Income Prospects of Engineering Graduates in Croatia

A. Tecilazić
Algebra University College, Zagreb, Croatia
ana.tecilazic@algebra.hr

***Abstract* - Research on the employability of graduates based on data collected in the Eurograduate Pilot Survey shows that the field of study is one of the three most important factors for graduates with a professional bachelor's degree in Croatia to obtain a job with a higher monthly income. The results of the analysis conducted on a sample of graduates with bachelor's degrees obtained in 2016/2017 from professional higher education institutions in Croatia show that graduates in the broad field of "Engineering, manufacturing and construction" (ISCED F) find employment in occupations with a gross monthly income that is on average EUR 676 higher than the gross monthly income of graduates with comparable qualifications in the reference educational field. Factor analysis was applied to reduce the number of measured variables indicating the same constructs of human, social or cultural capital to produce factor scores that were used as predictors of monthly income in a multiple linear regression analysis. These research findings support the core propositions of human capital theory that investing in quality and relevant education and training brings economic benefits to individuals and society.**

Keywords* - *Eurograduate, engineering education, employability, income, human capital theory

I. INTRODUCTION

The most recent developments in education and labor market policies show that human capital is becoming increasingly important for economic growth and the development of inclusive societies. Moreover, the possession of relevant skills and competences arguably increases individuals' chances of achieving better outcomes in the labor market. Building on the main principles of human capital theory, supplemented by the stipulations of cultural capital and social capital theories, as presented in Section II. Theoretical and Conceptual Framework, this paper explores the relationship between the field of study and earnings after graduation. Focusing on the relationship between the field of study and salary level, the assumption that a causal process exists between the field of study and earnings level was tested. Data on early labor market outcomes of higher education graduates collected through the first pilot European graduate tracking study - Eurograduate - were used to analyze the predictors influencing salaries in the first year after graduation. The dataset collected through Eurograduate contains responses from a total of 16,408 graduates from eight European countries. The dataset used for the analysis presented in this paper includes 464 individuals who graduated from a bachelor's degree program at professional higher education institutions in Croatia in 2016/2017. The sample is presented in more detail in Section III. Research Methods.

II. THEORETICAL AND CONCEPTUAL FRAMEWORK

The theoretical framework for the analysis presented in this paper is based on the human capital theory developed in the 1960s by economists Gary Becker and Theodore Schultz [1], [2] and complemented by the theories of cultural and social capital advanced by French sociologist Pierre Bourdieu [3], [4]. Human capital is generally and broadly defined as a person's skills and competencies. De la Fuente and Ciccone describe it as "knowledge and skills embodied in people and accumulated through schooling, training and experience that are useful in the production of goods, services and further knowledge" [5]. There is a large body of research on the private returns from investment in education and skills that demonstrates a positive relationship between investment in human capital and labor market outcomes as measured by the level of individuals' earnings [5], [6]. De la Fuente and Ciccone estimate that "one year of training increases wages by as much as 5%." [5].

However, to focus only on people's skills and knowledge in explaining labor market outcomes would ignore the broader social context that plays an important role in creating education and training opportunities for people [7], the role of social capital in creating human capital [8], and the importance of social networks in finding better paying jobs [9], [10], [11]. According to Bourdieu, cultural capital may be institutionalized in the form of parents' educational qualifications, while social capital, which is composed of family and personal social networks and connections, is defined as "the aggregate of the actual or potential resources which are linked to possession of a durable network of more or less institutionalized relationships of mutual acquaintance and recognition - or, in other words, to membership in a group" [12].

The theoretical framework as delineated by human capital theory and social and cultural capital theory formed the basis for the construction of a conceptual framework for analyzing graduate employability. In examining the historical development of the construct of employability, an operational model based on the theories of human, cultural and social capital was developed in the context of a doctoral thesis Employability of Higher

Education Graduates: Transition From Higher Education to the Labor Market [13], which was used as a conceptual framework for the research presented in this paper. Figure 1 shows an extract from the operational model, which includes the constructs of human capital, cultural capital and social capital as predictors of employability as measured by the level of monthly income. Assuming that human capital formation depends, among other things, on the field of study, this paper hypothesized that individuals with degrees in engineering, manufacturing and construction would have a higher chance of employment with higher earnings.

