

Determinants of science graduates labour market success*

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Abstract

The article studies the problem of success in the labour market entry of higher education graduates in the European perspective. The core of the analysis is the study of determinants of widely defined labour market success. Differences between countries and study domains are analysed in the aspects of the influence of various socio-demographic characteristics as well as market environment and process of learning, modes of teaching and study programmes characteristics. Specifically, the Science domain is taken under focus. Data used in the analysis comes from two special surveys of European research projects REFLEX and HEGESCO. The research shows important role of factors related to study programmes modes and processes as well as individual graduates' study and early work-related experience.

Key words: labour market success, graduates



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Introduction

In the last decade the number of students in the EU-27 grew by almost 30% (from 15 million in 1998 up to more than 19 million in 2009). Most dynamic changes occurred in the new member states of the Central and Eastern Europe, where number of students grew two- or even threefold, but positive trend prevailed in all EU member countries. As a result, the problem of tertiary education graduates' employability became an central issue in labour market policy in most EU countries. Figure 1 presents the dynamics of the total number of tertiary graduates per 1000 of population aged 20-29 compared to dynamics of the number of tertiary graduates in science and technology¹ per 1000 of population aged 20-29 in DEHEMS countries. The height of the bars shows the respective number of graduates in 2009 (2008 for Italy) if 1999 = 100. This figure shows a massive increase in the number of graduates, ranging from 50% in Germany up to 170% in Turkey. In comparison to that, the number of graduates in science and technology followed a similar trend, but some country specifics can be observed. In Germany and Austria those two indicators followed almost hand in hand. In Italy, Slovenia and Turkey the increase in the number of science and technology graduates was less dynamic than for total number of graduates. Poland is on the other extreme, where the number of science and technology graduates in the last decade increased much faster than the total number of graduates.

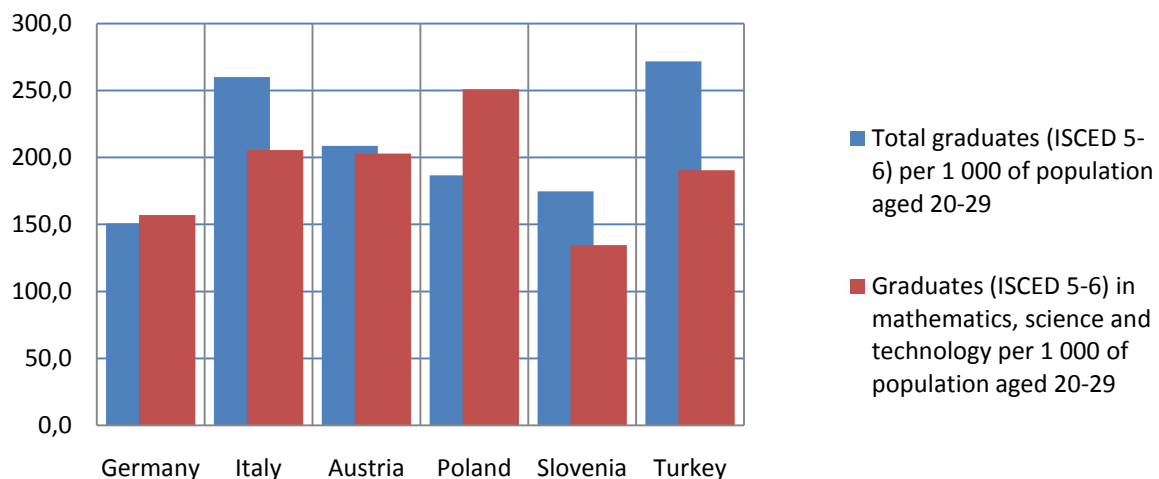


Figure 1. Total tertiary graduates and tertiary graduates in science and technology 2009/1999 dynamics

Source: Own elaboration of the Eurostat data.

At the same time most countries have experienced difficulties at the youth labour market. Usually the population of young people is characterised with the highest

¹ The indicator "Tertiary graduates in science and technology" includes new tertiary graduates in a calendar year from both public and private institutions completing graduate and post graduate studies compared to an age group that corresponds to the typical graduation age in most countries. It does not correspond to the number of graduates in these fields who are available in the labour market in this specific year. The levels and fields of education and training used follow the 1997 version of the International Standard Classification of Education (ISCED97) and the Eurostat Manual of fields of education and training (1999).

unemployment rates and the lowest employment rates. At the same time, it is a group suffering from lowest quality of employment (with relatively low wages and low level of employment security). It poses a question of efficiency of education process and its impact on employment and wage profiles.

The labour market success may be understood in many different ways. The measure mostly often used for labour market success is a fact of carrying out a paid work. It is regarded as an indicator of workers' attractiveness from the labour demand point of view and of the match of their education profile to market requirements. However such definition of a labour market success poses further difficulties: is an university graduate that failed to find work in her occupation and work for a three hours a week as a babysitter successful on the labour market? According to the ILO definitions, she will be recognised as an employed person. For assessing labour market success not only the fact of work, but also its time and quality should be taken for an account (the problem has been discussed by Kalleberg et al. 2000 and recently by Howell and Diallo, 2008). Only if we take into consideration characteristics of job, we'll be capable of shed some light of determinants of the actual labour market success.

1. Graduates' of Science domain socio-biographic background

In all six DEHEMS Project countries (Austria, Germany, Italy, Poland, Slovenia and Turkey, referred to as DEHEMS countries for short further on) students of Science domain constitute a very different part of all students population. The largest share is observed in Germany where every sixth student is studying a programme which belongs to Science domain. On the other extreme we have Slovenia with only 4,6%, which means that this study domain is not that much popular among young Slovenians. Detailed structure of students in the Science domain for six DEHEMS countries is shown in the table below.

Table 1. Share of Science domain students in DEHEMS countries

	Austria	Germany	Italy	Poland	Slovenia	Turkey
Life sciences (ISC 42)	3.1	3.7	3.5	1.9	1.4	1.7
Physical sciences (ISC 44)	2.3	4.8	1.3	1.3	1.1	3.6
Mathematics and statistics (ISC 46)	0.8	2.9	0.8	0.8	0.4	2.3
Computing (ISC 48)	7.1	5.0	1.3	3.4	1.7	1.1
Total	13.3	16.4	6.9	7.4	4.6	8.7

Source: OECD and Statistical Office of the Republic of Slovenia, as of 2009.

In all DEHEMS countries except for Italy, Science domain is dominated by male students. This observation is contrasting with the fact that generally for all study fields share of female students is higher than 50% (with the exception of Turkey, probably to traditional and cultural reasons). In Austria the scale of feminization of the Science domain is lowest with a share of women 33.1% only. The most man-dominated study field is not surprisingly Computing (ISC 48). Detailed figures for feminization are shown in table 2.

Table 2. Share of women in the population of Science domain students in DEHEMS countries

	Austria	Germany	Italy	Poland	Slovenia	Turkey
Life sciences (ISC 42)	67.3	66.6	70.1	74.0	71.2	62.3
Physical sciences (ISC 44)	34.6	43.7	38.9	65.8	44.4	43.3
Mathematics and statistics (ISC 46)	37.6	64.3	54.9	70.0	59.4	45.8

Computing (ISC 48)	17.4	15.6	15.9	18.6	7.8	24.0
Total over Science (ISC 400)	33.1	44.1	52.5	47.0	40.5	45.3
Total over all fields of study	52.8	55.4	58.3	65.6	64.3	46.4

Source: OECD and Statistical Office of the Republic of Slovenia, as of 2009.

2. Labour market success: key concepts

Traditionally, labour market success after graduation is interpreted in terms of possessing paid employment. Therefore a synthetic measure of success in given study discipline would be an aggregated employment rate. This traditional approach, although still useful is however not sufficient to describe various aspects of the term – “success” and its necessarily subjective nature. Given differences in preferences, one can observe different aspects being perceived as success by different individuals. Furthermore, the idea of success can be related to socio-demographic background of individuals, their values and beliefs and economic context (business cycle effect). Other aspects of success that can be taken under consideration are therefore:

- Types of employment contracts: short-term employment contracts do not give appropriate level of security;
- Employment stability: frequent job changes prevent from accumulating job-specific human capital;
- Wage level: low wages provide low return to education and decrease the incentives to acquire human capital through both formal education and on-the-job training;
- Human capital accumulation: knowledge cumulated by work experience is a valuable asset itself;
- Utilization of skills and knowledge acquired during education: allows to effectively use the skills and knowledge provided by HEI and to develop them by job experience;
- Personal development: important for subjective perception of overall development;
- Career perspectives: starting with low position but with open possibilities might be more important than having relatively high position from the beginning but with some form of glass ceiling;
- Degree in which actual job matches graduate’s expectations: important for subjective perception of satisfaction;
- General satisfaction: work-life balance, which gives enough time to spend with the family and enough income to enjoy consumption of variety of goods and services.

Labour market success can be interpreted in many ways, in terms of job satisfaction, job security, appropriate earnings, work autonomy and independence, work being a challenge and opportunity to develop skills and knowledge, ability to balance job duties with family and social life, possessing a job matching the skills and knowledge gained during studies. The problem of operationalization of the labour market success of graduates is described in section 4. Next section describes various characteristics of the first employment of science graduates.

