polish 3(179)'12
sociological
review
ISSN 1231 – 1413

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Graduate Labor Mismatch in Poland

Abstract: This paper investigates education-labor mismatch for university graduates in Poland using the HEGESCO survey. Mismatch refers to the level of discord between the job performed by an individual and its education and skills. We evaluate three different dimensions of mismatch: vertical (under-/over-education), horizontal (wrong field of study for the job performed), and skills mismatch (under-/over-skilled). We discuss our results in the light of the large increase in the demand for tertiary education as well as in the number of tertiary education institutions that occurred in Poland after the transition process from communism to market economy.

Keywords: vertical mismatch, over-education, horizontal mismatch, skills mismatch, competencies, fields of study, educational expansion, Poland.

Introduction

The economic and sociological importance of education-job match has been recognized for decades (Brunello, Garibaldi, and Wasmer 2007; Freeman 1976; Kalleberg and Sorensen 1979) and today remains on the center of the stage in labor sociology and labor economics (Budría and Moro-Egido 2009; Groot and Massen van den Brink 2000; Handel 2003; Hartog 2000; Korpi and Tahlin 2009; Kucel 2011). During those three decades, the education-job mismatch has been thoroughly studied in both sociological (Halaby 1994; Witte and Kalleberg 1995; Wolbers 2003) as well as economic literature (Chevalier 2003; Green and Zhu 2010; McGuinness 2006). However, almost all this research has concentrated on the Western Europe and the US. There is almost no evidence on education-job mismatch in Eastern Europe (Kogan and Unt 2005; Lamo and Messina 2010).

This paper aims at filling this gap by investigating education-labor mismatch in Poland using a unique and very rich dataset from the HEGESCO survey. Education-labor mismatch refers to the level of discord between the job performed by an individual and its education and skills. This data permits us to evaluate three different dimensions of mismatch: vertical (under-/over-education), horizontal (wrong field of study for the job performed), and skills mismatch (under-/over-skilled). We estimate the likelihood of each of these mismatches with respect to fields of study,

competencies and types of university program studied (broad, vocational, academically prestigious etc.).

Our results show important differences between fields of study and the likelihood of vertical mismatch which can be traced back to the labor force composition in Poland during the economic transition and shortly after it. We also show that some competencies are much more "successful" in the Polish labor market than others with respect to education-job matching. Furthermore, we demonstrate that having studied an academically prestigious program or one which employers are familiar with improves both skills match and horizontal (field of study) match. We believe these characteristics reflect differences across universities, which have seen a large increase in numbers after transition.

The paper is organized as follows. Section 2 presents the theoretical background to our analysis. Section 3 describes the data and methods used and Section 4 presents the results. Finally, conclusions are discussed in Section 5.

Theoretical Background

Three decades of research on education-job mismatch have demonstrated that it is a highly undesirable phenomenon in the labor market. First of all, mismatched workers tend to receive a lower pay than if they were matched (Chevalier and Lindley 2009; Dolton and Silles 2008; Lamo and Messina 2010; McGuinness 2006). Moreover, growth of their wages is slower than of their matched peers (Buchel and Mertens 2004; Lindley and McIntosh 2010). Mismatched workers have also been shown to receive less training than matched workers which in turn may affect their career mobility (Buchel and Mertens 2004; Smoorenburg and Velden 2000). Furthermore, mismatch leads to decreased job satisfaction (Allen and Velden 2001; Garcia-Aracil 2009; McGuinness and Sloane 2010) and affects negatively workers' productivity (Tsang 1987; Tsang, Rumberger, and Levin 1991). A recent paper by de Grip, Willems and van Boxtel (2008) also demonstrates that working in a mismatched job may have a detrimental influence on workers' cognitive ability. Finally, sociological research points out that mismatch may actually push into unemployment the less skilled and less educated individuals (Aberg 2003; Borghans and de Grip 2000; Kalleberg 1977). All these adverse effects of mismatch may seriously alter social mobility (Buchel 2001; Kucel 2011).

Given the bulk of evidence of the negative effects of mismatch on various socioeconomic outcomes, it is surprising how little is known on mismatch in Eastern European countries (Domanski 2005; Kogan and Unt 2005; Saar, Unt, and Kogan 2008).

The transition process from state socialism to a market economy caused a long period of opacity in the Eastern European labor markets (Solga and Konietzka 1999; Spence 1973; Thurow 1974). This process could be described as a two phase phenomenon with respect to matching in the labor market (Giesecke 2006; Groot and Massen van den Brink 2000; Roberts 1998; Roberts and Szumlicz 1995). The first phase was characterized by a deep economic crisis with high inflation and elevated

unemployment (Plessz 2009). The most important change was the growth of the new service sector and a relative reduction of the industrial sector (Jeong, Kejak, and Vinogradov 2008; Solga and Diewald 2001). The main consequence of these changes was a shortage of skilled labor for the service sector, which led to educational expansion aimed to fulfill those employment needs. For those workers who ended up in the service sector this meant rapid upward mobility and employment in under-educated or under-skilled positions, while many workers from the industrial sector suffered long unemployment spells and skills depreciation (Cazes and Nesporova 2003; Diewald, Solga, and Goedicke 2002).

