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Factors Contributing to Participation in Web-based Surveys among Italian University Graduates

by

Chiara Cimini ♥, Giancarlo Gasperoni ♦, Claudia Girotti ♣

Abstract
An established yearly survey aimed at monitoring the employment opportunities of Italian graduates, traditionally carried out with Cati methods, has been integrated during the last few years with Cawi. Cawi has become increasingly crucial due to the high number of graduates involved in the survey, which has mandated a reduction in fieldwork duration and unit costs. Although the seven Cawi surveys used here have different substantive and methodological characteristics, preliminary analysis reveals a common trend: the utmost participation is observed during the first few days immediately following initiation of fieldwork and, to a lesser degree, the delivery of follow-up reminders. Web respondents comprise a self-selected subgroup of the target population, having better academic performance and greater computer skills. A Cox regression model estimating response probability (or response time) shows, besides the obvious effects of certain personal and survey design characteristics, that faster response times are expressed by graduates in science or engineering and reporting good computer skills, whereas the fields of medicine/health and defence/security and no computer skills give rise to lower response probability. Ways to use these findings for fine-tuning data collection are discussed.

Keywords: Cawi surveys / Response rate / University graduates / Cox regression

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1. Introduction

For over ten years the ALMALAUREA Interuniversity Consortium[1] has conducted annual large-scale surveys with the goal of recording occupational outcomes of Italian university graduates 1, 3, and 5 years after their having earned their degrees. These surveys allow in-depth analyses of labour market trends for graduates through the detailed collection of data concerning graduates training and working experiences in the five years following completion of a university degree programme.

Until recently, the annual survey was performed only on individuals earning their degree in the so-called "summer session", i.e., in the period stretching from May to August of each year; graduates in this session were no different, in their overall profile, than those who completed their studies in other periods of the year. Recently, with the increase in the number of "post-reform" graduates[2], the survey has been extended to all graduates, regardless of the time of year in which they completed their programmes and earned their degrees. This decision is based on various elements, including the following facts:

1. University authorities need more detailed information, linked to single degree programmes, in order to better plan new teaching activities and programmes and assess their quality.
2. Whereas summer session graduates were generally representative of all graduates in the pre-reform system, this is no longer true in the post-reform system.

Of course, the extension of data collection to the entire population of graduates (as well as the constant increase in the number of universities joining the consortium) has entailed a dramatic increase in the number of individuals to be interviewed and engendered a need to contain the surveys' duration and costs. Since the year 2008, therefore, ALMALAUREA's data collection structure has undergone major changes. In particular, its traditional Cati (computer-assisted telephone interviewing) methods have incorporated Cawi (computer-assisted web interviewing) approaches (Cammelli 2009). This shift towards mixed-mode data collection has been made possible by two important developments: on the one hand, an increasingly wide availability of graduate e-mail addresses (which in general tend to be up-to-date, in that the graduates themselves provide them when they revise their on-line résumés hosted on ALMALAUREA's website and offered to potential employers); on the other hand, the consortium's growing experience in other on-line surveys (twenty over the last five years)[3]. More precisely, starting with the 2008, all first- and second-level graduates (of member universities)[4] who have provided an e-mail address are invited

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[1] ALMALAUREA was founded in 1994 by the Statistics Observatory of the University of Bologna and became an inter-university consortium in the year 2000. In March 2009 the number of its member universities was 52, which account for approximately 70% of all Italian university graduates. ALMALAUREA was established primarily as a service for graduates, member universities and employers. It pursues these goals by providing a timely data-base concerning high-level human capital which is available on-line in order to help match supply and demand on the national labour market and favour International labour mobility. For more information on ALMALAUREA's survey methods, see its website: www.almalaurea.it.

[2] After the Bologna Declaration (1999), the Italian university system was extensively reformed. The new system, introduced at the beginning of this decade, provides for the institution of first- and second-level degree programmes (typically lasting, respectively, 3 and 2 years: so-called "post-reform" programmes) which have been gradually replacing prior 4- and 5-year ("pre-reform") programmes.

[3] The first pilot studies were carried out in order to explore specific phenomena, usually pertaining in a general way to occupational outcomes, in a short time and with low costs. Examples include a study concerning the job condition of graduates aged at most 23, a study on graduates residing in the town of Imola, a study on intercultural dialogue aimed at recording graduates' opportunities at having contacts with non-Italian people and cultures in their workplaces.

[4] Second-level graduates include those completing two-year "specialist" programmes (enrolment in which requires a first-level degree; such programmes are equivalent to master's programmes in Anglo-Saxon countries) and those completing five- or six-year "unified cycle specialist" programmes (enrolment in which is possible with an upper secondary school diploma).

via e-mail to respond to an on-line questionnaire[5]. Subsequently, all those who do not complete the on-line questionnaire (including, of course, graduates who provided no e-mail address) are contacted by telephone in order to administer the same questionnaire. (It should be noted that ALMALAUREA surveys of graduates' occupational outcomes are *not* sample surveys; they aspire to collect data on *all* members of the target population.)