3. Transition of science graduates into labour market

3.1. Labour market status

The most standard approach to the labour market success relies on looking at the labour market status of graduates. When asked about their current status, 91,4% of graduates of

science programmes for all DEHEMS countries answer that they are employed, only 7,2% are unemployed and 1,4% are not in the labour force. Economic inactivity is much more visible in this group of graduates in Turkey (5,1%), where its share is even 97% higher than for all domains of study in Turkey. Turkey is also a country with the highest share of unemployed, reaching almost 12% of science programmes graduates. The situation is also relatively difficult in Italy, where 8,8% of science graduates declare to be unemployed. Unemployment for graduates of science is more serious problem as compared to other domains. In Germany the share of unemployed in the group of science graduates is almost double that for all domains. In Poland, Turkey and Italy unemployment is also more serious problem in the science group, but the ratio of shares is much smaller (15,9 – 22,7%). In Slovenia and Austria unemployment among science graduates seems to be less likely as compared to all study domains in those countries. It is worth noting, that the share of unemployed is the lowest in Poland, with only 2,27%.

Table 3. Labour market status: science vs all domains

Status	DEHEMS	AT	DE	IT	PL	SI	TR	Other	Total
Not in labour force	1.39	0,00	0,00	0,00	2.27	1.05	5.13	0.44	0.74
Employed	91.38	97.01	90.70	91.25	95.45	95.79	82.91	93.59	92.89
Unemployed	7.23	2.99	9.30	8.75	2.27	3.16	11.97	5.97	6.37
Science/All domains									
Not in labour force	1.158	-	-	-	0.870	0.479	1.973	0.772	0.974
Employed	0.980	1.013	0.953	0.985	0.999	1.014	0.952	0.981	0.981
Unemployed	1.298	0.714	1.910	1.186	1.227	0.938	1.159	1.463	1.406

Source: own calculations based on HEGESCO and REFLEX data.

3.2. Search duration

Statistical data of the REFLEX and HEGESCO projects reveal interesting differences among the countries with respect to the search duration². In the table below we present various characteristics of the distribution of search duration. The bottom part of the table shows the respective value for the domain of science divided by the value for all domains. For the graduates of science for all six DEHEMS countries the average search duration is around 4.8 months. The distribution is highly skewed as the median is only 2 months. It also appears that the science graduates devote on average 20.3% more time to find their first job as compared to graduates of all domains. It may be a signal of a more visible structural problem of matching in this domain. Of all DEHEMS countries, there are two: Italy and Slovenia with average times not too different from the DEHEMS average, Austria, Germany and especially Poland with significantly lower search durations and on the other extreme we observe Turkey with the average durations reaching 10 months. Basing on this data it can be argued that the most profound matching problem is observed in the case of Turkish graduates. If we take a look at the bottom the table, we can see how science graduates are doing as compared to all domains of study. It can be seen that only in two of the DEHEMS countries search durations are much higher for graduates of science, namely for Italy and Turkey. The statistics for EU-wide comparison is that it takes on average 28,7% longer for science graduates than all

² Search duration was calculated on the basis of the question C4AFTGRA “How many months did you search before you obtained this employment (after graduation)” from HEGESCO/REFLEX.

graduates to find their first jobs. Italy is an example where the science graduates situation is relatively the worst with respect to search durations.

Table 4. Search duration of graduates in the field of science

country	mean	sd	cv	Q1	M	Q3
DEHEMS	4.8	8.7	1.8	0	2	5
AT	1.8	3.1	1.7	0	1	3
DE	1.9	3.2	1.7	0	0	2.5
IT	4.3	8.0	1.9	0	1	5
PL	1.5	1.5	1.0	1	1	2
SI	4.0	6.1	1.5	0	1	5
TR	10.2	12.8	1.2	2	6	13
Other	3.5	6.0	1.7	0	1	4
Total	3.9	7.0	1.8	0	1	5

Science/All domains						
DEHEMS	1.203	1.258	1.046	-	1.000	1.000
AT	0.798	0.875	1.096	-	1.000	1.000
DE	0.878	0.733	0.835	-	-	0.833
IT	1.358	1.276	0.940	-	1.000	1.667
PL	0.792	0.638	0.806	1.000	0.500	1.000
SI	0.837	0.912	1.090	0.000	0.500	0.833
TR	1.266	1.267	1.001	1.000	1.200	1.182
Other	1.307	1.172	0.897	-	1.000	1.333
Total	1.287	1.229	0.955	-	1.000	1.667

Note: sd – standard deviation, cv – coefficient of variation, Q1 – first quartile, M – median, Q3 – third quartile.
Source: own calculations based on HEGESCO and REFLEX data.

3.3. Characteristics of the first job

Occupations

Data of the REFLEX and HEGESCO projects unfortunately do not allow to compare the distributions of graduates between the economic and ownership sectors for all DEHEMS countries. Those characteristics are only available for Germany, Italy and Austria. For all countries this breakdown is possible only for current job and not for the first job of a graduate.

Using the REFLEX and HEGESCO data, the distribution of occupations in the first job was calculated on the basis of the International Standard Classification of Occupations at the 2-digit level. For all DEHEMS countries the most commonly existing occupation is the group “Physical, mathematical and engineering science professionals” with the share of 38,7%. This group is the most important for all DEHEMS countries with the exception of Poland and Turkey. The second most common occupation group is the “Teaching professionals” with the share of 25,8%. This group has especially important share in employment of science graduates in Poland (43,8%) and in Turkey (35,7%). Important exception is Austria, where the share of this occupation group is only 8,5%.

Table 5. Occupations of science graduates, ISCO 2-digit level

	DEHEMS	AT	DE	IT	PL	SI	TR	Other	Total
Armed forces	0.4	0.0	0.0	1.0	0.0	0.6	0.0	0.5	0.4
Legislators and senior officials	0.1	0.6	0.0	0.0	0.0	0.0	0.0	0.2	0.2
Corporate managers	2.1	0.6	3.5	0.3	1.4	1.7	4.8	3.3	2.9
Managers of small enterprises	0.8	1.7	0.6	0.0	1.4	0.0	1.7	0.5	0.6

Professionals	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.3
Physical, mathematical and engineering science professionals	38.7	58.2	38.6	38.1	21.9	46.5	23.9	30.7	33.2
Life science and health professionals	7.9	10.7	1.8	13.1	0.0	3.5	9.1	10.9	9.9
Teaching professionals	25.8	8.5	25.7	24.2	43.8	25.6	35.7	14.6	18.2
Other professional	5.5	11.9	3.5	3.4	12.3	6.4	1.7	4.7	4.9
Technicians and associate professional	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1
Physical and engineering science associate professionals	7.0	4.0	18.7	5.7	5.5	4.7	4.4	10.5	9.4
Life science and health associate professionals	2.4	1.7	0.0	2.4	1.4	2.9	4.8	3.6	3.2
Teaching associate professionals	0.2	0.6	0.6	0.0	0.0	0.0	0.0	2.0	1.4
Other associate professionals	4.1	1.1	2.3	4.7	4.1	3.5	7.4	6.5	5.7
Other	5.3	0.6	4.7	7.1	8.2	4.7	6.5	11.5	9.5
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: own calculations based on HEGESCO and REFLEX data.

Type of contract

A slight majority (52,3%) of the science graduates in all DEHEMS countries have fixed term contract in their first jobs. It is by 12,9% higher share than for all domains of study, which indicates that in the science domain fixed term contracts are relatively more popular. This over representation is mostly visible in Turkey (by 70,6%) but in Austria actually we have the reverse situation, with fixed contracts in science being relatively less popular than in all other domains. The highest shares of fixed term contracts in the first jobs are observed in Italy and Poland (reaching over 65%), while in Turkey and Austria they amount only to one third of the graduates.

Table 6. Type of contract in the first job: science vs all domains

	DEHEMS	AT	DE	IT	PL	SI	TR	Other	Total
Unlimited	43.04	65.06	45.12	27.74	31.51	33.52	55.11	45.99	45.06
Fixed-term	52.32	34.34	54.88	68.98	65.75	57.95	34.67	48.01	49.37
Other	4.64	0.60	0.00	3.28	2.74	8.52	10.22	6.01	5.57
Science/All domains									
Unlimited	0.902	1.081	0.883	0.835	0.948	0.790	0.819	0.912	0.908
Fixed-term	1.129	0.885	1.130	1.143	1.042	1.160	1.706	1.078	1.095
Other	0.782	0.606	0.000	0.510	0.747	1.115	0.826	1.195	1.051

Source: own calculations based on HEGESCO and REFLEX data.

Earnings

Earnings were calculated as gross hourly earnings in the first job corrected for purchasing power parity. Table below summarizes the distribution of earnings for the DEHEMS countries science graduates, and the bottom part shows the ratio of given statistic to the value for all study domains.

The average hourly wage for all DEHEMS countries is EUR 12,10 for the science graduates and is comparable to all domains graduates. There are however some interesting country differences. The highest earnings are observed in Germany, while the lowest in

Turkey and Poland. It is also interesting that in all countries except for Slovenia and Turkey, graduates of science programmes earn a little more than all domain average. The highest, 7% difference is observed in Austria, then 4,6% in Germany. Poland and Italy have nearly 2,5% higher average hourly wages for graduates of science, while in Slovenia they are lower by 6,4%.