The second phase of the transition process with respect to education-job mismatch could be observed since 1995–1998 when the first cohorts of adequately skilled labor for the service sector entered the labor market and the pace of growth of skilled jobs in the service sector slowed down (Groot and Massen van den Brink 2000). This new situation led to an excess of educated workers and, consequently, caused some students to prolong their studies and delay their entry into the labor market (Helemäe and Saar 2000; Saar, Unt, and Kogan 2008).

We investigate the existence and determinants of education-job mismatch in Poland for the cohort of graduates from 2003. This cohort entered the labor market in a society considered by Słomczynski *et al.* (2007) a "typical capitalist society" with much more highly meritocratic employment and remuneration rules than under the previous state socialist system (Domański 2010). The Polish tertiary education system was, however, strongly shaped by the preceding transition period. Young graduates who entered the Polish labor market in 2003 had started their university studies in the second phase of the economic transition, namely in the end of nineties. By then, the education system in Poland responded to the increase demand of tertiary education with a flourishing amount of private tertiary institutions (Fulton, Santiago, Edquist, El-Khawas, and Hackl 2007). By the time our sample graduated, Poland had 427 tertiary education institutions, which is 4.4 times as much as in 1989 when there were 97 tertiary institutions in Poland. A grand majority of these institutions were private (301 out of 427). As regards the number of graduates in both private and public institutions, the numbers grew by 680% between 1990 and 2003 from 56,000 to 384,000. Moreover, more than 40% of those graduates obtained their diplomas in social sciences, business and law, while only 3.9% of graduates finished Sciences studies (Fulton et al. 2007, p. 18–19). All these changes in the Polish tertiary education were mostly a response to the raise in demand for higher education, while little effort was made to attune programs to the skills demanded in the labor market. The strong detachment between universities and labor market in Poland and the large supply of newly created tertiary education institutions made it more difficult for employers to screen the large pool of graduates. In this context, program characteristics such as academic prestige or employer familiarity with the content, gained importance in determining the education-labor mismatch of the graduates.

The scarce existing evidence on Eastern Europe shows that Slovenia, Estonia and Hungary did not escape the trap of education-job mismatch, so well-known in Western Europe and the US (Kogan and Unt 2005; Lamo and Messina 2010; Lindberg 2009).

Although in our study we cannot observe whether an individual graduated from a public or private institution, we have a battery of program characteristics which allow us to analyze which of them allowed their graduates to avoid education-job mismatches. A priori we expect to observe that prestigious and well known programs should diminish the likelihood of mismatch together with science and vocational types of programs. Contrary to that social sciences are expected to prove rather "unsuccessful" in matching their graduates to jobs since most of the expansion in private institutions was directed towards this field of study.

Data Description and Methodology

Data description

We use HEGESCO survey for Poland in our analysis. HEGESCO survey includes also information on Slovenia, Turkey, Lithuania and Hungary. It consists of a representative sample of ISCED5A graduates who got their degree in the academic year 2002/2003. Data collection took place five years after graduation, in 2008. A questionnaire was sent by mail asking about their educational and career experience during five years since graduation, giving a quasi-longitudinal character to the data. The response rate in Poland was 20%, which corresponds to 1.200 observations (Allen and Van der Velden 2009).[1]

We use three dependent variables measuring different types of labor mismatch: vertical, horizontal and skills mismatch. Vertical mismatch refers to three possible categories: under-educated if the respondent considered his/her job required more education than s/he currently possessed, matched if the respondent considered his/her level of education adequate for his/her present job, and over-educated if the respondent considered s/he had more education than required by the job. Horizontal mismatch refers to the adequacy of the field of study to the current job. The worker is considered to be horizontally matched if own or related field was the most appropriate for the present job, and horizontally mismatched when completely other or no specific field was required according to the respondent. The third dependent variable measures the level of skill mismatch. When the respondent considers that his/her knowledge and skills are little utilized in his/her current job, then s/he is regarded as over-skilled. Instead, when the respondent feels that the current work demands more knowledge and skills than s/he can offer, then s/he is coded as under-skilled. If s/he is neither over-skilled nor under-skilled, s/he is matched in terms of skills. Certainly, this kind of measures of education-job mismatches is not free from possible flaws. The major criticism of the measure used here is that it may reflect worker's subjective desires more than the real mismatch situation. Other measures based on statistical approximations of educational requirements of job across occupations have also been heavily criticized. At the moment there is no consensus

[1] For further information on the HEGESCO survey, see http://www.hegesco.org.

in the mismatch literature which measures are clearly better and the choice is usually determined by data availability (Chevalier 2003; Halaby 1994; McGuinness and Sloane 2010).

