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Master Students in University–Industry–Government Collaborations

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Abstract

This study shows how extensively master students collaborate with industry and government around the time of their graduation. This finding corresponds with the triple helix model, which predicts that university-industry-government interactions are likely to increase in the knowledge economy. Our findings also complement the results of the previous literature concerning the industry-interactions of doctoral students. Further, we provide empirical illustrations of how work-based learning such as placements and internships, and thesis made in collaboration with employers, are experienced by master students. This is important because a large majority of the literature have concentrated on employers' perceptions of the employability of new graduates. By exploring graduates own views on stakeholder interactions further understanding can be achieved about how to promote employability skills of new graduates. Finally, we use a regression model to study whether pre-graduate university-industry-government interactions have an effect on the probability to find a job.

Keywords: Triple Helix, employability, student-stakeholder collaboration

Introduction

Recent studies of university-industry relationships have stressed the importance of doctoral students, who are not only important knowledge producers in collaborative research projects, but also an important channel for knowledge transfer between universities and firms (Bienkowska and Klofsten 2012; Thune 2010). However, in addition to doctoral students, a large number of master students interact with firms/government or receive funding from firms/government before their graduation. As well as doctoral students, these master level students are important "bridge builders" between the university, industry and government.

This mainly empirical paper aims to shed light on the following questions. (i) How common phenomena certain kind of forms of industry/government interactions are among graduate students? (ii) How students experience these interactions?

Because our data stems from individuals who have just graduated, we are also able to look at whether the interactions during the studies have any effect on the probability to be employed after the graduation. This is our third main interest in the paper at hand.

Triple Helix context

In scientific history, double and triple helixes play a significant role. In 1953, Linus Pauling and Robert B. Corey presented that the DNA of organisms can be described as three chains, which wrap around each other and take a spiral-shape. Only a few months later, James Watson and Francis Crick presented their own double helix model. Now, we know that the latter model became known as the correct DNA template. The triple helix model, instead, has used as a model for a variety of transition processes for example in molecular biology.

The triple helix was used to model institutional structure and its evolution for the first time in technology research workshop in 1994 by Henry Etzkowitz and Loet Leydesdorff. Their interest was to analyse relations between university, industry and government and in particular to model the constant change in those relations; (Leydesdorff and Van den Besselaar 1994; Etzkowitz 1994; Etzkowitz and Leydesdorff 1995). The triple helix model combined Etzkowitz's long-term interest in the university and industry relationship between the analysis of institutional evolution; (David and Foray; Nelson 1994; Leydesdorff 2012).

According to Leydesdorff and Etzkowitz, the university-industry-government relations are driven by a common goal to promote innovation, in which science based knowledge is central. With such a common goal, the three sectors are beginning to take the role of the others though at the same time retaining their traditional missions. As a consequence, hybrid organizations and networks appear.

In universities, the traditional teaching role is likely to change as education policies are geared towards emphasizing employability and workplace skills, entrepreneurship education and collaboration with industry as part of educational programs. To promote e.g. employability and collaborations we need to know, what kind of problems appear in student-industry collaborations. There are some literature focusing on samples of PhD students who participate in specialized industrial PhD programs or collaborate with industry in some other less formal way. From those studies we know that several characteristics of the collaborations, such as firm characteristics, type of organization, resource exchange and routines developed during the course of collaboration, have an effect have an impact on PhD students' interaction experiences; see (Thune 2010; Butcher and Jeffrey 2007; Wallgren and Dahlgren 2005). In addition to doctoral students, a large number of master students interact with firms or receive funding from firms before their graduation. Very little is known about master students experiences or problems in industry collaborations, although master level students are important "bridge builders" between university and industry as well as doctor students.

Employability context

The former literature has highlighted the importance of work-based learning such as placements and internships in promoting the employability of graduates (Wilson 2012). The large majority of the literature have, however, concentrated on employers' perceptions of the employability of new graduates; see e.g. (Lowden et al. 2011). We aim to take a look at the other side of the issue: we explore graduates own views on their employability skills, and whether work placements and also thesis made in collaboration with employers could be used as a mean to promote employability skills.