This shift had to be implemented with great care, in that ALMALAUREA's surveys on graduates' job conditions have been characterised by exceptionally high response rates[6]. For example, in 2005 ALMALAUREA aimed to interview over 75,000 individuals who had graduated from member institutions in 2000, 2002 or 2004 (in order to record their working conditions 1, 3 or 5 years, respectively, after having earned a degree); for 2004 graduates the response rates were 87.5 and 86.4% (for post-reform and pre-reform programmes, respectively); for 2002 graduates the rate was 81.4%; for 2000 graduates 76.3%. The survey involved approximately 62,500 completed interviews. In the year 2008, the target population of graduates who had earned their degree in 2007 increased to over 156,000, 88% of whom were successful interviewed (almost 138,000 individuals, plus over 40,000 others contacted 3 or 5 years after completing their studies); the combination of the two data collection methods allowed ALMALAUREA to continue achieving its relatively high response rates. The decision to resort to web-based interviewing was facilitated not only by the generally acknowledged strengths of on-line surveys (relating to speed, cost efficiency, Internet's global reach, flexibility, opportunities for methodological control: Jackob and Zerback 2006), but also by the following considerations (which offset some of the weaknesses usually associated with on-line surveys): the target population was "special", in that it comprises people who are (almost always) young, highly-educated, prone to Internet usage (but we will explore the theme of computer skills' effects later), generally equipped with a strong sense of identity towards their *alma mater* – and who perhaps see themselves as having a vested interest in participating in the ALMALAUREA survey. The implementation of this new data collection strategy requires the acquisition of more information, especially as regards factors that contribute to high response rates in web-based interviews and, subsequently, the modification of future research operations. In order to obtain this information, we have analyzed a selection of ALMALAUREA surveys of graduates which have used web-based interviewing techniques.

2. Selected Structural Features of ALMALAUREA Post-Graduate Surveys Using Web-based Interviewing

The need to identify variables that affect Cawi response rates among graduates when the survey concerns working conditions is best served by examining surveys involving a similar target population. We have thus excluded from our analysis some web-based surveys that involved either specific populations (graduates in particular fields of study) or specific topics (intercultural dialogue), which could have introduced unwanted bias in response rates and therefore in our findings. We have thus focused exclusively on surveys which concern post-reform graduates' educational and occupational experiences one year after earning their degree.

We thus focus on seven separate studies involving a population of almost 254 thousand graduates (Table 1), over 200 thousand of which (79,6% of the total) had provided a valid e-mail address[7].

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[5] Unlike Cati surveys, which are contracted to an external company as regards the actual interviews, ALMALAUREA's carries out all stages of Cawi surveys internally, from the development of the questionnaire to delivery of e-mail messages, from the management of follow-up messages to data collection.

[6] Strictly speaking, this shift toward mix-mode data collection has *not* been rendered necessary due to a strong decline in response rates when using Cati-based methods, although the prevailing trend pointing in this direction – in Italy as elsewhere – will undoubtedly begin to have significant effects in the future (Callegaro and Poggio 2004; Cutrtin et al 2005; Berinsky 2008; Lavrakas 2008).

[7] The remaining 20.4% includes graduates reporting no e-mail address as well as those who received no e-mail message due to "permanent rejections" (erroneous e-mail addresses) or "temporary rejections" (full mailboxes, automatic "out-of-office" replies, etc.). On the whole, graduates who were not contacted via e-mail are mostly those who did not

The incidence of e-mail availability varies among the populations considered: it is only 74% among first-level graduates in 2004, but rises to 83% among second-level graduates in July-December 2007. This difference is in all likelihood due to the fact that possession of an e-mail account (and/or willingness to disclose it) has been gradually rising among university graduates and the fact that information quality has also been rising (as shown by the diminishing incidence of non-operational e-mail addresses over the last few years)[8].

Table 1 – Features of the target population of seven web-based surveys on graduates' occupational and educational experience one year after earning their degrees

Survey ID code	Type of graduate and period in which degree was earned	Graduates		E-mail-equipped graduates	
		N	% having e-mail	N	%
07	L 2004	47,380	74.0	35,043	17.4
08	L 2005 (January-April)	23,697	74.7	17,696	8.8
10	L 2005 (September-December)	39,054	77.9	30,415	15.1
16	L 2007 (January-April)	41,591	81.1	33,711	16.7
18	LS 2007 (January-June)	13,956	83.9	11,706	5.8
22	L 2007 (July-December)	63,848	83.4	53,258	26.4
23	LS 2007 (July-December)	24,114	83.2	20,062	9.9
TOTAL		253,640	79.6	201,891	100.0

Note: L = first-level 3-year degree; LS = second-level degree.

The graduates equipped with e-mail and that could have participated in one of the seven surveys mentioned here[9] have been pooled into a single data base for the analyses that will form the focus of section 4. The composition of this pooled data-base is described, in part, in the last column of Table 1. Survey no. 22, involving July-December 2007 first-level graduates, accounts for over a quarter of the pooled target population, whereas other three surveys (including the only two comprising second-level graduates) each account for less than 10% of the pooled target population.