III. RESEARCH METHOD

The data used in this paper were collected as part of the Eurograduate - first pilot graduate tracking survey conducted in eight European countries (Austria, Croatia, Czech Republic, Germany, Greece, Lithuania, Malta, Norway) between October 2018 and February 2019 [14]. The survey included bachelor and master graduates from two cohorts, one and five years after graduation, i.e. graduates from 2012/2013 and 2016/2017. The final dataset was weighted using population data and includes responses from a total of 16408 graduates. The analysis presented in this paper is conducted on a sample of bachelor graduates from professional higher education institutions who graduated in Croatia in 2016/2017. The final dataset contains the sample of a total of 464 graduates who responded to the question about their completed study program and the questions about their earnings. The sample is distributed across nine broad fields of study according to the broad European classification ISCED-F, which includes: Education; Arts and Humanities; Social Sciences; Journalism and Information; Business, Administration and Law; Information and Communication Technologies (ICT); Engineering, Manufacturing and Construction; Agriculture, Forestry, Fisheries and Veterinary; Health and Welfare; Services. Table 1 provides a description of the sample distributed across the study areas.

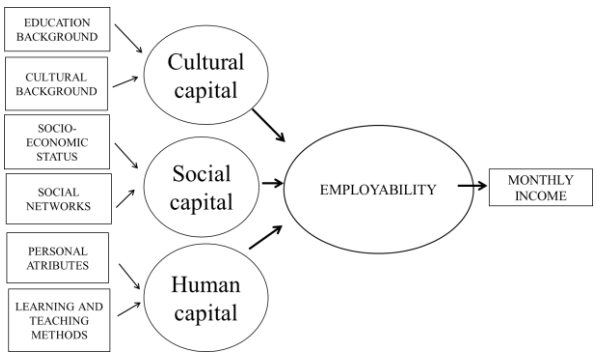

FIGURE 1. OPERATIONAL MODEL (EXTRACT)

TABLE 1. SAMPLE DISTRIBUTED WITH RESPECT TO THE FIELDS OF STUDY

ISCED-F	Frequency	Percent
Education	10	2.1
Arts and Humanities	4	0.9
Social Sciences. Journalism and Information	13	2.8
Business. Administration and Law	161	34.6
Information and Communication Technologies	40	8.7
Engineering. Manufacturing and Construction	80	17.3
Agriculture. Forestry. Fisheries and Veterinary	14	3.0
Health and Welfare	100	21.6
Services	42	9.0
Total	**464**	**100.0**

The survey instrument was a standardized online questionnaire with data centrally collected and anonymized by the Deutsche Zentrum für Hochschul und Wissenschaftsforschung (DZHW) – German Centre for Higher Education Research and Science Studies.

In analyzing the data, a descriptive and comparative statistical analysis of the sample was carried out on the one hand, and a linear regression analysis on the other hand, in order to determine the causal relationship between the field of study and the amount of gross monthly income. Descriptive statistical analysis was conducted in such a way that the respondents were divided into five categories with the following gross monthly incomes: (1) up to 1,000 EUR; (2) 1,001 to 2,000 EUR; (3) 2,001 to 3,000 EUR; (4) 3,001 to 4,000 EUR; (5) 4,001 to 5,000 EUR (6) 5,001 EUR and above. The descriptive analysis showed that 90.2% of the respondents in the whole sample receive a gross monthly income of up to 2,000 EUR (Table 2), indicating that a more sophisticated data set was needed in a linear regression analysis to test the influence of field of study on monthly income.

The comparative analysis between respondents grouped by field of study shows that all respondents with a degree in the field of education (100%) fall into the first category with the lowest monthly income, while the share of respondents with the highest monthly income (5,000 EUR and more) belongs to the group of people with a degree in engineering, manufacturing and construction (Figure 2).