An Empirical Study

Research design

Our data stems from 296 persons who have graduated from the Finnish university (University of Jyväskylä) to qualify as a Master of Science in 2013. These persons were interviewed by phone to gather data on several questions concerning e.g. their industry collaborations during studies. Data collection began in xx 2013 and was completed in February? 2014. The sample of interviewed persons covers 20% of all new graduates from University of Jyväskylä in 2013. To ensure that the distribution of fields of sciences in a sample correspond to the whole population of graduates we used stratified sampling. The random sample from graduates from each faculty was taken in a number proportional to the faculty's size when compared to the population of all graduates.

University of Jyväskylä is a multi-disciplinary university located at the Central-Finland. It has its origins in the first Finnish-speaking teacher training college founded in 1863, thus it has played a significant role in Finnish cultural history. The university is divided into seven faculties: humanities, information technology, education, sport and health sciences, mathematics and science, school of business and economics, and social sciences. Each faculty provides undergraduate and graduate degree programs in more than one subject.

Characteristics of respondents

Interviews were based on stratified random sample of MSc graduates. We had seven strata representing the faculties of the University of Jyväskylä. For this reason, in absolute terms, most of the sample of the interviewees came from the biggest faculties, Humanities and the Faculty of Education. Non-response rate throughout the study was very low, about 5%

The age range of the respondents is wide: the youngest respondents were under 25 and the oldest almost 60 years old. The youngest respondents came from Faculty of Mathematics and Science and from Faculty of Humanities. The average age of the respondents in these faculties is less than 30 years. In addition, in Faculty of Mathematics and Science, all respondents were under 37.

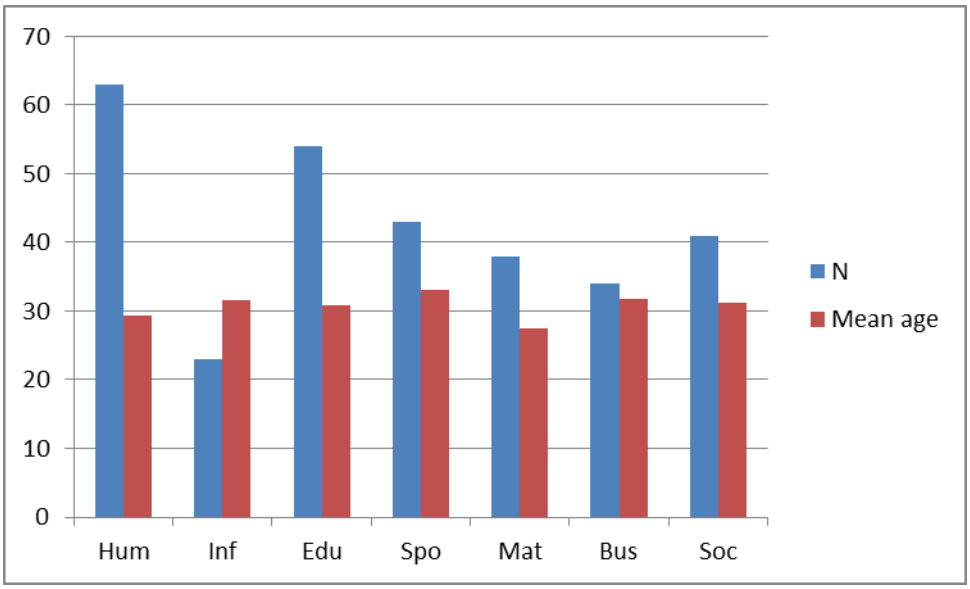

Figure 1: The number of respondents and mean age by faculty. Hum, Inf, Edu, Spo, Mat, Bus and Soc refer to faculties of humanities, information technology, education, sports and health sciences, mathematics and science, business and social sciences, respectively. N=296.

Thesis made in collaboration with industry or government

Of all the respondents 35 per cent made their graduation thesis in collaboration with industry or government. As can be seen from Figure 2 below, there are some variability between faculties in shares of collaborative works. In faculty of information technology over 60% of master thesis was collaborative works whereas in faculty of education the corresponding figure was around 25%.