Table 7. Distribution of gross hourly earnings in the first job: science vs all domains

	mean	sd	cv	p25	p50	p75
DEHEMS	12.07	5.97	0.49	7.47	10.96	16.00
AT	15.42	4.27	0.28	12.30	15.89	17.44
DE	19.07	6.02	0.32	15.07	19.02	21.92
IT	10.33	4.21	0.41	7.30	9.73	12.35
PL	8.35	3.90	0.47	5.67	8.10	9.79
SI	11.51	4.64	0.40	7.83	10.96	13.05
TR	8.35	4.62	0.55	5.26	7.17	10.74
Other	14.84	8.22	0.55	10.66	14.08	17.39
Total	13.57	7.40	0.55	8.78	12.67	16.72
Science/All domains						
DEHEMS	0.995	1.024	1.029	0.955	0.987	1.022
AT	1.070	0.932	0.871	1.100	1.137	1.040
DE	1.046	1.058	1.012	1.032	1.081	1.000
IT	1.025	1.019	0.994	1.000	1.040	1.008
PL	1.026	0.953	0.929	1.078	1.115	1.011
SI	0.936	0.921	0.984	0.909	0.933	0.926
TR	0.989	0.961	0.972	0.970	1.000	1.061
Other	1.030	0.987	0.958	1.047	1.032	1.043
Total	1.007	0.988	0.981	0.974	1.001	1.026

Note: sd – standard deviation, cv – coefficient of variation, Q1 – first quartile, M – median, Q3 – third quartile.
Source: own calculations based on HEGESCO and REFLEX data.

Kernel density estimates of the gross hourly wage distribution, broken down by countries is shown on the graph below:

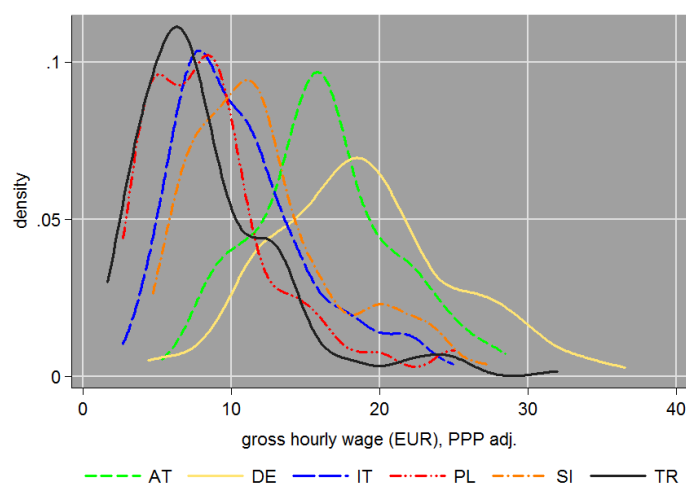


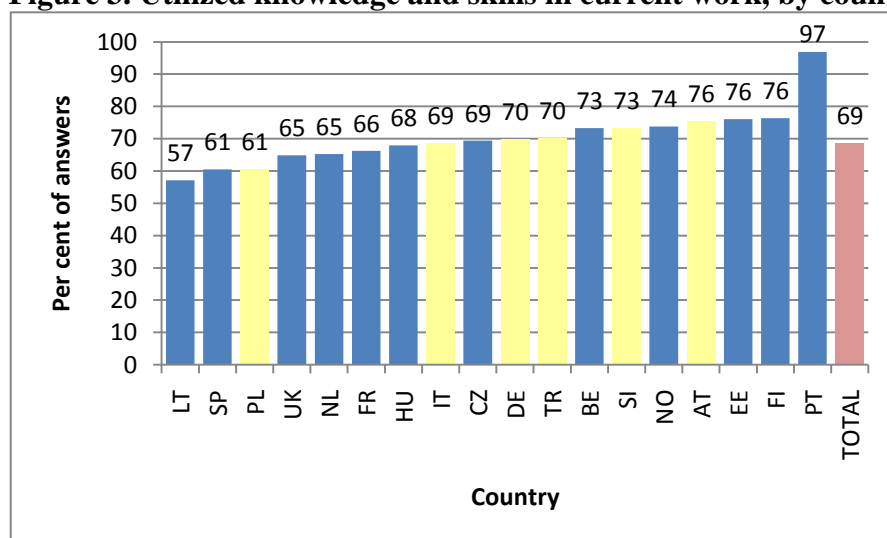
Figure 2. Distribution of gross hourly wages (by countries, adjusted for PPP)

Source: own elaboration based on HEGESCO and REFLEX data.

Utilization of knowledge

Interesting aspect of the first job is the extent to which it can utilize the skills and knowledge gained in the education process. The figure and table below show the percentages of graduates who assess their first job as utilizing their knowledge and skill to a high or a very high extent. The average share of science graduates indicating this statement for all DEHEMS countries is 70,2%. There is no big difference in this share for all other domains. There are however some country differences. The highest share of strongly positive answers is observed for Austria (75,5%), while the lowest – for Poland (60,7%). The divergence between science and all other domains is also the highest in Poland, where strongly positive answers for other domains are observed in 10% more cases.

Figure 3. Utilized knowledge and skills in current work, by country (in per cent)



Question F11 (Hegesco), F11 (Reflex): To what extent are your knowledge and skills utilized in your current work? Responses "to a high or a very high level".

Table 8. Utilized knowledge and skills in current work: science vs all domains

	DEHEMS	AT	DE	IT	PL	SI	TR	Other	Total
Science	70.2	75.5	69.8	68.2	60.7	73.4	70.2	66.9	67.9
All domains	70.9	75.1	72.7	69.4	66.8	71.6	69.2	70.2	70.4
Science/all	0.991	1.005	0.961	0.982	0.909	1.025	1.013	0.954	0.965

Source: own calculations based on HEGESCO and REFLEX data.

4. Determinants of the labour market success: regression analysis

The study of determinants of the labour market success requires to operationalize the concept described in section 2. The idea of the labour market success was made operational by adopting factor analysis for selected variables describing various aspects of labour market success described above (see the Appendix). All variables were used in the factor analysis in order to find common factors describing labour market success. The number of factors was determined by standard criterion of eigenvalues greater than unity. As a result six factors were

selected and named: job satisfaction, education appropriateness, job as a challenge, job security, independence and work-life balance. Eigenvalues and factor loadings are presented in the Appendix in the tables A1 and A2.

Determinants of six measures of labour market success were analysed using regression method on a set of explanatory variables. The subset of significant regressors was chosen using the stepwise selection method with 10% threshold significance level. Construction of explanatory variables is presented in the Appendix in the table A3.

After merging data from those two data sets, an integrated dataset included 43311 observations for all REFLEX and HEGESCO countries. Dataset consisted of 533 variables, in most cases of binary or discrete type. The most significant problems with the data elaboration are listed below:

- In many cases one particular piece of information is located in many variables, each of which is relevant only for one country due to specific regulations. Average grade is an example of this problem, with different grade systems in different countries.
- Estimating a domain-specific model for every country is hardly possible due to the low number of observations in some domains (see tab. 3).
- In case of some variables, the share of missing values is significant.
- Basing on theoretical considerations, a list of potential dependant variables was formulated that included almost thirty variables.

Data elaboration process included several steps. The first one consisted in processing of each of the variables potentially useful for analysis. The “no answer” and “not relevant for this country” etc. observations were treated as missing values and had been re-coded. In several cases, where original variables seemed to contained too detailed information, new variables were created as a result of an aggregation of several variable’s values.

The key problem with the HEGESCO/REFLEX dataset is the number of observations available for single country and domain. In the table 3 the lowest subsamples were written in boldface font. In these cases it is hardly possible to proceed with any statistical and econometrical analysis.

Table 3. Numbers of subsamples in REFLEX/HEGESCO data

Country	Education	Science	Engineering	Medicine	Social sciences	Business and economics	Total
Austria	237	188	267	75	180	397	1344
Germany	118	188	405	112	78	236	1137
Italy	84	329	559	269	288	538	2067
Poland	146	88	218	31	145	289	917
Slovenia	411	192	309	222	127	940	2201
Turkey	253	283	475	37	91	690	1829
Other	3911	2760	5100	1883	1520	5508	20682
Total	5160	4028	7333	2629	2429	8598	30177

Source: own study based on REFLEX/HEGESCO data.

With a prepared dataset, we moved to an econometric modeling phase. The first task in the construction of the econometric model was a theoretical research and identification of

dependent and explanatory variables. In the REFLEX/HEGESCO data set, experts were able to identify almost sixty independent and almost thirty dependent variables. Preparation of thirty separate econometric models for each domain would be too detailed and meaningless in the context of the DEHEMS project's objectives. To resolve this problem Principal Component Analysis³ was carried out.

The main objective of PCA is to reduce number of variables for analysis. This is done by finding a relatively small number of components which are linear combinations of original variables. PCA is based on analysis of correlations. The key idea is to group together variables that behave similarly and transform the dataset from a large to a relatively small number of variables by reducing dimensions. This process keeps as much information as possible about the original data variability. Of course losing some information is a cost, but it is compensated by increased readability and usefulness of the data. The number of factors taken to further analysis is determined by the eigenvalues (if higher than one - total variance is explained by a single component). Factor loadings describe the strength of input of variables into components. Results of PCA are usually rotated so as each variable has high loading in no more than one component. Analysis of factors gives a mathematical solution, which is not always interpretable. Possible corrections to obtain sensible results and their interpretation are done by a researcher. Components do not have direct numeric interpretation, but they allow to identify variables of key significance for each of the factors.

In the HEGESCO/REFLEX PCA methodology was used twice. First, it was used in a creation of new variables which were respectively corresponding to the difference between J1 section A and J1 section B (difference between actual job's characteristics and its desired features). On those synthetic variables factor analysis was set. The result lead to the conclusion that those variables can be replaced with two synthetic factors. The highest loading values are highlighted in the Table 4.

Table 4. PCA factor loadings for J1 variables

Variable	Factor1	Factor2
difrauton	0.4632	0.2020
difrsecur	0.2745	0.3734
difrlearn	0.7342	0.0174
difrearn	0.5926	0.2420
difrchalle	0.7778	-0.0654
difrcareer	0.7560	0.1294
difrleisure	0.0163	0.8362
difrsocstat	0.5694	0.2248
difrsocuse~l	0.4102	0.3478
difrfamily~e	0.0665	0.8452

Source: own study based on REFLEX/HEGESCO data

According to the substantive analysis of the highest factors, loading factors were renamed as "difpushpower" (difference in pushpower character of job) and "difleisurefam" (difference in enjoying leisure).