The surveys here considered are similar as regards the topics addressed by the questionnaire, but they differ as regards other structural features, such as the time of day and the day of the week on which the survey started; the overall duration of data collection; the length of the questionnaire in terms of number of items[10]; the number of follow-ups sent out to non-respondents[11]; the day of the week on which follow-ups were sent (Table 2).

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complete a previous questionnaire described in footnote 16; such graduates tend to be more numerous among individuals residing in Central or Southern Italy and who have earned degrees in medicine; they also tend to have lower self-reported computer skills.

[8] Non-operational e-mail addresses usually comprise about 3% of the target population, varying between 5% among first-level graduates in 2004 and in September-December 2005 and 1% among graduates in the first part of 2007.

[9] In order to ensure that graduates were interviewed at the same interval of time from their degree – a required condition for safeguarding comparison among data refereed to an entire year, all surveys (with the exception of the one on 2004 graduates) were divided into two or three separate data collection periods: for the year 2005 January-April graduates were interviewed first, then those having earned their degrees in May-August (only via Cati), and finally those having graduated in September-December; in 2007 the first group of interviews involved January-June graduates, and the second group comprised July-December graduates.

[10] The variable pertaining to "number of questions" distinguishes between: apparent questions (i.e., the number of items the interviewee actually sees when he or she initially accesses the on-line questionnaire), minimum number of questions (the number of questions that must be answered in the shortest possible version of the questionnaire, usually involving unemployed graduates) and maximum number of questions (associated with the longest possible version of the questionnaire, involving employed graduates and contingent on their responses to various items leading to other conditional items).

Table 2 – Structural features of seven web-based surveys on graduates' occupational and educational experience one year after earning their degrees

Structural variables	Survey ID code						
	07	08	10	16	18	22	23
Day of initiation of data collection	Thursday	Tuesday	Tuesday	Monday	Monday	Monday	Monday
Time of day at which data collection started	9-11:30 a.m.	9-11:30 a.m.	12:30-2 p.m.	12:30-2 p.m.	12:30-2 p.m.	12:30-2 p.m.	9-11:30 a.m.
Duration of data collection in days	27	21	21	30	29	23	22
Number of follow-ups	2	1	1	2	2	2	2
Day of week on which first follow-up was sent	Thursday	Tuesday	Wednes-day	Tuesday	Tuesday	Tuesday	Tuesday
Day of week on which second follow-up was sent	Thursday	–	–	Monday	Monday	Wednes-day	Wednes-day
No. of apparent questions*	6.5	6.5	7	8	8	8	8
Minimum no. of questions*	7.5	9.5	9	11	10	11	10
Maximum no. of questions*	50.5	18.5	18	23	19	23	19

* In batteries each single item was counted as half a question.

More specifically, each survey on 2007 graduates was initiated on a Monday, the two surveys on 2005 graduates began on a Tuesday, and the survey on 2004 graduates commenced on a Thursday. Four of the seven surveys kicked off at lunch time (12:30-2: p.m.), whereas the other three (2004 first-level graduates, January-April 2005 first-level graduates, July-December 2007 second-level graduates) started earlier in the morning. The surveys had variable durations of fieldwork, ranging from 21 days for the two surveys involving 2005 graduates to 30 days for the January-June 2007 first-level graduates. It is important to underscore the fact that in our earlier web-based studies, the primary goal was to maximize the number of completed interviews, while possibly avoiding any "request overload" for the graduates. Therefore, the duration of fieldwork, the number of follow-ups and the days on which they were sent were determined on a "decide-as-you-go" basis, i.e., according to the evolution of daily response rates. The recent introduction of mixed data collection strategies (Cati + Cawi) entails a more precise schedule for web-based interviewing: in particular, the latter's duration must be pre-determined, for Cawi data collection must terminate before a certain date in order to commence procedures for the following Cati phase; this also means a tight organization of follow-ups (usually two, in order to maximize the response rate and check the amount of resources devoted to telephone interviewing).