TABLE 2. GROSS MONTHLY INCOME IN EUR

	Frequency	Valid Percent	Cumulative Percent
up to 1,000 EUR	269	58.0	58.0
1,001 to 2,000 EUR	149	32.2	90.2
2,001 to 3,000 EUR	31	6.8	97.0
3,001 to 4,000 EUR	8	1.8	98.8
4,001 to 5,000 EUR	0	0.0	98.8
5,001 EUR and more	6	1.2	100.0
Total	**464**	**100.0**	

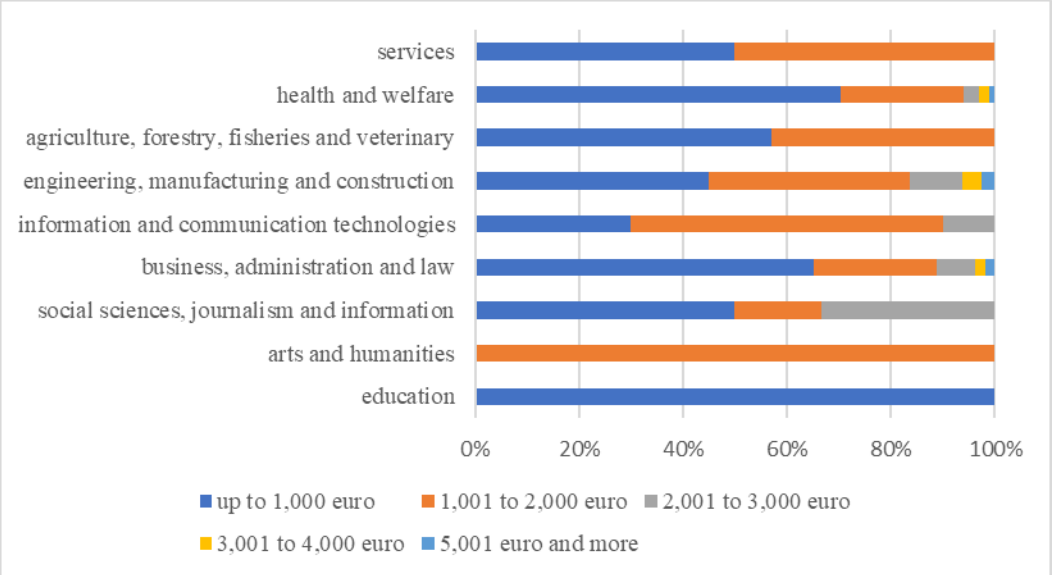

FIGURE 2. MONTHLY INCOME IN RELATION TO THE FIELD OF STUDY

Linear regression analysis was used to predict the relationship between field of study as the independent variable and gross monthly income as the dependent variable, controlling for other possible predictors identified in the operational model (Figure 1). Predictors of monthly income included measured and latent variables. Factor analysis was applied to reduce the number of measured independent variables indicating the same constructs of human, social or cultural capital to create factor scores as latent variables that were used as predictors of monthly income in the multiple linear regression analysis.

The independent variables were included in the analysis as covariates in blocks. The first block contained eight variables related to fields of study, with "Services" as the reference field of study, which was therefore omitted from the block. The second block contained factor scores related to the individual's characteristics and family cultural background, and the third block contained factor scores related to learning and teaching methods and high-impact practices (volunteering, internships, work experience, study abroad) during studies. The fourth block contained variables related to job search strategies as follows: "Finding a job through advertisements in electronic media"; " Finding a job through the Croatian Employment Service"; "Finding a job by contacting the employer on one's own initiative"; "Finding a job by being approached by an employer"; "Finding a job through family, friends and acquaintances".

IV. RESULTS

The results of linear regression (Table 3) on a sample of individuals with bachelor's degrees from professional higher education institutions in Croatia show that when controlling for other variables, the following factors predict the search for a job with higher income: the field of study, volunteering and internships during studies, while the experience of studying abroad, previous work experience and finding a job through the Croatian Employment Service have a statistically significant and negative effect on finding a job with higher monthly income.