Next step of analysis was the PCA, which was performed on a set of all identified dependent variables. In this case, six factors had eigenvalues higher than one. Below the rotated factor loadings table is presented (Table 5). The loadings with highest eigenvalues are

³ Jolliffe, I. T., *Principal Component Analysis*, Springer-Verlag, 1986

highlighted. The theoretical analysis of the loadings values allowed us to rename factors on the basis of their principal component variables and their theoretical and mathematical co-linearity. As a result six new variables (Job_satisfaction, Appropriateness, Challenge, Job_security, Independence and Work-life_balance) were created.

Table 5. PCA factor loadings for all dependent variables

	Variable	Job satisfaction	Appropriateness	Challenge	Job security	Independence	Work-life balance
Employment status	empl	0.0077	-0.0310	0.0487	-0.1556	0.0093	0.2357
Current type of contract	contract	-0.0438	-0.0683	0.1063	0.8492	-0.0352	-0.0347
To what extent job security actually applies to your current work situation	security	0.1859	0.0612	-0.0154	0.7773	0.0616	0.1608
To what extent high earnings actually apply to your current work situation	feel_earn	0.6243	-0.0793	0.0535	0.1587	-0.1562	0.2343
To what extent social status actually applies to your current work situation	soc_stat	0.5845	0.0773	0.0783	-0.0119	-0.1502	0.2877
Years of higher education most appropriate for current job	need_hiedu	0.2009	0.5658	0.1570	-0.1740	0.0220	-0.1337
Field of study most appropriate for this work	field	-0.0032	0.7701	0.0038	0.0341	-0.0220	-0.0044
To what extent are knowledge and skills utilized in your current work	util	0.2545	0.6823	0.2131	-0.0258	0.0436	-0.0554
To what extent does your current work demand more knowledge and skills than you can offer?	morethanhave	0.3245	0.1572	-0.1944	0.0734	0.1880	-0.5156
Opportunity to learn new things	learnnew	0.7194	0.1630	0.0855	-0.0075	0.1152	-0.1939
Good career prospects	career	0.7491	0.0018	0.0455	0.1053	-0.2359	0.1148
Professional colleagues rely on me as an authoritative source of advice	profrole	0.0522	0.1046	0.7516	0.1273	-0.1128	0.0548
Do you play a role in introducing these innovations in your organisation?	innov	0.1061	0.0960	0.6027	0.0233	0.0154	-0.1690
Deciding how you do your own job.	autonomy	0.1836	0.0875	0.5842	0.0024	0.4211	0.0623
How closely is your performance monitored by your own supervisor?	supervision	0.1548	0.0251	0.0739	-0.0174	-0.7209	-0.0618
To what extent they actually apply to your current work situation Work autonomy.	auton_apply	0.3578	0.0853	0.3410	-0.0182	0.5035	0.1279
To what extent they actually apply to your current work situation new challenges	challenges~y	0.7613	0.1221	0.1438	-0.0365	0.0825	-0.1949
Satisfied with your current work	satisfaction	0.5438	0.3579	0.1241	0.0419	0.1363	0.1269
If you were free to choose again, would you choose the same study programme at the same institute of HE?	choice_again	0.1233	0.4824	-0.0322	0.0477	0.0047	0.3525
Difference in enjoying leisure	diffreleisur~m	0.0075	0.0070	-0.0675	0.2193	0.3000	0.6595
Difference in pushpower character of job	diffpushpo~r	0.8247	0.0972	-0.0089	0.0393	0.0859	-0.0549

Source: own study based on REFLEX/HEGESCO data

Next step of econometric analysis was to conduct a regression analysis using the least squares method. As a dependent variable, six generated factors were taken. The right side of the regression equation included all theoretically identified variables that could potentially influence graduates' labour market success. In total, thirty six regressions were performed – one for each factor and domain. In order to verify the correctness of the PCA, regressions using the key variables from the original REFLEX/HEGESCO data set were also carried out. The results were consistent with the output of regressions performed on synthetic factors. To reduce models, the “stepwise” procedure (automatically discarding variables in order from the highest level of insignificance) was implied.

At a final stage, diagnostic tests were carried out. The problem of heteroscedasticity and omitted variables were tested. In most cases functional form was found to be appropriate. When the Ramsey RESET test indicated for rejection of appropriate functional form hypothesis, an attempt to improve functional form of equation was undertaken. In case of a failure, logit models were used (with a necessary transformation of a continuous dependent factors to a binary variable, with 1 – for values over the average and 0 – for values below or equal the average of respective variable).

Detailed regression results are shown in the table A4 in the Appendix. Here, the most interesting outcomes will be discussed and commented.

Socio-demographic characteristics

Gender was found a significant predictor of education appropriateness and job security only. In both cases, male science graduates have higher values of those two variables than women. Higher levels of parents education seems to decrease current job satisfaction while it increases education appropriateness. It does not play any role for other dimensions of labour market success. Country differences were found quite interesting. In terms of job satisfaction, Polish science graduates have significantly higher values than European average, while Italian and Slovenian graduates have significantly lower. In terms of education appropriateness, the only country that is significantly different from European average is Slovenia, where graduates have higher values of education appropriateness. Austrian and Polish science graduates appear to have more challenging jobs than European average, while their Italian colleagues have significantly lower values of this dimension. In terms of job security DEHEMS countries do not differ from the European average. Austrian and German science graduates exhibit higher values of work-life balance, while Italians are characterized by significantly lower values. Italian, Slovenian and Turkish graduates (to the highest extent) are found to have significantly lower work independence than the average. Austrian and Polish graduates do not differ from the average significantly but Germans have significantly higher values of work independence.

Study process characteristics

Completing master degree programme results in more education appropriateness but it decreases work independence at the same time as compared to bachelor graduates. Having finished additional HE programme reduces the probability of experiencing more job security. Vocational secondary education background is correlated with lower values of overall job satisfaction. Study duration was not found significant predictor of any of the labour market success measures.

Programme characteristics

Graduates who evaluate their programmes as good for their personal development experience higher values of job security and work-life balance. Those for whom the study programmes were good for performing current job tasks exhibit higher current overall job satisfaction and higher education appropriateness. The same is true about the programmes which were regarded as good for starting work, but additionally graduates from such programmes experience also higher work independence. Science graduates from prestigious programmes experience higher work-life balance. Good knowledge of the programme by employers influences positively the job satisfaction and has no relation to other labour market success measures. Demanding programmes seem to reduce the work-life balance of science graduates. High level of freedom in shaping own study programme increases education appropriateness. Broad focus of the study programme decreases job satisfaction but increases work-life balance. Vocational orientation of the programme also reduces job satisfaction but increases job security.

Modes of teaching

From the set of variables describing modes of teaching, high extent of lectures decreases current job satisfaction. High extent of oral presentations increases job security, while high extent of written assignments reduces both education appropriateness and work-life balance. High extent of problem based learning favours education appropriateness. Graduates who stated that teacher was the main source of information experience higher job security. High extent of theories and paradigms favours work independence but reduces education appropriateness. High extent of research projects in the study programmes increases both job satisfaction and job security while it decreases work independence. High extent of group assignments influences job satisfaction and work independence negatively. And lastly, high extent of multiple choice questions increases work-life balance but reduces challenge and work independence.

Personal attitude

Science graduates with higher grades than average tend to have higher job security but lower job challenge. Those who strived for highest possible marks experience lower overall job satisfaction and lower work independence. Finally, those who performed extra work above what was required to pass exams tend to have higher work independence than others.

International mobility

Spending time abroad during studies and after studies both for study and work purpose plays very little role in determining labour market success. Graduates who spent time abroad after graduation both for study and work purpose tend to have lower job security than others. Higher values of work independence are observed for graduates who spent time abroad for study purpose both during studies and after graduation.

Labour market experience

Study-related work experience acquired before HE tends to increase current job satisfaction and work-life balance but reduces education appropriateness and work independence. Non study-related work experience gained during HE increases current job satisfaction. Study-related work experience during HE decreases job satisfaction but affects positively education appropriateness and work challenge.

Firm or current job characteristics

Serious change that occurred in the firm increases job challenge. High extent of quality orientation of firms increases job satisfaction and education appropriateness. More stable demand on the market on which the firm operates results in higher job security and higher work-life balance. High level of competence in analytical thinking, coordinating others' work and language skills increase job satisfaction. The latter determinant reduces job security and work independence.

5. Conclusions

In this article we tried to find determinants of the labour market success of science domain graduates for six DEHEMS countries. The task is not trivial due to possible misunderstanding of the term ‘success’. Project results indicated that labour market success should be understood in terms of the following aspects: employment status, type of contract, job security, job autonomy, earnings, social status, appropriateness of education, utilization of knowledge, opportunity to learn new things, career prospects, professional role, new challenges, work satisfaction. In order to reduce the number of dependent variables of the study we conducted a PCA analysis and found 6 factors, which were then used as measures of labour market success. The set of determinants included variables describing socio-demographic characteristics, study process characteristics, programme characteristics, modes of teaching and learning, personal attitude, international mobility, labour market experience, firm or current job characteristics. In the process of econometric procedure robust OLS estimations were conducted, and where necessary (rejection of the null hypothesis of correct functional form) logistic regressions were applied.