As explanatory variables we use standard individual and job characteristics, fields of study and six characteristics of the study program (whether it was demanding, vocationally oriented, broad in content, academically prestigious, employers were familiar with content and there was freedom to compose own program). The characteristics of the study program are a 5-level Likert-type scale variable. As we have discussed before, program characteristics used in this paper are crucial controls for the model in order to tackle the relative quality differences of skills signal across different tertiary schools in Poland.

Further, we construct five indexes of competencies based on a battery of questions regarding individuals' self-perception of nineteen facets spanning from knowledge of their own field, through ability to coordinate activities, negotiate, use time efficiently, to knowledge of foreign language (Garcia-Aracil and Van der Velden 2008). Every facet of competency was measured on 7-level Likert-type scale with 1 indicating the lowest level of competency in that facet and 7 the highest. Table 1 presents the groupings of all nineteen facets into indexes based on a factor analysis and their corresponding Cronbach's alpha coefficients of reliability. Each index was later standardized to mean 0 and variance 1.

Table 1

Indexes of Competencies and Competency Facets Comprising Each Index

Index	Competency facets	Cronbach's alpha*
knowledgeable	mastery of own field or discipline knowledge of other field or disciplines ability to acquire new knowledge analytical thinking	$\alpha = 0.78$
executive	ability to negotiate effectively ability to perform well under pressure	$\alpha = 0.62$
leadership	ability to coordinate activities ability to use time efficiently ability to work productively with others ability to mobilize the capacities of others ability to make your meaning clear to others ability to exert authority	$\alpha = 0.84$
enterprising	alertness to new opportunities ability to come up with new ideas and solutions willingness to question your own and others' ideas ability to use computers and internet	$\alpha = 0.77$
communication	ability to present products, ideas or reports to an audience ability to write reports, memos or documents ability to write and speak in a foreign language	$\alpha = 0.62$

* Each index is computed as the average of the competency facets indicated above.

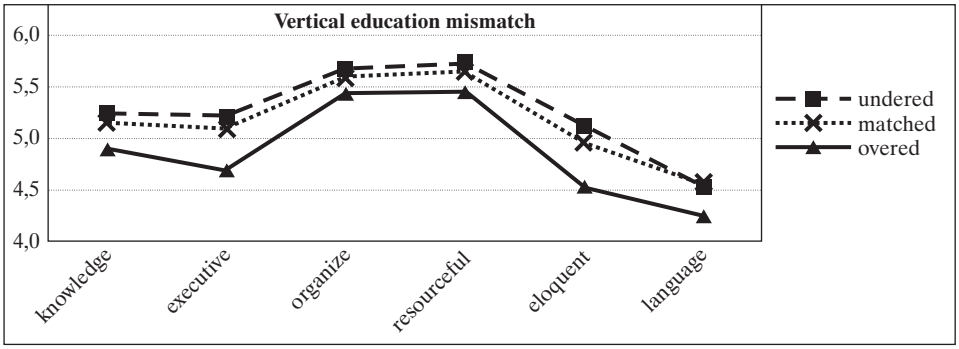
After excluding all missing cases, as well as self-employed and part-time workers (those who worked less than 20 hours per week),[2] and those above 65 years old, we are left with 720 valid cases for our analysis.

Around 22% of university graduates are under-educated in Poland, a number much higher than in Western European countries due to the transition process as explained in the theoretical discussion. Around 15% of university graduates are over-educated, a figure more in line with results found in Western European countries. Under-skilling is also large in Poland (close to 40%), with only 8% of respondents reporting over-skilling. With regards to horizontal mismatch, around 18% of university graduates work in a job that does not require the field of study of their university program.

Figures 1 and 2 show the average reported amount of competencies for vertical and skill mismatch, respectively. The main differences occur for the over-educated and over-skilled individuals, who report lower level of competencies than the rest of individuals (Figures 1 and 2). This observation is in line with recent studies which argue that those individuals who get over-educated are missing skills of some type (Chevalier and Lindley 2009; Garcia-Aracil and Van der Velden 2008; Green and McIntosh 2007; Heijke, Meng, and Ris 2003; Hernandez-March, Martin del Peso, and Leguey 2009). There is no significant difference in competencies between those horizontally matched and mismatched.

Figure 1

Average Level of Competencies and Vertical Education Mismatch



Similarly, figures 3 and 4 show the average program characteristics level reported for skills and horizontal mismatch, respectively. On average, over-skilled and horizontally mismatched individuals report having studied a worse program. There are no significant differences in program characteristics for vertical mismatch.

[2] The self-employed and part-time workers are very specific groups. Different reasons can explain why individuals become self-employed or prefer a part-time job. Explaining them is beyond the scope of this paper.