Regression analysis showed that among graduates with a bachelor's degree obtained at professional higher education institutions, those with qualifications in the fields of "Engineering, Manufacturing and Construction" are more likely to find a job with higher income than graduates in the reference field of study "Services". After controlling for other variables, graduates with bachelor's degrees in "Engineering, Manufacturing and Construction" are employed in jobs with an average gross monthly income 676 EUR higher than graduates with comparable qualifications in the education field of "Services" ($p < 0.001$; $B = 676.195$). This result is consistent with the comparative analysis of a sample of graduates with bachelor's degrees obtained at a professional higher education institution (Figure 2).

The results of the analysis confirm the hypothesis and show that, controlling for other variables, the field of study has a significant predictive effect on obtaining higher-income employment and that individuals with degrees in engineering, manufacturing and construction have a higher probability of obtaining higher-income employment. It should be noted, however, that much of the data was anonymised or categorised into broader groups in accordance with the General Data Protection Regulation.

TABLE 3. PREDICTORS FOR FINDING EMPLOYMENT WITH HIGHER INCOME

	Unstand. Coef.		Stand. Coef.	t	Sig.	95.0% Confidence Interval for B	
	B	SE	Beta			Low.B.	Up. B.
(Constant)	892.148	185.209		4.817	0.000	527.894	1256.402
Education	-93.429	315.982	-0.016	-0.296	0.768	-714.875	528.018
Arts and Humanities	-458.387	597.933	-0.039	-0.767	0.444	-1634.351	717.577
Social Sciences, Journalism and Information	-9.294	315.040	-0.002	-0.030	0.976	-628.887	610.299
Business, Administration and Law	205.000	162.312	0.115	1.263	0.207	-114.220	524.221
Information and Communication Technologies	277.623	206.423	0.086	1.345	0.180	-128.353	683.598
Engineering, Manufacturing and Construction	676.195	175.462	0.298	3.854	0.000	331.112	1021.278
Agriculture, Forestry. Fisheries and Veterinary	133.896	270.393	0.028	0.495	0.621	-397.889	665.682
Health and Welfare	208.956	178.773	0.098	1.169	0.243	-142.640	560.552
Family cultural capital	-4.068	48.956	-0.004	-0.083	0.934	-100.350	92.213
Human capital (education outcomes)	-106.562	55.665	-0.099	-1.914	0.056	-216.038	2.915
Passive learning and teaching methods	-66.798	44.220	-0.075	-1.511	0.132	-153.767	20.171
Active learning and teaching methods	-4.353	47.978	-0.005	-0.091	0.928	-98.713	90.007
Study abroad	-165.999	68.508	-0.119	-2.423	0.016	-300.734	-31.264
Volunteering	141.891	50.105	0.147	2.832	0.005	43.348	240.434
Work experience	-103.185	43.250	-0.123	-2.386	0.018	-188.246	-18.123
Internship	136.034	56.617	0.122	2.403	0.017	24.684	247.384
Finding a job through advertisement in (online) newspaper	24.212	116.458	0.012	0.208	0.835	-204.828	253.252
Finding a job through the Croatian Employment Service	-300.282	122.675	-0.144	-2.448	0.015	-541.550	-59.015
Finding a job by contacting the employer on one's own initiative	-187.630	114.539	-0.091	-1.638	0.102	-412.896	37.636
Finding a job by being approached by an employer	170.935	129.306	0.070	1.322	0.187	-83.374	425.243
Finding a job through family, friends or acquaintances	3.421	105.193	0.002	0.033	0.974	-203.464	210.306

For example, programmes of study were grouped into broad areas of study, which limits the researcher's ability to conduct a more detailed analysis and provide evidence of comparative differences between qualifications from different education fields.

V. CONCLUSION

From the perspective of human capital theory, it pays to invest in quality and relevant higher education. Based on the theories of human capital, cultural capital and social capital, the application of the operational model for the analysis of employability to a set of data collected in the European pilot Eurograduate survey revealed a causal relationship between field of study and income. After controlling for other predictors of employability, the results of the analysis showed that an engineering education increases the chances of getting a first job.

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