Regression analysis revealed a number of interesting facts. In some cases labour market success can be related to parents education. Therefore one can argue that investment in HE can be seen to have some cross-generational positive social external effects. Country dummies were found to be significant in many cases, so one can only regret that insufficient number of observations did not allow for more detailed study of country specifics. Study process characteristics seemed to play relatively minor role in determining future labour market success. On the other hand the most important factors come from the set of variables describing programme characteristics and modes of teaching but also firm or current job characteristics. It is worth noting that study programme characteristics and modes of teaching are under control of HE management. Regression results indicate that programmes regarded as good for performing current job tasks, regarded as good basis for starting work, known by employers favour labour market success in terms of overall job satisfaction, which is a mixture of high earnings, social status, good career prospects and job matching expectations.

Further studies could be conducted to look for other aspects of labour market success. For instance, it would be very interesting to look at qualification mismatch and the problem of under or over qualification of young labour force. Dynamic analyses using panel data could also shed some light on the problem of unemployment persistence, employment stability and labour market flows for the graduates across Europe.

6. Appendix

Variables identified as components of the labour market success:

Employment status (*empl*) – 1: working, 0: not working;

Type of contract (*contract*) – 0: fixed term, 1: self-employed, 2: full time contract;

Job security (*security*) – to what extent job security applies to current work – 1 (not at all) to 5 (to a very high extent);

Job autonomy (*auton_apply*) – to what extent job autonomy applies to current work – 1 (not at all) to 5 (to a very high extent);

Earnings (*feel_earn*) – to what extent high earnings apply to current work – 1 (not at all) to 5 (to a very high extent);

Social status (*soc_stat*) – to what extent social status applies to current work – 1 (not at all) to 5 (to a very high extent);

Years of higher education most appropriate for current job (*need_hiedu*);

Field of study most appropriate for this work (*field*) – 0: completely different than possessed, 1: own or related;

Utilization of knowledge (*util*) – to what extent are knowledge and skills utilized in current work – 1 (not at all) to 5 (to a very high extent);

Demand for more skills (*morethanhave*) – to what extent does current work demand more knowledge and skills than can actually be offered – 1 (not at all) to 5 (to a very high extent);

Opportunity to learn new things (*learnnew*) – to what extent opportunity to learn new things applies to current work – 1 (not at all) to 5 (to a very high extent);

Good career prospects (*career*) – to what extent good career prospects applies to current work – 1 (not at all) to 5 (to a very high extent);

Professional role (*profrole*) – professional colleagues rely on me as an authoritative source of advice: 1 (not at all) to 5 (to a very high extent);

Innovativeness (*innov*) – playing a role in introducing innovations in organisation (Product or service, Technology, tools or instruments, knowledge or methods);

Own deciding (*autonomy*) – to what extent are you responsible for deciding how you do your own job – 1 (not at all) to 5 (to a very high extent);

Supervision (*supervission*) – how closely is performance monitored by own supervisor – 1 (not very closely) to 5 (very closely);

New challenges (*challenges_apply*) – to what extent new challenges apply to current work – 1 (not at all) to 5 (to a very high extent);

Work satisfaction (*satisfaction*) – how satisfied are you with your current work – 1 (very dissatisfied) to 5 (very satisfied);

Choosing the same programme again (*choice*) – would you choose the same study programme at the same institute – 1: Yes, 2: No, a different study programme at the same institute, 3: No, the same study programme at a different institute, 4: No, a different study programme at a different institute, 5: No, I would decide not to study at all;

difrleisurefam - divergence between own valuation and the actual realisation of work features related to leisure time and combining work and family duties;

difrpushpower - divergence between own valuation and the actual realisation of work features related to earnings, career prospects, social status, going something important for society, new challenges.

The last two variables were created using scoring coefficients after factor analysis on measures of the divergence between the importance of given job feature and its actual

realisation. Those features were measured statements about the importance of: autonomy, security, high earnings, new challenges, good career prospects, enough time for leisure activities, social status, chance of doing something important for society, good chance to combine work with family tasks.

Table A1. Eigenvalues for factors describing the labour market success

Factor	Eigenvalue	Difference	Proportion	Cumulative
Factor1	4.5093	2.765	0.215	0.215
Factor2	1.7440	0.098	0.083	0.298
Factor3	1.6461	0.448	0.078	0.376
Factor4	1.1985	0.062	0.057	0.433
Factor5	1.1363	0.126	0.054	0.487
Factor6	1.0103	0.011	0.048	0.535
Factor7	0.9996	0.054	0.048	0.583
Factor8	0.9459	0.066	0.045	0.628
Factor9	0.8802	0.062	0.042	0.670
Factor10	0.8182	0.019	0.039	0.709
Factor11	0.7989	0.091	0.038	0.747
Factor12	0.7079	0.029	0.034	0.781
Factor13	0.6793	0.048	0.032	0.813
Factor14	0.6316	0.025	0.030	0.843
Factor15	0.6063	0.041	0.029	0.872
Factor16	0.5652	0.058	0.027	0.899
Factor17	0.5071	0.033	0.024	0.923
Factor18	0.4743	0.023	0.023	0.946
Factor19	0.4518	0.086	0.022	0.967
Factor20	0.3656	0.042	0.017	0.985
Factor21	0.3236	.	0.015	1.000

Table A2. Factor loadings for factors describing the labour market success

Variable	Job satisfaction (f1)	Education appropriateness (f2)	Job challenge (f3)	Job security (f4)	Independence (f5)	Work-life balance (f6)
empl	0.0077	-0.0310	0.0487	-0.1556	0.0093	0.2357
contract	-0.0438	-0.0683	0.1063	0.8492	-0.0352	-0.0347
security	0.1859	0.0612	-0.0154	0.7773	0.0616	0.1608
feel_earn	0.6243	-0.0793	0.0535	0.1587	-0.1562	0.2343
soc_stat	0.5845	0.0773	0.0783	-0.0119	-0.1502	0.2877
need_hiedu	0.2009	0.5658	0.1570	-0.1740	0.0220	-0.1337
field	-0.0032	0.7701	0.0038	0.0341	-0.0220	-0.0044
util	0.2545	0.6823	0.2131	-0.0258	0.0436	-0.0554
morethanhave	0.3245	0.1572	-0.1944	0.0734	0.1880	-0.5156
learnnew	0.7194	0.1630	0.0855	-0.0075	0.1152	-0.1939
career	0.7491	0.0018	0.0455	0.1053	-0.2359	0.1148
profrole	0.0522	0.1046	0.7516	0.1273	-0.1128	0.0548
innov	0.1061	0.0960	0.6027	0.0233	0.0154	-0.1690
autonomy	0.1836	0.0875	0.5842	0.0024	0.4211	0.0623

supervission	0.1548	0.0251	0.0739	-0.0174	-0.7209	-0.0618
auton_apply	0.3578	0.0853	0.3410	-0.0182	0.5035	0.1279
challenges_apply	0.7613	0.1221	0.1438	-0.0365	0.0825	-0.1949
satisfaction	0.5438	0.3579	0.1241	0.0419	0.1363	0.1269
choice	0.1233	0.4824	-0.0322	0.0477	0.0047	0.3525
difrleisurefam	0.0075	0.0070	-0.0675	0.2193	0.3000	0.6595
difrpustpower	0.8247	0.0972	-0.0089	0.0393	0.0859	-0.0549

Table A3. Explanatory variables for the analysis of the labour market success

Socio-demographic background					
Variable	Description	Values	Freq.	Percent	Cum.
gender (K1)	Gender	female	24829	57.3	57.3
		male	16762	38.7	96.0
		.	1720	4.0	100.0
eduparents (K11)	Parent's and, if applicable, partner's highest education	ISCED 1+2	6377	14.7	14.7
		ISCED 3+4	13740	31.7	46.5
		ISCED 5+6	14680	33.9	80.3
		.	8514	19.7	100.0
livewith (K8)	How do you live with at present	With parents	6771	15.6	15.6
		Alone	8134	18.8	34.4
		With partner, relatives, or fiends	24880	57.4	91.9
		.	3526	8.1	100.0
children (K9)	Do you have children	no children	28978	66.9	66.9
		one	6944	16.0	82.9
		two	4016	9.3	92.2
		three or more	1039	2.4	94.6
		.	2334	5.4	100.0

Study experience

Variable	Description	Values	mean	median	sd
study_duration (A2GSTUDU)	Gross study duration in months	1-609	59.2	56.0	27.9
Variable	Description	Values	Freq.	Percent	Cum.
domain (A1FOE1, A1FOE2, A1FOE3)	Domain of study as defined in DEHEMS project	Education	5160	11.9	11.9
		Sciences	4028	9.3	21.2
		Engineering	7333	16.9	38.2
		Medicine	2629	6.1	44.2
		Social sciences	2429	5.6	49.8
		Business	8598	19.9	69.7
.		13134	30.3	100.0	
typestudy (A4)	Situation in the last one to two years of study	fulltime student	31264	72.2	72.2
		part-time student	9138	21.1	93.3
		.	2909	6.7	100.0