3. Response Rates

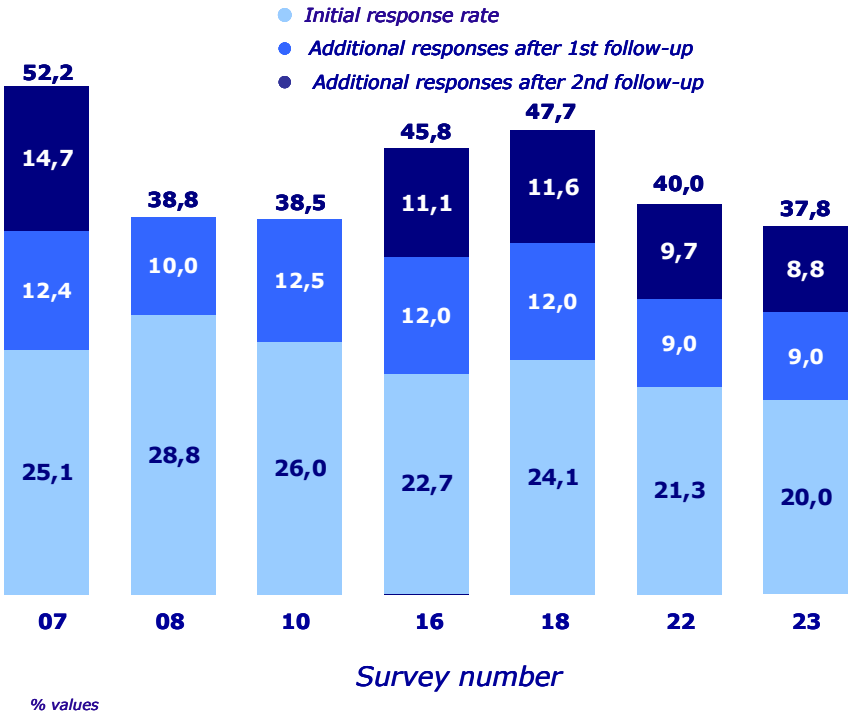
Participation in web-based interviews in the surveys here considered was relatively high: 43% of eligible graduates completed the on-line questionnaire[12]. This result is quite positive, but also appreciably lower than the response rate usually achieved in AlmaLaurea telephone surveys on the same target populations. For example, in the 2008 Cati survey on pre-reform graduates' job conditions, the response rate ranged from 75% (for graduates contacted five years after graduation) and 90% (after 1 year). In addition, the response rate varies widely according to the specific survey

[11] A follow-up is here understood to be an additional e-mail message, usually sent after a week or so from the initial message (or initial follow-up), addressed solely to members of the target population who have yet to complete the on-line questionnaire. In the studies here examined at least one follow-up was used.

[12] This response rate refers to the set of graduates who were equipped with a functional e-mail address, and thus excludes graduates who reported no e-mail address and those having accounts which rejected the initial message (see footnotes 7 and 8).

considered (Figure 1): only 38% among July-December 2007 second-level graduates, but 52% among 2004 first-level graduates.

Figure 1 – Final response rates and contribution of follow-ups in seven web-based surveys on graduates' occupational and educational experience one year after earning their degrees



Participation depends, as we shall see later in more detail, on various factors associated with both the target populations and the data collection strategies. Particularly relevant, although not surprising, is the role of follow-ups. Each follow-up produced an immediate, sizeable increase in the number of completed questionnaires, ranging from 9 to 12.5 percentage points for the first follow-up and from 9 to 15 points for the second (when used)[13].

With the exception of survey no. 23 (July-December 2007 second-level graduates), the lowest response rates are observed among 2005 first-level graduates (surveys nos. 8 e 10). This lower participation does not seem to have been determined by a lower degree of interest among these graduates; in fact, the same surveys also produced the highest initial (i.e., before performing the first follow-up) response rates (29 and 26%, respectively). They also featured a sole follow-up[14], so it seems reasonable to argue that if a second follow-up had been carried out final response rates would have been even higher than the average of the others employing two follow-ups.

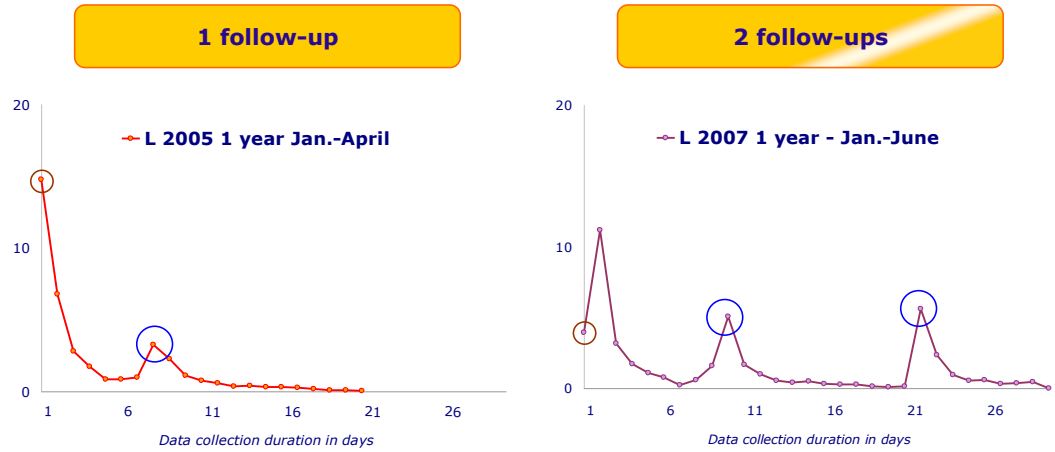
A closer look at the response rates shows that each survey has a similar response rate curve, the general shape of which, regardless of the absolute values obtained in the various surveys, seems to

[13] The contribution of the first follow-up is the ratio between the number of questionnaires completed from the day the first follow-up was sent to the day preceding the second follow-up (or the last day of fieldwork if no second follow-up was performed) and the total number of members of the target population having a functional e-mail address. Similarly, the contribution of the second follow-up is the ratio between the number of questionnaires completed between the day said follow-up was sent and the end of fieldwork and the total number of graduates with e-mail addresses.