Figure 2

Average Level of Competencies and Skill Mismatch

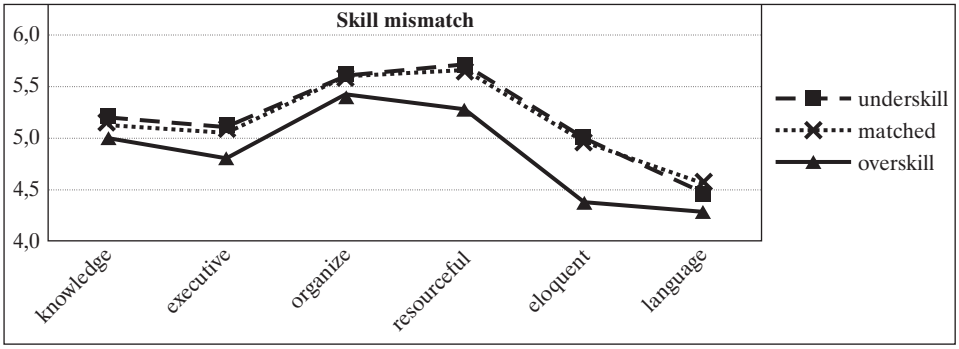


Figure 3

Program Characteristics and Skill Mismatch

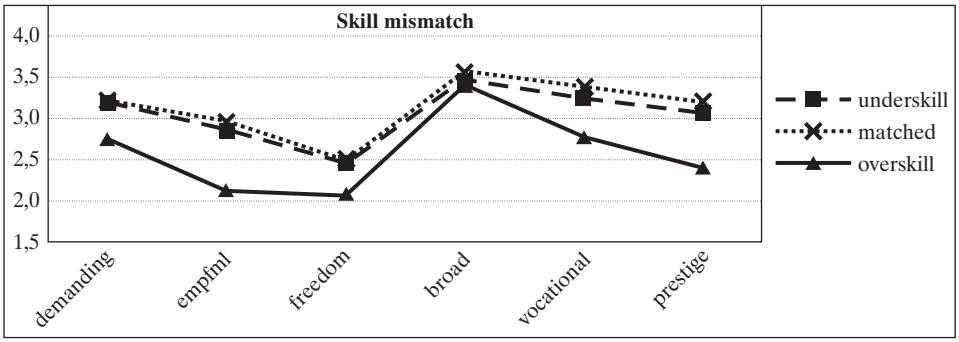
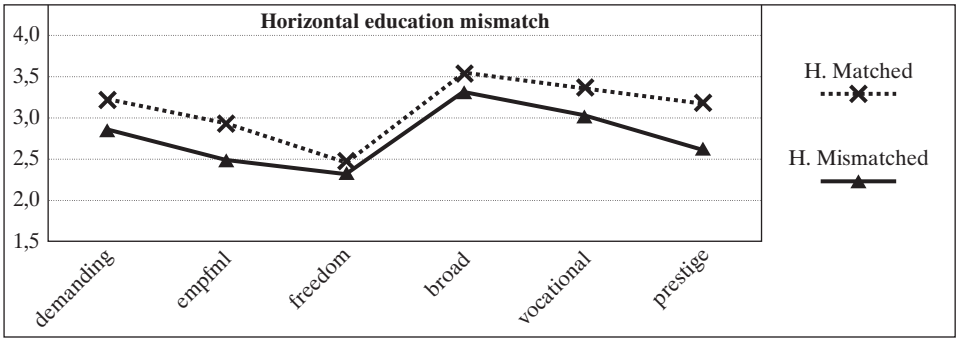


Figure 4

Program Characteristics and Horizontal Education Mismatch



Methodology

Given the categorical nature of the dependent variables we employ multinomial logistic models for vertical and skills mismatch and a logistic model for the horizontal

mismatch. A similar modeling approach has been used in Kogan and Unt (2005) for studying vertical mismatch in Estonia, Slovenia and Hungary. Multinomial logistic model permits us to assess the relative impact of explanatory variables such as competencies or fields of study on the dependent variable education-job mismatch with respect to the matched workers category. The relative impact of particular competencies on the likelihood of being under-/over-educated or under-/over-skilled is estimated in comparison to the group of correctly matched workers (those who work in jobs requiring their education level or skills level). The estimation of the multinomial logistic model is straightforward using present statistical packages such as SAS or STATA. In this paper we have estimated the model using mlogit command in STATA 11 Special Edition. The procedure has been excellently explained using applied examples as well as theoretical definition in Cameron and Trivedi (2010, Ch. 15).[3] Other statistical packages such as SPSS result somewhat more difficult in use for multinomial logit models, as they require previous data transformation, which is done automatically by STATA or SAS.

For the horizontal mismatch, whereby workers are employed in jobs requiring different field of study than their achieved field, we use logistic regression and compare relative likelihood of being horizontally mismatched with respect to the reference category of correctly allocated workers. These techniques allow us to determine which competencies and fields of study increase or decrease the likelihood of education-job mismatch in Poland in the year 2008.

A note of caution is needed for the reader not familiar with binary and multinomial binary models: results presented in Tables 2–4 contain rough logit coefficient estimates. This means that we can only interpret their signs and not their magnitudes. Comparisons across logit models are also only possible if predicted probabilities are first computed from each model. For further theoretical explanations see Cameron and Trivedi (2005, Ch. 15) or Wooldridge (2002, Section 15.9). In our models we interpret therefore only the signs of the coefficients which tell us if certain controls contribute to an increase or a decrease of the likelihood of mismatch. Further analysis using predicted probabilities and/or marginal effects are possible and often useful depending on the research hypotheses.

