2}{k-1} \sum_{i=1}^{k-1} Q_i \quad (5)$$

The Gini index satisfies the symmetry property. It can assume therefore an identical value, in case of distributions having the same frequency distribution, but different skewness. This may be not desirable for the goals of our research.

Apart from g , all the other indexes need to be normalized (divided by their maximum) to a value between 0 and 1 that we indicate, respectively, as G^* , L^* , H^* , M^* . We have calculated the correlation matrix between all indexes. It shows positive correlations, very next to 1, between the indexes. This means that using other indexes rather than the Gini index, would not bring to meaningfully different results. Besides, all the above indexes are also symmetric and therefore not suited for our purposes. We propose a different approach: we applied, to the data about Ph.d. Doctors, a new non parametric index, built on the basis of the cumulative distribution function alone, which embodies the essential information for ordinal data. We propose to consider the sum of the values of the cumulative distribution function, according to the stochastic dominance approach to model selection, as described e.g. in Cerchiello et al (2010). It is well known that the cumulative distribution function is a monotonously increasing (or more precisely, non decreasing) function bounded between 0 and 1. For brevity this index will be named SDI, (Stochastic Dominance Index). A relative version is obtained dividing it by its maximum value, J , which is attained when all data points are concentrated in the lowest class. We can define SDI as follows:

$$SDI = \sum_{i=1}^J F_i \quad (6)$$

where F is the cumulative distribution function, and J the number of classes. Note that, this index is based on the cumulative distribution function as the index suggested by Leti (equal to $\sum_{i=1}^{k-1} f_i(1 - f_i)$). However, while the SDI index is a second order stochastic dominance measure, based on the arithmetic mean ideal for comparison purposes, Leti's index aims to measure heterogeneity between statistical units.

We believe that our proposal is convenient, because the index maintains the ordinal nature of the data, it is not based on parametric assumptions and its construction is simple to communicate and to interpret.

The proposed index can be normalized into a $[0, 1]$ range. Considering α as the minimum and β as the maximum values assumed by SDI, we can define SDI^* as follows:

$$SDI^* = \frac{SDI - \alpha}{\beta - \alpha} \quad (7)$$

Note that $\alpha \leq SDI^* \leq \beta$ and $0 \leq SDI^* \leq 1$.

3 Results

The SDI index proved useful to compare the different aspects of the investigation. Specific items were considered for each macro-area identified: a) overall satisfaction of teaching activities, b) overall satisfaction of research activity, c) job satisfaction, d) satisfaction in comparison to the initial expectations, wish to repeat the experience. The various items report a score between 0 and 1, (higher scores correspond to higher level of satisfaction).

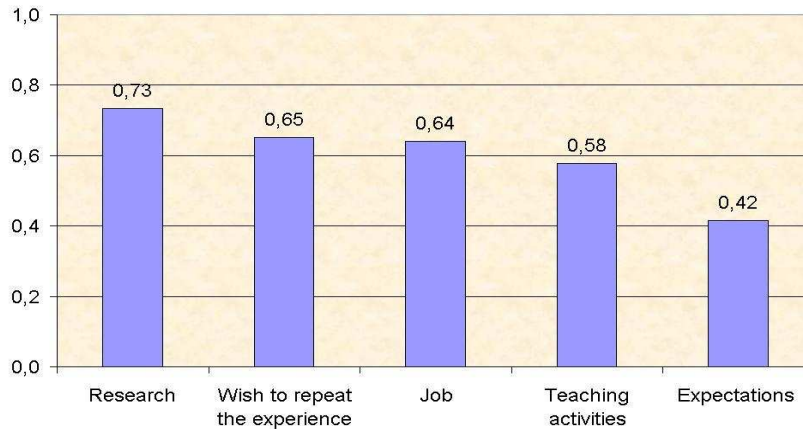


Fig. 1 SDI index applied to the risk factors for the general satisfaction.

In Figure 1 we show how the satisfaction in comparison to the initial expectations presents a low level of 0.42. The best area is the research, with a score of 0.73. Many research Doctors would repeat the experience of the same course in the same University, but a part of the Doctors would go to the foreign countries or would change course.

We added a further focus about the teaching activities, analyzing quantity, quality, level of in-depth study, teachers' competence, teachers' availability and overall satisfaction. The SDI index scores (Figure 2) underline as the Doctors appreciated the lessons, but they generally would enjoy a greater investment in "quantity" and "level of in-depth study". The highest scores brought by the items "competence" and "availability" of the teachers, don't seem to compensate enough the level of the general satisfaction: its level remains near to the lowest values of "quantity" and "level of development". The most important risk factor for the Ph.d. training