edupriorHE (B1LEVEL)	Sublevel of highest secondary qualification	General secondary	31334	72.4	72.4
		Vocational secondary	7909	18.3	90.6
		.	4068	9.4	100.0
gradetoaverage (A3)	Grade to average	much lower than the average	173	0.4	0.4
		2	1422	3.3	3.7
		3	15578	36.0	39.7
		4	14368	33.2	72.8
		much higher than the average	3370	7.8	80.6
		.	8400	19.4	100.0
intrptstud (A2IRUPT)	Interrupting the study programme for 4 or more months	no	28934	66.8	66.8
		yes	3901	9.0	75.8
		.	10476	24.2	100.0
workafts (K6)	Spending time abroad since graduation: for work	no	34862	80.5	80.5
		yes	5923	13.7	94.2
		.	2526	5.8	100.0
studafts (K6)	Spending time abroad since graduation: for study	no	37979	87.7	87.7
		yes	2784	6.4	94.1
		.	2548	5.9	100.0
workdurs (K5)	Spending time abroad during higher education: for work	no	37271	86.1	86.1
		yes	3404	7.9	93.9
		.	2636	6.1	100.0
studdurs (K5)	Spending time abroad during higher education: for study	no	33989	78.5	78.5
		yes	6927	16.0	94.5
		.	2395	5.5	100.0
nrexpdur (B4)	non study-related work experience	no	18729	43.2	43.2
		yes	22601	52.2	95.4
		.	1981	4.6	100.0
rexpdur (B3)	study-related work experience	no	23819	55.0	55.0
		yes	18024	41.6	96.6
		.	1468	3.4	100.0
strivebest (A9STRIVE)	strived for the highest possible marks	not at all	2494	5.8	5.8
		2	5957	13.8	19.5
		3	11358	26.2	45.7
		4	13996	32.3	78.1
		to a very high extent	8750	20.2	98.3
		.	756	1.8	100.0
extrwork (A9EXWORK)	work above what was required to pass exams	not at all	4318	10.0	10.0
		2	9582	22.1	32.1
		3	13273	30.7	62.7
		4	11061	25.5	88.3
		to a very high extent	4121	9.5	97.8
		.	956	2.2	100.0

partinplacement (A8)	participated in work placement/internships	no	16627	38.4	38.4
		yes	23670	54.7	93.0
		.	3014	7.0	100.0

Modes of teaching and learning

Variable	Description	Values	Freq.	Percent	Cum.
egzmultip (A7MULTCH)	Multiple choice exams	not at all	13587	31.4	31.4
		2	11705	27.0	58.4
		3	9695	22.4	80.8
		4	5265	12.2	92.9
		to a very high extent	2365	5.5	98.4
		.	694	1.6	100.0
oralprez (A7ORALPR)	Oral presentations by students	not at all	4371	10.1	10.1
		2	10686	24.7	34.8
		3	12808	29.6	64.3
		4	10801	24.9	89.3
		to a very high extent	4053	9.4	98.6
		.	592	1.4	100.0
wriasg (A7WRIASG)	Written assignments	not at all	2426	5.6	5.6
		2	7022	16.2	21.8
		3	11857	27.4	49.2
		4	14600	33.7	82.9
		to a very high extent	6871	15.9	98.8
		.	535	1.2	100.0
problearn (A7PROBAL)	Project and/or problem-based learning	not at all	6965	16.1	16.1
		2	13076	30.2	46.3
		3	12410	28.7	74.9
		4	7610	17.6	92.5
		to a very high extent	2567	5.9	98.4
		.	683	1.6	100.0
teacherboss (A7TEACHR)	Teacher as the main source of information	not at all	1050	2.4	2.4
		2	5895	13.6	16.0
		3	14733	34.0	50.1
		4	14980	34.6	84.6
		to a very high extent	6065	14.0	98.6
		.	588	1.4	100.0
theoryparadig (A7THEORI)	Theories and paradigms	not at all	1900	4.4	4.4
		2	4695	10.8	15.2
		3	10898	25.2	40.4
		4	15345	35.4	75.8
		to a very high extent	9777	22.6	98.4
		.	696	1.6	100.0
worcpl (A7WORPLC)	Internships, work placement	not at all	13016	30.1	30.1
		2	9019	20.8	50.9

		3	8080	18.7	69.5
		4	7817	18.1	87.6
		to a very high extent	4696	10.8	98.4
		.	683	1.6	100.0
rsrchproj (A7RESPRJ)	Participation in research projects	not at all	15882	36.7	36.7
		2	13487	31.1	67.8
		3	7539	17.4	85.2
		4	4304	9.9	95.2
		to a very high extent	1506	3.5	98.6
		.	593	1.4	100.0
groupassign (A7GROASG)	Group assignments	not at all	4347	10.0	10.0
		2	10398	24.0	34.0
		3	12047	27.8	61.9
		4	11496	26.5	88.4
		to a very high extent	4520	10.4	98.8
		.	503	1.2	100.0
lectures (A7LECTUR)	Lectures	not at all	1102	2.5	2.5
		2	3514	8.1	10.7
		3	8568	19.8	30.4
		4	15485	35.8	66.2
		to a very high extent	14224	32.8	99.0
		.	418	1.0	100.0

Description of the programme

Variable	Description	Values	Freq.	Percent	Cum.
proppersdev (I1PERSDV)	To what extent has your study programme been a good basis for your personal development	not at all	1058	2.4	2.4
		2	3169	7.3	9.8
		3	9821	22.7	32.4
		4	16310	37.7	70.1
		to a very high extent	10472	24.2	94.3
		.	2481	5.7	100.0
progperftask (I1PERFRM)	To what extent has your study programme been a good basis for performing your current work tasks	not at all	3311	7.6	7.6
		2	6333	14.6	22.3
		3	11384	26.3	48.6
		4	12676	29.3	77.8
		to a very high extent	6786	15.7	93.5
		.	2821	6.5	100.0
proggoodstart (I1START)	To what extent has your study programme been a good basis for starting work	not at all	3654	8.4	8.4
		2	5326	12.3	20.7
		3	9928	22.9	43.7
		4	12554	29.0	72.6
		to a very high extent	9410	21.7	94.4
		.	2439	5.6	100.0
progprestig (A6ACPRES)	programme was academically prestigious	not at all	4581	10.6	10.6
		2	9563	22.1	32.7

		3	13580	31.4	64.0
		4	10231	23.6	87.6
		to a very high extent	4638	10.7	98.3
		.	718	1.7	100.0
emplknowprogr (A6EMPFML)	Employers are familiar with the content of the programme	not at all	5471	12.6	12.6
		2	9985	23.1	35.7
		3	11260	26.0	61.7
		4	10597	24.5	86.2
		to a very high extent	4960	11.5	97.6
		.	1038	2.4	100.0
programsublev (A1SUBLEV)	Sublevel of study programme	long programme not providing direct access to doctorate	21223	49.0	49.0
		long programme providing direct access to doctorate	21750	50.2	99.2
		.	338	0.8	100.0
progrdemand (A6DEMAND)	The programme was generally regarded as demanding	not at all	872	2.0	2.0
		2	4601	10.6	12.6
		3	14728	34.0	46.6
		4	15547	35.9	82.5
		to a very high extent	7083	16.4	98.9
		.	480	1.1	100.0
progfreedom (A6FREEDC)	There was freedom in composing your own programme	not at all	8219	19.0	19.0
		2	11986	27.7	46.7
		3	11427	26.4	73.0
		4	8023	18.5	91.6
		to a very high extent	3053	7.1	98.6
		.	603	1.4	100.0
progbroadfocus (A6BROADF)	The programme had a broad focus	not at all	1297	3.0	3.0
		2	5394	12.5	15.5
		3	13039	30.1	45.6
		4	15983	36.9	82.5
		to a very high extent	6933	16.0	98.5
		.	665	1.5	100.0
progvocorient (A6VOCORI)	The programme was vocationally orientated	not at all	4930	11.4	11.4
		2	9388	21.7	33.1
		3	10986	25.4	58.4
		4	11400	26.3	84.8
		to a very high extent	5972	13.8	98.5
		.	635	1.5	100.0
addHEprogram (B6)	Additional HE programme	no	30256	69.9	69.9
		yes	12607	29.1	99.0
		.	448	1.0	100.0

Work-related experience

Variable	Description	Values	Freq.	Percent	Cum.
nonrelpriorwork (B4BEFHE)	non study-related work experience before HE	no	18658	43.1	43.1
		yes	20430	47.2	90.3
		.	4223	9.8	100.0
relpriorwork (B3BEFHE)	study-related work experience before HE	no	31826	73.5	73.5
		yes	9379	21.7	95.1
		.	2106	4.9	100.0
country_new (COUNTRY)	Country	Other	30229	69.8	69.8
		AT	1821	4.2	74.0
		DE	1700	3.9	77.9
		IT	3139	7.3	85.2
		PL	1200	2.8	87.9
		SI	2923	6.8	94.7
		TR	2299	5.3	100.0

Firm environment

Variable	Description	Values	Freq.	Percent	Cum.
job_stab (G7)	How stable is demand in the market in which your organization operates	unstable	1674	3.9	3.9
		2	5221	12.1	15.9
		3	9107	21.0	37.0
		4	7842	18.1	55.1
		highly_stable	4680	10.8	65.9
		.	14787	34.1	100.0
qual_orient (G6)	Does your organization compete mainly by price or by quality	mainly price	1163	2.7	2.7
		2	2164	5.0	7.7
		3	7200	16.6	24.3
		4	7215	16.7	41.0
		mainly quality	7630	17.6	58.6
		.	17939	41.4	100.0
mrkt_compet (G5)	How strong is the competition in the market in which your organization operates	very week	1832	4.2	4.2
		2	2323	5.4	9.6
		3	5908	13.6	23.2
		4	9884	22.8	46.1
		very strong	10559	24.4	70.4
		.	12805	29.6	100.0
org_earthquake (G9)	changes that have taken place in your organization since you started working	no	17952	41.5	41.5
		yes	23694	54.7	96.2
		.	1665	3.8	100.0