[14] Only one follow-up was carried out in these surveys in that the initial first-week yield and that of the first follow-up were relatively plentiful. As previously mentioned, in the first ALMALAUREA web-based surveys the data collection procedures were not rigidly predetermined; some key decisions, relating for example to the number of follow-ups and when to perform them, were made after the commencement of data collection activities and especially on the basis of the actual evolution of daily response rates.

be affected by the number of follow-ups and the time of day (morning or afternoon) when data collection commences. Figure 2 shows the daily response rate curves of two surveys (involving first-level graduates in January-April 2005 and January-June 2007). These two curves are generally representative of the evolution of daily response rates in all seven surveys. More specifically, the first example in Figure 2 is typical of surveys in which data collection begins in the morning and features a sole follow-up; the second example is typical of surveys in which data collection starts in the afternoon and features two follow-ups. The figure clearly shows that participation is concentrated in the initial days (hours, almost) of data collection and then rapidly drops off. More specifically, if data collection begins in the morning, the first day is the one achieving the highest response rate; if it begins in the afternoon, the highest daily response rate is achieved the following day. Subsequent follow-ups show a similar pattern: an immediate growth and peak in completed questionnaires, followed by a quick reduction. The number of peaks obviously corresponds to the number of follow-ups (see also Camillo and Girotti 2008).

Figure 2 – Evolution of daily response rates for two typical web-based surveys on graduates' occupational and educational experience one year after earning their degrees



Note: The initiation of data collection and the sending of follow-up messages are indicated by circles in the two graphs.

4. Estimating Response Probability (or Response Time) in Web-Based Surveys

ALMALAUREA data-bases contain information relating to graduates' socio-demographic characteristics (such as gender, age, social origins), university experience (geographic location of university, field of study, final mark, delay in earning degree[15], intention to continue university-level studies, willingness to repeat one's programme choices), and additional acquired abilities (such as computer skills). Such information is drawn from two different sources: on the one hand, member universities supply ALMALAUREA with administrative data concerning their graduates; on the other, each member university graduate is invited to complete a questionnaire shortly before completion of studies[16] and draft a résumé to be published on-line for the benefit of prospective employers (the résumé contains information regarding the individual's university career, previous university and work experiences, special skills, professional goals, etc.).

[15] A graduate is considered as having earned her or his degree with no delay when the degree programme is completed in the legally defined number of years associated with the programme (three academic years for first-level degrees, two years for second-level "specialist" degrees, five or six years for unified cycle degrees); if the degree is earned in a greater amount of time, then there is a delay. The incidence of such delay in Italy was 57% among first-level graduates in 2007 and 37% among second-level graduates in the same year.

[16] This questionnaire is administered to students upon completion of their programmes, through which information is collected concerning previous university experience, jobs held during university studies, satisfaction for a set of university services and structures, and so on.

This ample availability of personal information, combined with the structural features of the interviewing undertaken by ALMALAUREA (day and time of data collection commencement, number of follow-ups, etc.), makes it possible to identify a profile for respondents and non-respondents in the web-based surveys. The method used, the DEMOD statistical procedure implemented in SPAD software, identifies variables that, regardless of their nature, distinguish a certain group of subject from others. Appropriate probability tests (based on chi-squared coefficients) identify variable categories or means that differ significantly from the overall population values and order them according to their discriminating power. The results of this analysis, reported in the remaining part of this section, should thus be interpreted in probabilistic terms: some groups have greater or lower chances of possessing certain traits than the target population on the whole.

4.1. Respondents

Graduates who responded to a web-based questionnaire had a greater probability of having completed a programme in the field of engineering, political and social science, economics or statistics; they had a greater chance of having been enrolled in a Central Italian university (and residing in Central Italy), achieved better-than-average school and academic performances (in terms of final marks at both school- and university-leaving exams, age at which their degree are earned and length of time devoted to completing the programme, regular attendance of lessons, and "purity"[17]), and completed first-level programmes. About 70% of respondents had at least one parent with an upper secondary school diploma (and 25% had at least one parent with a university degree), 32% came from the white-collar middle class[18], 65% were "student-workers"[19] and 26% have no previous work experience: all these percentages are significantly *higher* than those observed in the target population. Respondents tended not to have studied abroad during their university years, nor had they any previous university experiences. They intended to continue their studies at a higher level and would repeat the same academic choices if they could go back in time (80% would have picked the very same programme they just completed). Moreover, respondents in ALMALAUREA's web-based studies had a greater chance of having completed the pre-graduation questionnaire (thus displaying a relatively favourable attitude towards survey participation) and also of having good (self-reported) skills in the field of web-surfing, word processing software, use of spreadsheets and computer operating systems; 72% claim to have good knowledge of at least three different categories of computer tools. As regards the structural features of the surveys themselves, graduates turned into actual respondents with a greater frequency when there was only a year separating the fieldwork and the introduction of the new university reform[20], when data collection was initiated in the morning, on a Thursday, when fieldwork lasted longer than usual and the number of follow-ups was higher, when the number of apparent questions was relatively low and the time elapsed since completing the degree was relatively short[21].