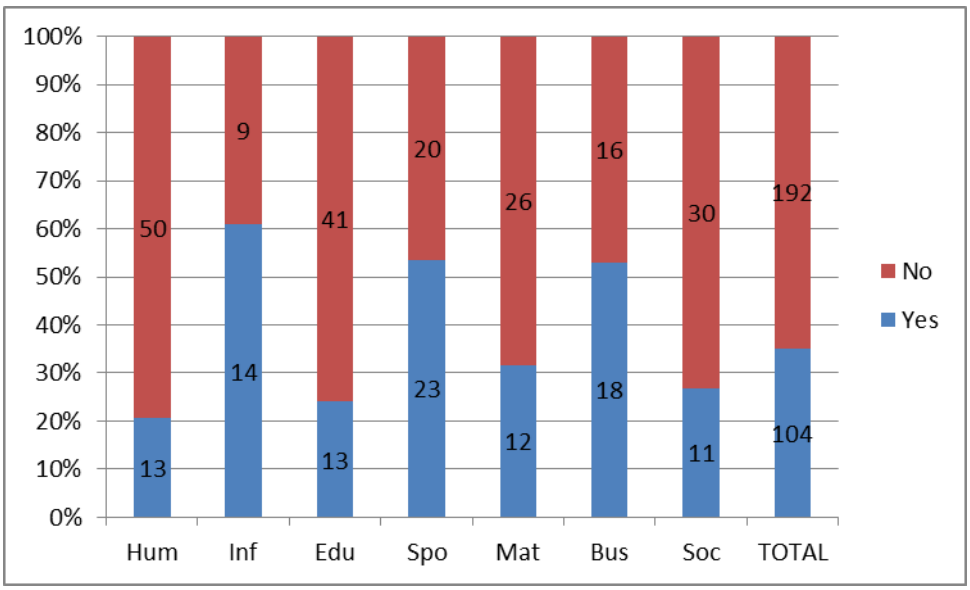

Figure 2: The share of collaborative thesis by faculty. Absolute numbers are shown inside the bars. N=296.

Given that thesis was a collaborative work, the topics of them were suggested by the stakeholder institution as usually as the student herself/himself. Only slightly more than a half (53%) of the topics were invented by stakeholder institutions.

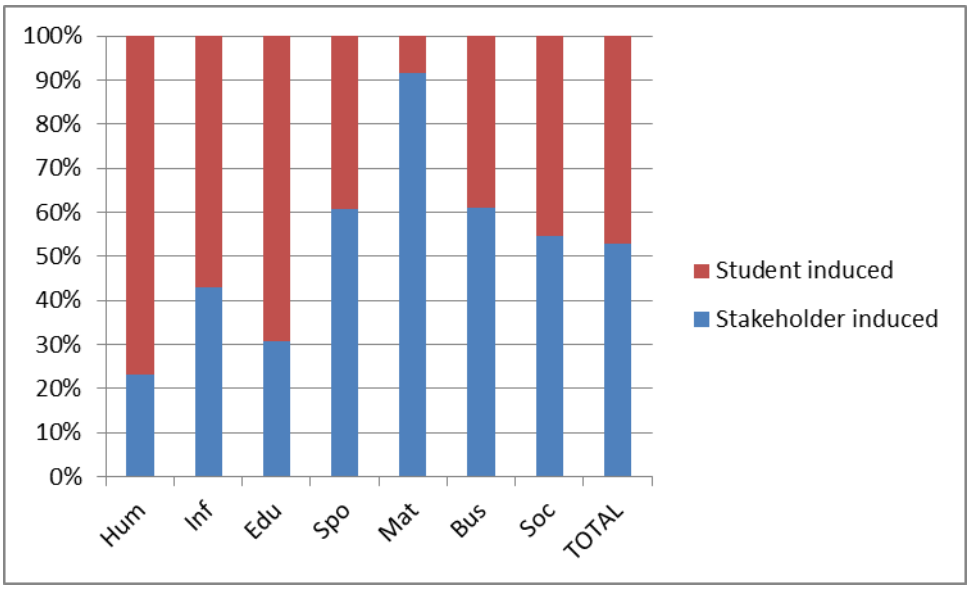

Figure 3: The inventor of the topic of the collaborative thesis by faculty. N=104.

A share of 34% of the collaborative thesis resulted in to a follow-up project or event with the stakeholder. In this context, it is worth to mention the Faculty of Information Technology, in which more than half of the collaborative thesis led to a new project /event. Of all the follow-up projects, 19% were work attachments between graduates and collaboration firms or organizations.