Required level of competence in work

Variable	Description	Values	Freq.	Percent	Cum.
thinkanal (H1ANALYR)	Analytical thinking	low	4837	11.2	11.2
		medium	14515	33.5	44.7
		high	16552	38.2	82.9
		.	7407	17.1	100.0

cordinability (H1COORDR)	Ability to coordinate activities	low	3601	8.3	8.3
		medium	12316	28.4	36.8
		high	19980	46.1	82.9
		.	7414	17.1	100.0
teamworkability (H1WWOTHR)	Ability to work productively with others	low	3406	7.9	7.9
		medium	11449	26.4	34.3
		high	21061	48.6	82.9
		.	7395	17.1	100.0
languageability (H1FLANGR)	Ability to write and speak in a foreign language	low	15308	35.3	35.3
		medium	9644	22.3	57.6
		high	10961	25.3	82.9
		.	7398	17.1	100.0

	OLS (1)	OLS (2)	Logit (3)	Logit (4)	Logit (5)	Logit (6)	Logit (7)	Logit (8)	Logit (9)	OLS (10)	OLS (11)	OLS (12)
	Job satisfaction All	Job satisfaction SCI	Appropriate- ness ALL	Appropriate- ness SCI	Challenge ALL	Challenge SCI	Job security ALL	Job security SCI	Work-life balance ALL	Work-life balance SCI	Independence ALL	Independence SCI
Gender (Male)				0.0796 [0.101]	0.0762** [0.000]		0.0259* [0.038]	0.0835 [0.076]	0.0946** [0.000]		-0.0438 [0.069]	
eduparent_2		-0.1429* [0.041]										
eduparent_3			0.0304* [0.034]	0.1068* [0.024]	0.0298* [0.030]				0.0860** [0.001]			
livewith_1									0.0561* [0.050]		0.0774** [0.007]	
livewith_2							0.0251 [0.057]					
children_1					0.0376* [0.032]				-0.1001* [0.017]		0.0576 [0.071]	
children_3					0.0819 [0.060]			0.2529** [0.003]				
Country AT					0.1547** [0.000]	0.2035** [0.001]	-0.0609* [0.033]		0.1792** [0.001]	0.3224* [0.025]		
Country DE	-0.1023** [0.009]				0.1423** [0.000]		-0.1094** [0.000]		0.0994* [0.029]	0.2441* [0.040]		0.2117* [0.039]
Country IT	-0.3266** [0.000]	-0.2143 [0.083]	0.0554 [0.051]		-0.1664** [0.000]	-0.1980* [0.016]			-0.1818** [0.001]	-0.2431 [0.055]	-0.3526** [0.000]	-0.3662* [0.016]
Country PL	0.0947 [0.061]	0.6093** [0.002]	0.0765** [0.008]		-0.0569 [0.053]	0.1714* [0.011]	-0.1064** [0.001]				-0.2804** [0.000]	
Country SI	-0.2837** [0.000]	-0.3763** [0.001]	0.2374** [0.000]	0.3191** [0.000]	0.1611** [0.000]		-0.0527* [0.022]				-0.5034** [0.000]	-0.3580** [0.004]
Country TR			0.1110** [0.001]		0.1516** [0.000]				0.1326* [0.043]		-1.2693** [0.000]	-1.0059** [0.000]
typestudy_2	-0.0735* [0.013]				0.0534** [0.002]		0.0265 [0.095]					
programs_u_1			0.1525** [0.000]	0.2097** [0.000]	0.0436** [0.007]		-0.0590** [0.000]		-0.0660* [0.028]		-0.0510 [0.096]	-0.1748 [0.053]

addHEprog_1	0.0536* [0.022]		0.0270 [0.070]				-0.0628** [0.000]	-0.2241** [0.000]			0.1172** [0.000]
eduprior_1		-0.3016* [0.012]		0.1827** [0.001]			0.0427* [0.017]		0.0690* [0.037]		0.1853** [0.000]
Study duration											0.0014** [0.006]
intrptstu_1			-0.0539* [0.021]			0.1550** [0.003]					
lectures_2	-0.0762 [0.087]	-0.3216 [0.051]								-1.1353* [0.032]	
lectures_3										-1.0744* [0.037]	
lectures_4		-0.1584* [0.019]	0.0277 [0.054]							-0.9512 [0.062]	
lectures_5					0.0416** [0.004]					-1.0492* [0.040]	0.0863** [0.001]
oralprez_2			-0.0424* [0.012]								
oralprez_4											
oralprez_5	-0.1038* [0.015]							0.1496* [0.049]			
wriasg_2			-0.0338 [0.087]						-0.0616 [0.086]		
wriasg_3							0.0413* [0.016]	0.1253** [0.005]			
wriasg_4					0.0284 [0.053]	0.0840* [0.046]	0.0397* [0.018]		-0.0707* [0.020]		
wriasg_5	-0.0587 [0.084]			-0.1344 [0.100]	0.0559** [0.006]		0.0503* [0.012]		-0.1083** [0.006]	-0.2259* [0.040]	
problearn_3					0.0347* [0.027]		-0.0239 [0.085]				
problearn_4				0.1211* [0.033]	0.0434* [0.016]						0.0615* [0.031]

problearn_5												
teacherbo_2			0.1439** [0.001]				0.0714 [0.057]					
teacherbo_3			0.1094* [0.015]				0.0688 [0.073]	0.1380* [0.014]				
teacherbo_4			0.1130* [0.012]				0.1009** [0.007]	0.1870** [0.001]			-0.0525* [0.030]	
teacherbo_5			0.1297** [0.003]				0.0757* [0.045]	0.1659** [0.007]				
theorypar_2			-0.0746 [0.069]									0.4729* [0.020]
theorypar_3	0.0860** [0.002]		-0.0664 [0.086]					-0.1725** [0.001]				0.3774* [0.042]
theorypar_4	0.0621* [0.020]		-0.0933* [0.015]	-0.0838 [0.090]								0.3629* [0.049]
theorypar_5			-0.1160** [0.006]						-0.0844* [0.021]			0.4069* [0.036]
worcpl_2						0.0901 [0.053]						
worcpl_3					-0.0284 [0.095]			0.1361** [0.007]				
worcpl_4											-0.0529 [0.075]	
worcpl_5			0.0953** [0.000]					-0.1624 [0.102]			0.0953* [0.016]	0.4404** [0.003]
rsrchproj_2											-0.0774** [0.007]	
rsrchproj_3			-0.0320 [0.085]		0.0322 [0.060]			0.1125* [0.020]			-0.1024** [0.002]	
rsrchproj_4			-0.0399 [0.093]		0.0456* [0.034]		-0.0440* [0.029]				-0.1264** [0.002]	-0.2134* [0.049]
rsrchproj_5	0.2289** [0.001]	0.3079* [0.049]	-0.0934* [0.040]		0.0852* [0.025]							

groupassi_2	0.0720* [0.015]					-0.1307** [0.008]			-0.0680 [0.082]	-0.2744* [0.040]		
groupassi_3								-0.1091* [0.023]	-0.0508 [0.060]	-0.3251** [0.008]		
groupassi_4	0.0457 [0.066]									-0.2303 [0.070]		
groupassi_5		-0.3307* [0.021]										-0.3800** [0.009]
egzmultip_2						-0.1105* [0.024]			0.0820* [0.018]			
egzmultip_3	0.0612* [0.028]		-0.0359* [0.043]			-0.1606* [0.024]			0.1685** [0.000]	0.2131* [0.049]	-0.0977** [0.001]	
egzmultip_4	0.0771* [0.038]					-0.3896** [0.000]			0.1930** [0.000]		-0.1249** [0.002]	-0.3831* [0.014]
egzmultip_5									0.1845** [0.002]		-0.1518** [0.009]	-0.5135* [0.012]
progpersd_2	0.2791* [0.021]		-0.1005** [0.000]		-0.0448 [0.086]		0.0992* [0.019]					
progpersd_3	0.3522** [0.002]		-0.0318 [0.059]		-0.0334* [0.038]	-0.0949* [0.048]	0.1080* [0.011]		0.2117** [0.004]			
progpersd_4	0.3902** [0.001]						0.1200** [0.009]		0.2740** [0.000]	0.1669* [0.036]		
progpersd_5	0.5090** [0.000]						0.1371** [0.001]	0.0983 [0.065]	0.4274** [0.000]	0.2353* [0.026]		
progperft_2	0.2459** [0.000]	0.5310** [0.001]	0.1842** [0.000]	0.2039* [0.020]	-0.0321 [0.088]		0.0455* [0.023]			0.1924 [0.053]	0.0625 [0.074]	
progperft_3	0.2418** [0.000]	0.6393** [0.000]	0.3001** [0.000]	0.3971** [0.000]			0.0835** [0.000]	0.1384** [0.002]			0.0529 [0.051]	0.1620* [0.036]
progperft_4	0.2345** [0.000]	0.4551** [0.002]	0.4241** [0.000]	0.5155** [0.000]			0.0950** [0.000]		0.0530 [0.086]			
progperft_5	0.1885** [0.006]	0.7418** [0.000]	0.4319** [0.000]	0.4480** [0.000]	0.0640** [0.001]				0.0773 [0.058]			
proggoods_3			0.0597** [0.005]									