4.2. Non-respondents

Non-respondents, obviously, display different characteristics. They came from Northern Italy (in terms of both enrolment, 59%, and residence, 52%), were relatively older when they completed

[17] "Pure" graduates have carried their entire programme within the post-reform framework; "hybrids" are generally older students who started in the pre-reform framework and then decided to transfer to a post-reform programme.

[18] This social class scheme here used is that used by Cobalti and Schizzerotto (1994).

[19] "Worker students" report having been engaged continuously in a full-time job for at least half the duration of their university studies. "Student workers" comprise all other graduates who worked, to a lesser degree, during their university experience.

[20] Since initial surveys on post-reform graduates emphasized the importance of participation for assessing the reform's consequences, this variable was introduced in order to record the potential effect of this potential motivational aspect on response rates.

[21] The interval between date of interview and date of degree is calculated using the initiation of fieldwork as a reference point for the former.

their studies and took longer to do so, and had weaker marks in their school- and university-leaving exams. In relative terms, they did not intend to continue with university-level studies, came from lower social class backgrounds, have weaker computer skills (especially as regards operating systems, multimedia applications, and creating websites), and tended to have "hybrid" university careers[22]. As regards structural features of surveys that encouraged non-participation, we may cite starting data collection in the afternoon, on Mondays or Tuesdays, longer time spans between fieldwork and the introduction of university reform (60% four years, 26% two years) and between fieldwork and time of completion of studies. Also, non-response is greater when the number of apparent questions is higher than usual, when duration of fieldwork is shorter than usual, and when there are relatively few follow-ups.

4.3. Estimating Response Rates with a Cox Regression Model

The probability of participating in a web-based survey – and, in more general terms, response time – thus seems to be linked to both structural features concerning survey design and individual characteristics relating to the graduates comprising the target population. In order to further explore this topic we employed a Cox regression model (also known as a proportional hazard regression model), that estimates response time curves when a set of explanatory variables' effects is controlled (Biffignandi and Pratesi 2003). This model identifies various factors that contribute to response time in web-based interviewing, namely graduates' field of study, computer skills, intention to continue studying, and the geographic area in which degrees were earned.

The Cox regression model follows the approach of models based on survival data analysis, which attempt to ascertain simultaneously the effect of a set of variables on expected survival time and compare survival distributions among different subpopulations. Recourse to Cox regression model seemed appropriate due to the presence of censored observations, i.e., individuals who at any given time may have responded but haven't done so (yet). In this study the Cox model was used to estimate the function of survival in the state on non-respondent of each individual i – $S_i(t)$ – given a set of explanatory variables. In formal terms, the model is expressed by the following function:

$$S_i(t) = S_0(t)^{\exp(\sum_{j=1}^{J} x_{ij}\beta_j)}$$

where $S_i(t)$ is survival function of individual i, i.e., the individual i's probability of being still a non-respondent after t units of time from the initiation of the survey; x_{ij} is value of the variable X_j for the individual i; $ß_j$ is the parameter which expresses the effect of variable X_j on the survival function; and $S_0(t)$ is the baseline survival function, which corresponds to the individual for which $x_{ij}=0$ for every $j = 1, \ldots, J$.

This model was applied to the over 200 thousand graduates equipped with an e-mail account and who had been invited to complete ALMALAUREA's on-line questionnaire[23]. Potentially relevant variables in determining response time, and therefore included in the model, are of two types: the first type relates to survey structure; the second are individual, i.e., relate to graduates' personal or university study characteristics. Survey structural features included in the model are: day of the week and time of day when fieldwork started; number of apparent questions which can be seen at initial access of the on-line questionnaire; minimum and maximum number of questions[24]; elapsed time since earning of degree; years since introduction of university reform. We did not include the number of follow-ups nor the day of week on which they were implemented due to the fact, as we

[22] See footnote 17.

[23] As previously stated in section 2, the analyses focus on graduates having a functional e-mail account; graduates having reported no e-mail address or invalid ones have been excluded from the analysis.

[24] See footnote 10.

previously stated, that in some of the surveys these elements were not planned out beforehand but decided *post hoc*, mostly on the basis of observed daily response rates.
Individual variables relating to graduates included in the model are: gender, age upon completion of degree programme, geographical location of university[25], field of study, the mark earned in the final university-leaving exam, delay in earning degree, intention to continue studying, willingness to repeat past choices[26], and number of computer skill categories in which the graduate is proficient.
Among all these variables, only two were identified as having no significant effect on response time and were consequently omitted from the final model: day of the week when fieldwork started and minimum number of questions.