In the base model (Model 1) we introduce a battery of explanatory variables entailing individual characteristics such as gender, age, average grade in secondary education (a proxy for ability), education level, fields of study, control if student participated in an internship and job characteristics, such as tenure, firm size, three dummies for aggregate occupations and three dummies for aggregate sectors.[4] In Model 2 we extend the previous analysis by introducing the measures on competencies.

[3] The coefficients obtained through multinomial logistic regression as well as those obtained through logistic regression cannot be directly interpreted as in standard regression. It is, however, possible to interpret their signs and this tell us whether a given control variable has a positive or negative effect on the dependent variable (mismatch in our case). In the case of multinomial model the model is represented by two equations: one for under-/over-education (or under-/over-skilling) respectively.

[4] Higher disaggregation although desirable proved impossible due to small N in certain categories of ISCO and NACE. HEGESCO is a university graduates' survey and that creates a situation where majority of respondents work in higher occupations ISCO 1–3 and sectors typical for high skills requirements.

Model 3 extends the base model by adding the program characteristics in the equation. Finally, Model 4 introduces both sets of variables together, competencies and program characteristics. Such methodology permits us to compare models' parsimony (using AIC and/or BIC statistics as well as pseudo R^2 coefficients). These criteria lead our discussion of the results below.

Results

In this section we present the econometric results for vertical mismatch, skills mismatch and horizontal mismatch. First we analyze the vertical dimension of education-job mismatch referring to whether an individual possesses too much or too little formal education as compared to the required level. Next we move on to analysis of skills mismatch, again distinguishing between over-skilling and under-skilling for the job. Finally, we analyze horizontal mismatch, whereby workers report if their job requires their field of study or it requires some completely other field or no field.

Vertical Mismatch

Table 2 reports the coefficients for the multinomial logistic estimation for vertical mismatch. We explain a large part of vertical mismatch as pseudo R-squares for these estimations show (around 40%).

Results reveal that having studied Social Sciences or Sciences and Mathematics improve the chances of being under-educated while it decreases the chances of being over-educated with respect to Engineering.[5] These results are consistent with the fact that few students graduate from Sciences and Mathematics, which facilitates their finding adequate jobs or even more demanding jobs as compared to their level of education. Social Sciences keep being a good field of study as for vertical mismatch, indicating that the labor market for this type of graduates did not saturate in Poland yet.

Once we introduce competencies in the model (Model 2), we observe that executive skills clearly help in avoiding over-education, while communication skills make it more likely to become under-educated. These are, therefore, valuable skills for the Polish labor market. From Model 3 we see that program characteristics do not matter to explain vertical mismatch.

The rest of the variables behave as expected. Average grade in secondary education increases chances of being under-educated and decreases chances to be over-educated. Having higher education level makes it easier to become over-educated, and decreases odds of under-education. Participation in an internship helps in getting an under-educated job. Finally, being a female or working in a big firm decreases the likelihood of being over-educated. While the latter is consistent with the literature on

[5] Engineering during the "communist" times was the strategic field providing skilled labor for the overgrown industry (especially heavy industry) sector. We choose engineers to be the reference category because we expected them to be the relative "losers" in the early transition stages in Poland.