proggoods_4			0.1251** [0.000]					0.0630* [0.046]			0.2000* [0.016]
proggoods_5	0.0614* [0.045]	0.2244** [0.004]	0.0911** [0.000]	0.1049 [0.057]			0.0316* [0.049]	0.0835* [0.019]			0.2103* [0.024]
progprest_2			0.0484 [0.057]	0.1443** [0.007]				-0.0672* [0.050]			
progprest_3			0.0554* [0.026]		-0.0250 [0.082]			0.0515 [0.097]			
progprest_4			0.1220** [0.000]								
progprest_5	0.0975* [0.019]		0.0929** [0.003]					0.1491** [0.001]	0.2648* [0.042]		
emplknowp_2	0.0960* [0.028]			-0.1635** [0.002]			-0.0358* [0.016]				
emplknowp_3	0.0910* [0.034]		0.0673** [0.000]		0.0847* [0.046]		-0.1377** [0.007]				
emplknowp_4	0.1444** [0.001]	0.1490 [0.055]	0.0932** [0.000]							-0.0472 [0.070]	
emplknowp_5	0.1880** [0.000]		0.1254** [0.000]							-0.1067** [0.009]	
progdema_2							0.1444* [0.040]				0.2663 [0.070]
progdema_3									-0.3374* [0.043]	-0.1094** [0.006]	
progdema_4									-0.2704 [0.091]	-0.1558** [0.000]	
progdema_5							0.1081* [0.041]		-0.3223 [0.064]	-0.1824** [0.000]	
progfreed_2		-0.1395 [0.058]	-0.0349* [0.033]	0.1418** [0.006]		0.0263 [0.050]		0.0961* [0.018]			0.3975** [0.001]
progfreed_3				0.1389** [0.008]				0.1201** [0.002]		0.0652* [0.022]	0.5176** [0.000]
progfreed_4			-0.0546** [0.004]		0.0582** [0.001]			0.1737** [0.000]		0.1059** [0.001]	0.4837** [0.000]

progfreed_5				0.1630*	0.0767**				0.1785**		0.1148*	0.3943*
				[0.017]	[0.005]				[0.002]		[0.022]	[0.020]
progbroad_2		-0.2101*					-0.0393			0.5499		
		[0.034]					[0.059]			[0.082]		
progbroad_3		-0.1395								0.7296*		
		[0.067]								[0.016]		
progbroad_4									0.0565*	0.7671*		
									[0.029]	[0.012]		
progbroad_5						0.1286*	-0.0455**			0.7675*		
						[0.015]	[0.008]			[0.015]		
progvocor_2								0.2019**			0.1099**	
								[0.001]			[0.001]	
progvocor_3							0.0277	0.1516*	0.0967**		0.0601*	0.1496
							[0.085]	[0.015]	[0.001]		[0.031]	[0.064]
progvocor_4		-0.1596	0.0373*		-0.0317*		0.0371*	0.2241**	0.0614			
		[0.060]	[0.025]		[0.034]		[0.024]	[0.000]	[0.087]			
progvocor_5		-0.3289*	0.0608*				0.0663**	0.2634**				
		[0.046]	[0.011]				[0.001]	[0.000]				
gradetoav_2									0.1114*		0.3908*	
									[0.045]		[0.018]	
gradetoav_3			-0.0371*	-0.1413*		-0.2042*					0.4108**	
			[0.011]	[0.041]		[0.037]					[0.008]	
gradetoav_4				-0.1231	0.0364*	-0.1957*		0.1545**			0.4288**	
				[0.056]	[0.010]	[0.032]		[0.001]			[0.006]	
gradetoav_5	0.0838*				0.0756**	-0.2848*	-0.0614**	0.1302*			0.3950*	
	[0.045]				[0.001]	[0.011]	[0.005]	[0.035]			[0.013]	
strivebes_2												
strivebes_3	-0.0627*		0.0365*				0.0236					
	[0.045]		[0.022]				[0.092]					
strivebes_4	-0.0945**										-0.0680*	-0.2092**
	[0.003]										[0.013]	[0.009]
strivebes_5	-0.1760**	-0.1650	0.0520**							0.1585	-0.0634	-0.3379**
	[0.000]	[0.063]	[0.007]							[0.094]	[0.091]	[0.001]

extrwork_2			-0.0347*								-0.0679*	
			[0.040]								[0.030]	
extrwork_3					-0.0413**		-0.0274*	-0.0991*			-0.0665*	
					[0.010]		[0.045]	[0.043]			[0.016]	
extrwork_4	0.0488				-0.0411*				-0.0713*			
	[0.054]				[0.015]				[0.022]			
extrwork_5												0.3046*
												[0.040]
workafts_1					0.0459**			-0.1158*	-0.0562	-0.1918*		
					[0.008]			[0.035]	[0.071]	[0.033]		
studafts_1							-0.0805**	-0.1491		-0.2439		0.2582
							[0.003]	[0.076]		[0.069]		[0.072]
workdurs_1	0.1123**											
	[0.003]											
studdurs_1			-0.0305				-0.0587**					0.1856*
			[0.083]				[0.000]					[0.032]
nonrelpri_1											0.0424	
											[0.082]	
relpriorw_1		0.2615*		-0.1610	0.0420*					0.2424*		-0.2005
		[0.024]		[0.055]	[0.012]					[0.034]		[0.091]
nrexpdur_1		0.1432*	-0.0451**		0.0264			0.0779				
		[0.036]	[0.002]		[0.057]			[0.085]				
rexpdur_1		-0.1735*	0.0466**	0.1253**		0.0947*						
		[0.013]	[0.001]	[0.009]		[0.020]						
partinpla_1	-0.0654**		-0.0274		-0.0432**		-0.0699**	-0.0850	-0.0550			-0.3399**
	[0.010]		[0.098]		[0.007]		[0.000]	[0.074]	[0.095]			[0.000]
org_earth_1	-0.0975**		-0.0513**		0.1335**	0.0767	0.0661**	0.0921	-0.1049**		-0.0768**	
	[0.000]		[0.001]		[0.000]	[0.088]	[0.000]	[0.060]	[0.000]		[0.003]	
qual_orie_2	0.1815*								0.1361			-0.3099*
	[0.013]								[0.075]			[0.021]
qual_orie_3	0.3866**	0.2634*	0.0620**			-0.1657**	0.0371*	0.1660**	0.1767*			-0.1639
	[0.000]	[0.032]	[0.005]			[0.002]	[0.012]	[0.001]	[0.013]			[0.081]
qual_orie_4	0.3938**	0.3893**	0.0388			-0.1116*	0.0291*	0.1717**	0.1786*			-0.2009*
	[0.000]	[0.002]	[0.078]			[0.028]	[0.043]	[0.000]	[0.012]			[0.030]

qual_orie_5	0.4854** [0.000]	0.4336** [0.000]	0.0998** [0.000]	0.1420** [0.003]	0.0806** [0.000]				0.1299 [0.071]		0.1514** [0.000]	
mrkt_comp_2	-0.1146* [0.017]	0.4234 [0.066]	-0.1224* [0.022]				0.0650** [0.005]	0.1906** [0.003]	-0.1511 [0.084]			0.3161* [0.023]
mrkt_comp_3		0.5443* [0.014]	-0.1410** [0.003]						-0.2207* [0.010]			0.3201** [0.001]
mrkt_comp_4	0.0496 [0.099]	0.5104* [0.015]	-0.1512** [0.001]				0.0436** [0.001]		-0.1942* [0.014]	0.1762* [0.020]	-0.1540** [0.000]	
mrkt_comp_5	0.0751* [0.018]	0.6457** [0.002]	-0.1897** [0.000]		0.0439** [0.002]				-0.2627** [0.001]		-0.2691** [0.000]	
job_stab_2							0.0955** [0.000]				-0.0979 [0.089]	
job_stab_3							0.1257** [0.000]				-0.1311* [0.018]	
job_stab_4	0.0877** [0.000]						0.1789** [0.000]	0.1452** [0.002]	0.1046** [0.000]		-0.1506** [0.007]	
job_stab_5	0.1388** [0.000]						0.1774** [0.000]	0.1934** [0.000]	0.1034** [0.006]	0.3834** [0.000]	-0.1592** [0.008]	
thinkanal_2	0.3095** [0.000]	0.2751* [0.036]	0.0926** [0.000]						-0.1248** [0.002]			
thinkanal_3	0.5179** [0.000]	0.5692** [0.000]	0.1178** [0.000]		0.0722** [0.000]				-0.1738** [0.000]	0.1852* [0.016]	0.0608* [0.014]	
cordinabi_2	0.3758** [0.000]	0.5849** [0.000]			0.1062** [0.000]							
cordinabi_3	0.4990** [0.000]	0.7871** [0.000]	-0.0275 [0.062]		0.1764** [0.000]	0.1157** [0.004]			-0.1187** [0.000]	-0.1621* [0.039]		
teamworka_2	0.1935** [0.000]				-0.0581** [0.000]		0.0835** [0.000]			0.2280** [0.003]	-0.0927 [0.086]	
teamworka_3	0.2459** [0.000]						0.1083** [0.000]		-0.0826** [0.003]		-0.1626** [0.002]	
languagea_2	0.2269** [0.000]	0.3720** [0.000]							-0.0827** [0.004]			
languagea_3	0.3583** [0.000]	0.5255** [0.000]					-0.0317* [0.018]	-0.0948* [0.037]	-0.1566** [0.000]			-0.1658* [0.025]

Constant	-2.2254** [0.000]	-2.4417** [0.000]							-0.1709 [0.175]	0.3109 [0.611]	0.1184 [0.517]	-0.2617 [0.208]
Observations	6,347	645	6,347	645	6,347	645	6,347	645	6,347	645	6,347	645
Adjusted R-squared	0.211	0.358	0.1868	0.275	0.1048	0.1297	0.0583	0.1963	0.072	0.117	0.136	0.215
RESET Ramsey test	0.0766	0.425							2.007	0.490	1.765	2.128
p-value	[0.973]	[0.735]							[0.111]	[0.689]	[0.152]	[0.0955]
Linktest			0.109	0.648	0.546	0.667	0.165	0.150				

Notes: p-values have been reported in parentheses

Significance levels have been indicated by asterisks: ** – 1%, * – 5%.