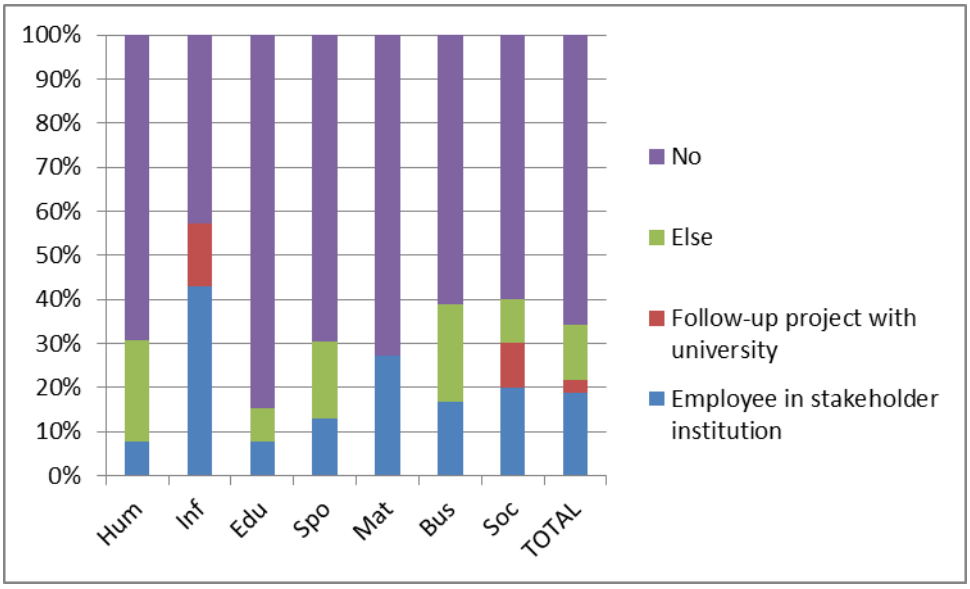

Figure 4: Did collaboration result in to a follow-up project of event after graduation? Share of responses by faculty. N=102.

The question of whether the topic of the thesis was invented by the stakeholder or by the student herself seems not to have a direct effect on the probability to end up in an employment relationship with a partner organization. In roughly half of the thesis leading to a work attachment the topics were invented by students themselves.

On-the-job training/Internships

Of all the respondents 65% participated in some kind of on-the-job training that was included in their studies. It seems that graduates consider on-the-job training as an important

factor in the probability to get the first job after graduation: around 60% of the respondents say that on-the-job training has helped them at least moderately in finding a job. Especially graduates think on-the-job training improves their ability to perform at work. When the impact of on-the-job training on the performance at work was asked, 80% answered it has affected at least moderately.

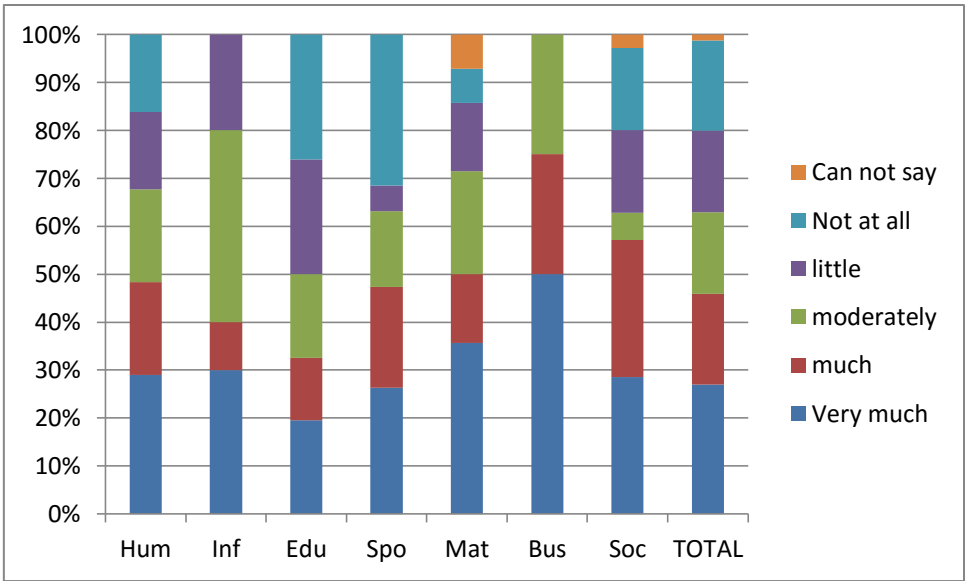

Figure 5: How much on-the-job training/internship has affected on your probability of become employed? Share of responses by faculty. N=159.