Table 2

Coefficients for the Multinomial Logistic Estimation on Vertical Mismatch

	Model 1		Model 2		Model 3		Model 4	
	undered	overed	undered	overed	undered	overed	undered	overed
Education	0.981	−0.475	1.098	−0.412	0.948	−0.603	1.028	−0.531
	(0.747)	(0.567)	(0.756)	(0.588)	(0.749)	(0.585)	(0.761)	(0.604)
Humanities	−1.257	−1.600	−1.192	−1.602	−1.491*	−1.469	−1.444	−1.528
	(0.822)	(1.121)	(0.861)	(1.131)	(0.860)	(1.115)	(0.898)	(1.134)
Social Sciences	0.731	−0.535*	0.780	−0.448	0.836*	−0.606*	0.860*	−0.495
	(0.468)	(0.309)	(0.484)	(0.322)	(0.499)	(0.326)	(0.513)	(0.337)
Science & Math	1.940***	−1.622**	1.907***	−1.749**	2.159***	−1.700**	2.086***	−1.836***
	(0.680)	(0.677)	(0.707)	(0.701)	(0.699)	(0.687)	(0.722)	(0.712)
Agriculture & Vet	−1.264	0.034	−1.361	−0.051	−1.567	−0.131	−1.681	−0.188
	(1.549)	(0.416)	(1.555)	(0.430)	(1.696)	(0.445)	(1.707)	(0.467)
Health	1.418	−1.130	1.498	−1.245	1.431	−1.122	1.526	−1.263
	(0.891)	(0.821)	(0.938)	(0.830)	(0.899)	(0.827)	(0.954)	(0.838)
Services	0.702	−0.665	0.952	−0.638	0.366	−0.774	0.617	−0.707
	(0.661)	(0.492)	(0.670)	(0.499)	(0.703)	(0.503)	(0.715)	(0.509)
Grade sec.	0.388**	−0.288**	0.300*	−0.247**	0.450***	−0.277**	0.360**	−0.248**
	(0.154)	(0.119)	(0.159)	(0.125)	(0.157)	(0.120)	(0.163)	(0.125)
ISCED5a & 6	−5.467***	0.875*	−5.631***	0.778*	−5.676***	0.914**	−5.808***	0.802*
	(0.434)	(0.457)	(0.457)	(0.458)	(0.471)	(0.460)	(0.491)	(0.460)
Internship	0.738*	0.222	0.701*	0.141	0.750*	0.228	0.699	0.156
	(0.422)	(0.312)	(0.424)	(0.316)	(0.434)	(0.316)	(0.436)	(0.320)
Female	0.594	−0.613**	0.599	−0.729***	0.539	−0.648**	0.530	−0.758***
	(0.370)	(0.252)	(0.378)	(0.267)	(0.381)	(0.256)	(0.391)	(0.270)
Age	−0.0305	0.0112	−0.0292	0.00996	−0.0321	0.0141	−0.0323	0.0143
	(0.077)	(0.047)	(0.078)	(0.048)	(0.085)	(0.047)	(0.086)	(0.048)
Tenure	0.00538	0.00191	0.00576	0.00174	0.00459	0.00249	0.00513	0.00203
	(0.005)	(0.004)	(0.005)	(0.004)	(0.005)	(0.004)	(0.005)	(0.004)
firmsizeG_2	0.287	−0.168	0.295	−0.111	0.376	−0.185	0.356	−0.120
	(0.451)	(0.305)	(0.457)	(0.312)	(0.464)	(0.308)	(0.471)	(0.315)
firmsizeG_3	0.516	−0.646**	0.519	−0.537*	0.606	−0.703**	0.577	−0.574*
	(0.416)	(0.298)	(0.431)	(0.308)	(0.435)	(0.305)	(0.451)	(0.315)
Leadership			−0.145	0.146			−0.136	0.164
			(0.247)	(0.173)			(0.251)	(0.175)
Executive			−0.277	−0.386**			−0.277	−0.395***
			(0.215)	(0.151)			(0.222)	(0.153)
Knowledge			0.183	0.0261			0.132	0.0547
			(0.223)	(0.166)			(0.224)	(0.170)
Enterprising			0.120	−0.162			0.129	−0.161
			(0.237)	(0.181)			(0.240)	(0.185)
Communication			0.338*	−0.102			0.355*	−0.108
			(0.203)	(0.152)			(0.210)	(0.155)
Demanding					−0.211	0.0285	−0.207	0.0516
					(0.175)	(0.136)	(0.177)	(0.139)
Employer familiar					0.107	0.0756	0.123	0.0925
					(0.137)	(0.103)	(0.140)	(0.105)
Freedom					−0.012	0.0295	−0.00948	0.0549
					(0.139)	(0.101)	(0.143)	(0.105)
Broad					−0.277	−0.0254	−0.284	−0.0328
					(0.174)	(0.135)	(0.182)	(0.137)
Vocational					0.241	−0.0551	0.226	−0.0468
					(0.169)	(0.129)	(0.171)	(0.131)
Prestigious					0.145	−0.205*	0.130	−0.168
					(0.168)	(0.123)	(0.170)	(0.125)
_cons	−0.210	−0.873	0.118	−0.940	−0.219	−0.450	0.259	−0.820
	(2.429)	(1.597)	(2.452)	(1.642)	(2.818)	(1.669)	(2.834)	(1.736)
N	720		720		720		720	
pseudo R^2	0.389		0.405		0.398		0.413	
AIC	892.2		890.8		904.0		904.4	
BIC	1075.4		1119.8		1142.1		1188.3	

Standard errors in parentheses. P-values: $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.
Reference category for fields of study: Engineering.
Coefficients for controls for occupation and economic sector not displayed (available from authors).
AIC denotes Akaike Information Criteria, BIC denotes Bayesian Information Criteria.

over-education, gender results could be explained by a strong selection mechanism on those female students that finish university degree and get to the labor market.

Skills Mismatch

Results on skills mismatch are presented in Table 3. Results reveal that graduates from Education and Agriculture studies feel themselves more under-skilled in their jobs than engineering graduates. Their study program adapted to the new labor market to the lowest degree and, similarly as in the Western Europe, does not equip their graduates with very "marketable" skills (Ortiz and Kucel 2008). The rest of fields of study do not seem to influence the probability of skills mismatch in Poland.

Graduates with good enterprising and communication skills are less likely to become over-skilled. However, the variable "knowledge" increases chances for an over-skilled job. These results hold even when program characteristics are included in the estimation. Having strong knowledge of your field and the ability to acquire new knowledge does not help in obtaining a job matching your skills. In contrast, ability to communicate and being alert to opportunities are important in this respect.