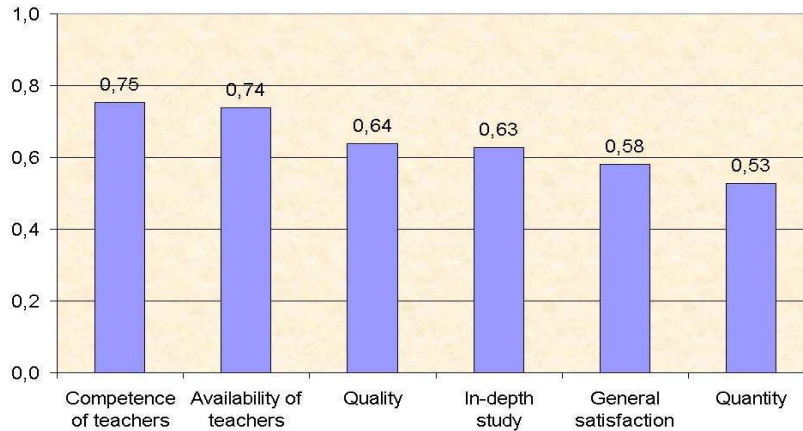


Fig. 2 SDI index applied to the risk factors for the general satisfaction of the didactics.

satisfaction seems to be the absence of structured lessons: the doctorate courses organized with cycles of lessons get more positive judgments than the others, maintaining the 2007 trend. Unfortunately not all the courses of the Pavia Athenaeum offer structured lessons: the percentage of Doctors who attended the lessons is almost 56%, and only 5.9% did not attend for personal decision. The others missed lessons only because they were not offered by the doctorate course.

As in the previous edition the image of the doctorate described by those people who have participated in the survey results very heterogeneous: regarding formative experience, there are very satisfied Doctors and others declaring that they would not repeat the experience (7.7%, 13.9% in the previous year) or they would repeat only the experience changing Athenaeum (5.3%; 4.1% in the preceding edition) or in foreign countries (32.5%; it was 32% last year). It must be underlined that only the 51.5% of the interviewed ones would repeat the experience (same course, same Athenaeum).

Also in this survey we noticed the presence of a group of Doctors that has a negative image of the course: the 31.2% of the research Doctors believe that the doctorate experience has been below the expectations (42% in the preceding edition) and for a part of these (the 16% of the total one, in comparison to the 22% found in the preceding cohort of Doctors) deals with a meaningful disappointment (“very below my expectations”). Despite this, it is however comforting to notice a good improvement of the trend in comparison to the past year.

Another factor that seems making the formative experience more effective is represented by the possibility to develop research activity with other researchers-

teachers: the 94.6% of the Doctors participated in researches, in continuous or irregular way: this trend is positive in comparison to the preceding year (80%), but those people who developed research activity in continuous contact with other researchers are limited to 78.1%, however in improvement in comparison the 55% of 2007. Moving the attention toward the researches developed in the same structure of affiliation (Department, Institute, etc.), we noticed that the Doctors found opportunity to effect research in the 88.8% of the cases, but only the 66.3% in continuous way.

The evaluation of the Doctors is also influenced obviously by their profession after the title attainment. The analysis of the expressed judgments puts in evidence that the value of the research doctorate is recognized only in some environments: the more satisfied Doctors are the ones remained inside the academic world and those people gone abroad, to foreign countries.

Concerning to the job, the positive result is that 95% of the Doctors declare having found a job, after a mean value of time of 2.6 months. The structure that seem more able to attract the high formation is the university (it absorbs the majority of those people who achieved the title, 40.9%, considering public and private structures, with an improvement in comparison to the 37.1% of 2007). Private firms absorb less than the 15% of the Doctors, with a light bending in comparison to the preceding year.

The analysis of the principal characteristics of the developed job underline two important criticisms: the precariousness of the jobs and the low income. In the university circle the most diffused positions are “research fellow” (47.8%) and “indefinitely contract” (20.2%), but among the indefinitely positions only 7.2% are researcher, in negative trend in comparison to the 10.6% of 2007. PostDoc fellows appear stable (from 14.9% to 14.5%) and there are also other forms of assumption, such as occasional work contracts. Looking at income answers, most of the research Doctors declare perceiving a monthly clean income that varies between 1100 and 2000 Euros, with a mode of 1200. Median values are attested on 1267 Euros for the ones working in the university and 1500 Euros for the ones in other structures.

The results follow the trend of the preceding year. Only 10.7% of Ph.d. Doctors still live with the family of origin: this is a value in decrease in comparison to the 22% of last year, but the 40.3% declares to arrive at the end of the month with some or a lot of difficulties.

4 Conclusions

High educational studies don't seem therefore to eliminate, from the working point of view, the problems: despite the elevated investment connected to the title attainment, the research Doctors don't seem having privileged working positions, regarding incomes and contractual stability. Nevertheless it must be underlined that precariousness and income remain the only negative aspects of the professions found by the Doctors: they generally seem instead satisfied, as the colleagues interviewed

in the preceding years, in comparison to the job in terms of prestige, realization, relationship with colleagues, growth - development and contents. Our research underlined as the principal problem is the absence of availability of lessons in many courses: this problem can heavily affect the general satisfaction. At the moment we are developing a longitudinal multivariate model to evaluate the data of the same survey, collected in different years.

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