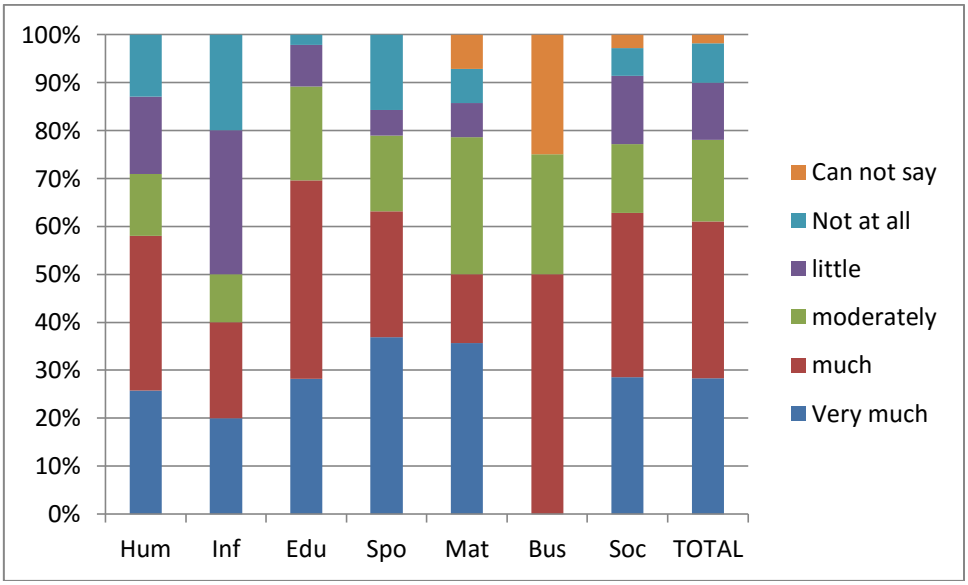

Figure 6: How much on-the-job training/internship has affected on your ability to perform at work? Share of responses by faculty.

Employment

In general, graduates from the University of Jyväskylä find jobs very quickly: around 80% of them become employed within few months after graduation or even faster; see Figure 7.

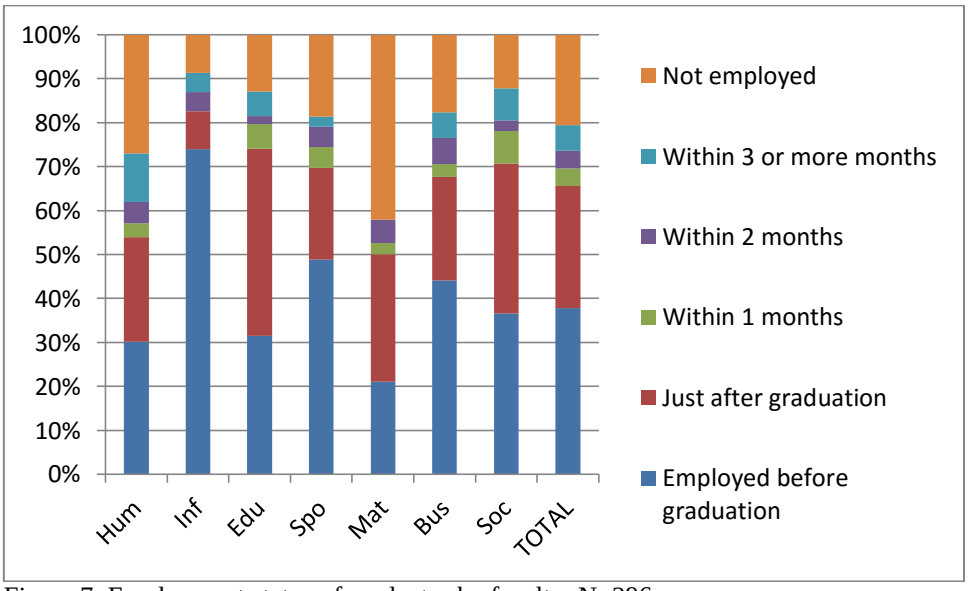

Figure 7: Employment status of graduates by faculty. N=296.