When employers are familiar with the program, the program was vocationally oriented and academically prestigious, the probability of over-skilling decreases. Moreover, in Model 4, having studied a vocationally oriented program also helps in avoiding feeling under-skilled at work. These results emphasize the importance of the type of tertiary education institution for skill mismatch. Those graduates from well-established programs known by employers or closely linked to the labor market (vocational) were more likely to obtain a job adequate to their skills. This finding might suggest (although it needs much more profound examination) that employers in Poland tend to value more programs which have been present in the country's education system for long, namely the programs offered by the public and perhaps some few very selected private tertiary institutions. This line of research requires clearly a further investigation.

Horizontal Mismatch

The main variables influencing the probability of horizontal mismatch are fields of study and program characteristics, as reported in Table 4. Notice that the Health field of study was dropped from the analysis because all graduates in Health reported being horizontally matched. In contrast, the worse field in terms of horizontal match is Humanities, which increases the chances of being horizontally mismatched even when controlling for program characteristics.

Although Social Sciences and Services increase the likelihood of horizontal mismatch in models 1 and 2, the significance disappears once program characteristics are introduced. Academically prestigious programs and employers' familiarity with them are the characteristics that decrease the probability of working outside one's own field of study. This is again related to the type of tertiary education institution. Those universities that manage to achieve or maintain a certain level of prestige and

Table 3

Coefficients for the Multinomial Logistic Estimation on Skill Mismatch

	Model 1		Model 2		Model 3		Model 4	
	underskill	overskill	underskill	overskill	underskill	overskill	underskill	overskill
Education	0.735*	0.565	0.729*	0.535	0.805**	0.377	0.779**	0.397
	(0.382)	(0.740)	(0.383)	(0.767)	(0.389)	(0.785)	(0.390)	(0.809)
Humanities	−0.789	0.372	−0.837	0.160	−0.804	0.466	−0.847	0.361
	(0.614)	(0.899)	(0.618)	(0.935)	(0.620)	(0.911)	(0.625)	(0.940)
Social Sciences	0.0823	0.139	0.0628	0.0626	0.0477	−0.438	0.0145	−0.478
	(0.235)	(0.448)	(0.238)	(0.470)	(0.247)	(0.496)	(0.250)	(0.513)
Science & Math	−0.0858	0.539	−0.144	0.436	−0.199	0.178	−0.279	0.0634
	(0.396)	(0.634)	(0.400)	(0.658)	(0.402)	(0.687)	(0.407)	(0.710)
Agriculture & Vet	0.923**	1.332**	0.874**	1.290**	1.019**	1.057	0.965**	1.067
	(0.377)	(0.611)	(0.382)	(0.626)	(0.397)	(0.673)	(0.403)	(0.695)
Health	−0.00755	0.472	−0.00412	0.306	−0.0120	0.579	−0.00936	0.684
	(0.471)	(0.881)	(0.474)	(0.902)	(0.478)	(0.937)	(0.482)	(0.949)
Services	0.277	0.532	0.288	0.380	0.324	0.263	0.325	0.159
	(0.355)	(0.606)	(0.357)	(0.623)	(0.360)	(0.644)	(0.362)	(0.673)
Grade sec.	0.0561	−0.352**	0.0568	−0.249*	0.0469	−0.339**	0.0482	−0.237
	(0.084)	(0.144)	(0.088)	(0.151)	(0.085)	(0.152)	(0.089)	(0.158)
ISCED5a & 6	−0.134	−0.0824	−0.123	−0.204	−0.146	−0.0779	−0.128	−0.253
	(0.191)	(0.340)	(0.192)	(0.346)	(0.194)	(0.353)	(0.196)	(0.361)
Internship	0.0874	−0.615*	0.137	−0.604*	0.115	−0.629*	0.175	−0.608
	(0.220)	(0.351)	(0.224)	(0.362)	(0.222)	(0.371)	(0.226)	(0.384)
Female	−0.0362	−0.218	−0.0334	−0.264	−0.0305	−0.185	−0.0368	−0.251
	(0.183)	(0.322)	(0.186)	(0.342)	(0.185)	(0.339)	(0.188)	(0.363)
Age	−0.00341	−0.0866	−0.00500	−0.100	0.00100	−0.0877	−0.000409	−0.125
	(0.036)	(0.079)	(0.036)	(0.083)	(0.036)	(0.083)	(0.036)	(0.089)
Tenure	−0.00322	−0.00207	−0.00344	−0.00250	−0.00279	−0.000322	−0.00299	0.0000948
	(0.003)	(0.005)	(0.003)	(0.005)	(0.003)	(0.005)	(0.003)	(0.005)
firmsizeG_2	−0.105	−0.0914	−0.105	−0.0111	−0.101	−0.244	−0.0969	−0.236
	(0.226)	(0.445)	(0.228)	(0.456)	(0.228)	(0.473)	(0.230)	(0.482)
firmsizeG_3	0.0392	0.396	0.0465	0.563	0.0485	0.205	0.0586	0.341
	(0.211)	(0.385)	(0.214)	(0.401)	(0.214)	(0.412)	(0.218)	(0.428)
Leadership			−0.0401	0.151			−0.0185	0.109
			(0.127)	(0.219)			(0.128)	(0.231)
Executive			0.0388	0.0220			0.0509	0.109
			(0.110)	(0.194)			(0.112)	(0.202)
Knowledge			0.193	0.396*			0.211*	0.464**
			(0.118)	(0.213)			(0.120)	(0.224)
Enterprising			−0.0264	−0.633***			−0.0247	−0.612***
			(0.129)	(0.222)			(0.131)	(0.236)
Communication			−0.0993	−0.425**			−0.128	−0.493**
			(0.108)	(0.187)			(0.110)	(0.199)
Demanding					0.0823	−0.0749	0.0865	−0.0755
					(0.091)	(0.180)	(0.091)	(0.183)
Employers familiar					−0.0582	−0.424***	−0.0590	−0.451***
					(0.072)	(0.139)	(0.072)	(0.143)
Freedom					0.0314	−0.133	0.0369	−0.140
					(0.071)	(0.141)	(0.072)	(0.144)
Broad					−0.0640	0.204	−0.0563	0.213
					(0.091)	(0.165)	(0.092)	(0.172)
Vocational					−0.140	−0.351**	−0.163*	−0.359**
					(0.089)	(0.156)	(0.091)	(0.160)
Prestigious					0.0165	−0.346**	−0.00304	−0.326*
					(0.085)	(0.163)	(0.087)	(0.171)
_cons	−0.372	1.895	−0.352	1.848	−0.0305	5.158*	0.0687	5.858**
	(1.191)	(2.517)	(1.196)	(2.627)	(1.275)	(2.718)	(1.278)	(2.911)
N	720		720		720		720	
pseudo R^2	0.042		0.059		0.076		0.092	
AIC	1330.3		1328.4		1309.9		1309.1	
BIC	1513.5		1557.3		1548.0		1593.0	