Table 3 – Cox model for response time to a web-based interview: estimated parameters and goodness-of-fit (reference categories in parentheses)

	B	Exp(B)	Sig.		B	Exp(B)	Sig.
Time of day initiation data collection (12:30-2 p.m. = 0)	–0.144	0.866	0.000	Field of study (Science = 0)			0.000
Max no. of items	–0.016	0.984	0.000	Chemistry & pharmaceutics	–0.248	0.780	0.000
No. of apparent items	–0.416	0.660	0.000	Geology & biology	–0.116	0.890	0.000
Elapsed time since degree (no. semesters)	–0.044	0.957	0.000	Medicine and health	–0.736	0.479	0.000
Years since university reform (1 year = 0)			0.000	Engineering	–0.087	0.917	0.000
2 years	–0.673	0.510	0.000	Architecture	–0.441	0.643	0.000
4 years	–0.240	0.787	0.013	Agriculture & veterinarian medicine	–0.209	0.811	0.000
Gender (men = 0)	+0.063	1.065	0.000	Economics & statistics	–0.256	0.774	0.000
University area (North = 0)			0.000	Sociology, political science, etc.	–0.289	0.749	0.000
Central Italy	+0.103	1.108	0.000	Law	–0.437	0.646	0.000
Southern Italy	+0.032	1.033	0.000	Letters	–0.342	0.711	0.000
Degree mark (66-110 scale)	+0.008	1.008	0.000	Foreign languages	–0.244	0.784	0.000
Age when earning degree	–0.008	0.992	0.000	Teaching	–0.444	0.642	0.000
Delay in earning degree (no delay = 0)			0.002	Psychology	–0.217	0.805	0.000
1 year	–0.018	0.982	0.034	Physical education	–0.451	0.637	0.000
2+ years	–0.035	0.966	0.001	Defence & security	–1.385	0.250	0.000
Intention to continue studies (yes = 0)			0.000	Self-reported computer skills (high, 3+ = 0)			
No	–0.108	0.898	0.000	None	–0.353	0.703	0.000
Not available	–0.239	0.788	0.000	Intermediate (1-2 categories)	–0.115	0.891	0.000
Willingness to confirm past choices (same degree = 0)			0.000	Not available	–0.168	0.845	0.021
Yes, different degree	+0.021	1.022	0.021				
No	–0.070	0.933	0.024				
Not available	–0.171	0.843	0.000				

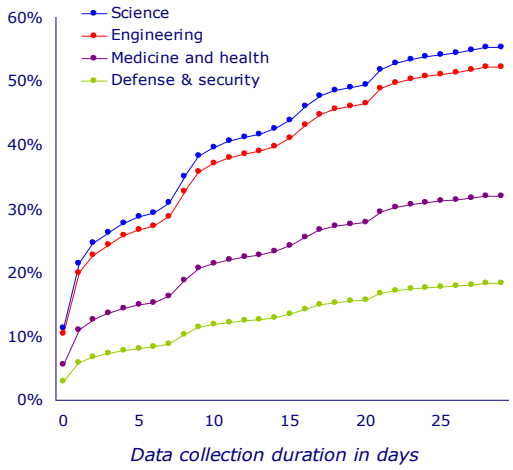
Note: Model's chi-squared coefficient = 6420.067 / Degrees of freedom = 36 / Significance = 0.000.

Table 3 lists the estimated parameters of the Cox model: each B parameter represents the effect on response time of the corresponding variable category with respect to the same explanatory variable's reference category (which is highlighted in bold). If B has a positive value it means that the corresponding variable category exerts, with respect to the reference category, a negative influence on the probability of persisting in the state of non-response. Vice versa, if the parameter has a negative value, the probability of remaining a non-respondent increases. The label Exp(B) identifies how much the odds ratio (i.e., the ratio between the probability of the "response" event

[25] We have included graduates' area of university as an indicator of geography, instead of area of residence, in that the former has greater explanatory power.
[26] The tendency to confirm one's past choices was included as a proxy of graduates' attachment to their university.

occurring and the probability of the opposite event occurring) varies for each unit of variation of the independent variable or for any change in the independent variable's category. The probability of the "response" event occurring increases when Exp(B) is greater than 1, decreases when Exp(B) is less than 1, and remains the same when Exp(B) is equal to 1.
Usually the only effects that are deemed worthy of note are those for which the significance level (i.e., the value in the "Sig." Column in Table 3) is lower than 0.05. All the effects listed in Table 3 have significance levels that are lower than 0.035.
The probability of remaining in the "non-response" condition can be conceptualized in terms of risk, i.e., the "risk" of experiencing the event of "questionnaire completion". Thus, a higher or lower probability of remaining in the state of "non-response" corresponds to a lower or higher risk of experiencing the "response" event[27]. Since time is in any case an underlying dimension for this type of risk, the latter can be effectively interpreted in terms of response time.
In order to facilitate comprehension of our findings, we have also included two figures relating to the two variables mostly closely associated with response time. In particular, we draw attention to the curves relating to the risk of having experienced "response" at time *t* for a set of fields of study[28] (Figure 3) and for differing levels of computer proficiency (Figure 4).