Regression analysis

In the previous chapters, we have presented illustrative evidence on how graduate students interact with industry and public sector around the time of the graduation. We concentrated on two perhaps most common ways of interaction: graduate thesis made in collaboration with stakeholder institutions and on-the-job training. Next, we link these two forms of student-stakeholder collaboration to the concept of employability which, in turn, is closely related to the probability of finding work after the graduation.

As a method of analysis we employ regression model, which allows us to study how large part of variation in post-graduate employment statuses among graduates can be explained by variation in pre-graduate interaction with potential employers. One benefit of regression analysis is that it allows us to model also the effects of several other characteristics of graduates, such as age and work experience, on the employment. This ensures that our results concerning the effect of pre-graduate interaction are not driven by these other characteristics. At the same time, we understand that there might be some other relevant factors that are not observable in the data. That is why we do not argue that our results are causal in the strict sense. Instead, we aim to provide illustrative information related to our research questions.

Our base model can be written as follows:

$$Y_i = \alpha + \beta_1 ColWork_i + \beta_2 OnTheJobTrain_i + OtherChar_i\gamma + \varepsilon_i,$$

Where Y_i is a binary variable indicating whether respondent i was employed at the time of the survey, alfa is a constant term, beta1 ja beta 2 are unknown parameters that represent the effect of collaborative thesis, ColWork, and on-the-job training, OnTheJobTrain, on the right-hand-side variable Y. The unknown parameter vector gamma represents the effects of other chararacteristics, OtherChar, of respondents on Y. This term is added to the model to ensure that the estimates of the beta variables are not driven by the other characteristics. Finally, epsilon is the usual error term in the regression model.

As a further analysis we estimate also the model, where the dependent variable Y is the number of months between the graduation and the time of getting the job given that respondent has finally employed.

We estimated the unknown parameters of the model by OLS. The estimation results are reported in Table 1 below. When the dependent variable was a binary variable, the estimated coefficient of Collaborative thesis does not deviate statistically significantly from zero.

Instead, the coefficient of on-the-job training .16 and is statistically significant. As the dependent variable can be interpreted as the probability to get a job, the results say that participating in the on-the-job training increases the probability of being employed by 16 percentage points.

We studied further those respondents who were employed at some point after (or even before) the graduation. We regressed the velocity of finding a job i.e. the number of months before a respondent become employed after the moment of graduation on the same regressors as in the case of the binary dependent variable. From the second column of **Fehler! Verweisquelle konnte nicht gefunden werden.**, we can see that given that a graduate will be employed after the graduation, she/he will find a job on average faster if her/his thesis is made in collaboration with a stakeholder institution.

	Model 1	Model 2
ColWork	-0.067	-2.105 ***
	(0.0544)	(0.5851)
OnTheJobTrain	0.156 *	0.154
	(0.0736)	(1.0819)
WorkExperience	0.014	-0.154
	(0.0073)	(0.0946)
Age	-0.004	0.004
	(0.0043)	(0.0545)
Intercept	0.747 ***	5.415 **
	(0.1296)	(1.7103)
Faculty dummies	Yes	Yes
Obs.	228	182

Table 1: Regression of probability to be employed (Model 1) and the number of months between the graduation and the time of getting the job given that respondent has finally employed (Model 2). Standard errors are in parentheses and are robust to heterogeneity; p-value indicated by *** p<0.001, ** p<0.01, * p<0.05.

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Conclusion

This study shows how extensively master students collaborate with industry and government around the time of the graduation. We find that 35 % of master students made their graduation thesis in collaboration with stakeholder. In addition, 65 % participated in some kind of on-the-job training that was included in their studies. This finding corresponds with the triple helix model, which predicts that university-industry-government interactions are likely to increase in the knowledge economy. Our findings also complement the results of the previous literature concerning the industry-interactions of doctoral students.

Further, we provide empirical illustrations of how work-based learning such as placements and internships, and thesis made in collaboration with employers, are experienced by master students. On average master students opinion is that industy/government collaborations have a positive effect on their employability and ability to perform at work.

Finally, our regression results indicate that (i) on-the job training increases the probability of getting a job and (i) making a collaborative thesis increases the speed of finding a job.

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