Figure 3 – Estimated response time for a web-based survey for a selection of graduates' fields of study

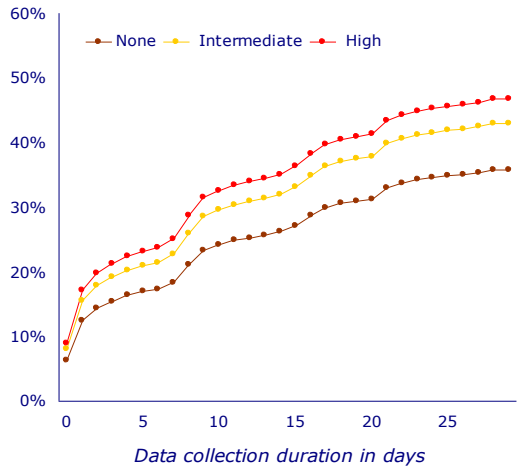


All other conditions being equal, graduated who earned a degree in science or engineering have lower probabilities, at any time *t*, of having remained "non-respondents" and, therefore, faster response times. Vice versa, individuals who majored in defence and security or in medicine and health are distinguished by relatively slow response times. For example, on the tenth day of fieldwork graduates belonging to one of the latter two groups have produced a response rate that is lower than 22%, whereas more than 35% of their colleagues earning science or engineering degrees have completed the questionnaires. The 35% threshold will not be achieved by the first two groups even at the termination of fieldwork. The model estimated response rates on the 30th day to be only 32% for medicine and health graduates and only 18% for defence and security graduates.
As Figure 4 shows, as computer skills grow the probability of response at time *t* also increases. Graduates who claim to have good skills in at least three computer skill categories have relatively

[27] The risk or probability of response is, obviously, the complement to 1 of the risk or probability of remaining in the condition of non-respondent.
[28] In order to render the graph more intelligible, only a selection of field of study response curves are depicted in Figure 3, and namely those with the fastest ("high" curves) or, vice versa, slowest ("low curves") response times. Other fields of study not represented in Figure 3 display intermediate response times.

fast response times, whereas those with no computer skills display significantly slower response times.

Figure 4 – Estimated response time for a web-based survey according graduates' self-reported level of computer skills



Besides field of study and computer use proficiency, other individual variables also seem to influence response time, which is faster, for example, among graduates who have had more successful academic careers in terms of: final exam marks, age upon completion of degree programme, delay in earning degree. In addition, quicker response time (and therefore higher response rates) distinguish graduates who were enrolled in Central (and, albeit to a lesser degree, Southern) Italian universities and among graduates who intend to enrol in a more advanced degree programme.

As regards the structural features of the various surveys, the variable which is most closely associated with response time is the number of apparent questions that the interviewee sees when she or he first accesses the questionnaire. As this number grows, response times increase. This seems to confirm that the initial visual impact is important and that a questionnaire that appears to be long and therefore demanding can discourage response.

Other effects are less pronounced yet significant. Namely, response times are influenced by the time of day when fieldwork starts and the maximum number of questions that the respondents may have to answer. As previously stated in Section 3, the highest daily response is recorded on the first day of fieldwork if the latter starts in the morning, on the second day if it starts in the afternoon (which obviously leaves less time for completing the questionnaire on the first day). Despite this, starting fieldwork in the morning produces slower response times, perhaps because graduates who are already busy with other activities (work or study) will more easily take a break and fill out the questionnaire during their lunch hour, which is thus the best time of day for initiating fieldwork and sending e-mail messages. The maximum number of questions exerts a negative effect on response times: the longer the questionnaire, the slower the response times. This resembles what occurs in association with the number of initially apparent items, although the effect is weaker.

5. Concluding Remarks

ALMALAUREA's increasing use web-based data collection techniques has rendered necessary a more detailed understanding of their methodological implications, the identification of graduates' socio-demographic traits that are associated with participation and non-participation, and the structural features of survey design that enhance response time. The analyses illustrated here show that:

1. Web respondents are a self-selected sample of the target population that tend to have had better academic performances and possess greater (self-reported) computer skills.

2. Follow-ups tend to produce an appreciable growth in response rates, which however is limited to a short period immediately following the dispatch of follow-up messages.
3. Response time depends on both graduates' personal characteristics (such as field of study, intention to continue with university-level programmes, etc.) and survey design features (day and time of data collection commencement, duration of fieldwork, etc.).

These findings can be useful for adapting ALMALAUREA's future surveys in order to achieve the highest possible response rates and reducing the amount of resources that have to be devoted to more costly telephone interviewing. In other words, these results will inform decisions concerning the advantageousness of implementing web-based data collection strategies and selected features of web interviewing, including: apparent questionnaire length, day and time of initiation of data collection, number of follow-ups, duration of fieldwork, and so on. Also, for example, as regards graduate subpopulations having fast response times (i.e., graduates with majors in science or engineering or having good computer skills), ALMALAUREA surveys could be performed exclusively through web-based interviewing; whereas for subpopulations featuring slow response times (security and defence or medicine and health majors, or those with rudimentary computer skills) web-based interviewing could be ignored and data collection carried entirely via telephone. Of course, such decisions need to consider (and require more research on) possible distortions in data introduced by mixed-mode surveys (see, among others, Voogt and Saris 2005; de Leeuw 2005; Dillman et al 2008).

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