Standard errors in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.
Reference category for fields of study: Engineering.
Coefficients for controls for occupation and economics sector not displayed (available from authors).
AIC denotes Akaike Information Criteria, BIC denotes Bayesian Information Criteria.

Table 4

Coefficients for the Logistic Estimation on Horizontal Mismatch

	Model 1	Model 2	Model 3	Model 4
Education	0.627	0.630	0.422	0.411
	(0.489)	(0.490)	(0.511)	(0.511)
Humanities	1.620***	1.475**	1.533***	1.387**
	(0.588)	(0.593)	(0.593)	(0.600)
Social Sciences	0.746**	0.669**	0.483	0.401
	(0.330)	(0.333)	(0.349)	(0.352)
Science & Math	0.347	0.348	0.0627	0.0800
	(0.513)	(0.519)	(0.534)	(0.540)
Agriculture & Vet	0.557	0.563	0.0641	0.0710
	(0.489)	(0.495)	(0.529)	(0.534)
Services	0.885**	0.858*	0.734	0.713
	(0.440)	(0.441)	(0.450)	(0.452)
Grade sec.	−0.380***	−0.394***	−0.386***	−0.407***
	(0.103)	(0.109)	(0.106)	(0.112)
ISCED5a & 6	0.0560	0.0450	0.0766	0.0837
	(0.240)	(0.242)	(0.247)	(0.250)
Internship	−0.217	−0.194	−0.236	−0.202
	(0.258)	(0.262)	(0.263)	(0.267)
Female	0.182	0.236	0.189	0.249
	(0.231)	(0.236)	(0.238)	(0.244)
Age	−0.00370	0.00348	0.00719	0.0133
	(0.043)	(0.043)	(0.044)	(0.044)
Tenure	−0.00505	−0.00505	−0.00428	−0.00422
	(0.003)	(0.003)	(0.003)	(0.003)
firmsizeG_2	0.155	0.119	0.0582	0.00893
	(0.287)	(0.289)	(0.297)	(0.300)
firmsizeG_3	0.151	0.0935	0.0454	−0.0393
	(0.270)	(0.273)	(0.279)	(0.284)
Leadership		−0.100		−0.103
		(0.159)		(0.163)
Executive		0.150		0.181
		(0.141)		(0.142)
Knowledge		0.105		0.161
		(0.149)		(0.155)
Enterprising		−0.169		−0.126
		(0.158)		(0.163)
Communication		0.109		0.0998
		(0.138)		(0.142)
Demanding			−0.0732	−0.0561
			(0.120)	(0.120)
Employer familiar			−0.202**	−0.202**
			(0.093)	(0.094)
Freedom			0.0774	0.0652
			(0.094)	(0.094)
Broad			−0.0584	−0.0479
			(0.115)	(0.116)
Vocational			−0.0408	−0.0404
			(0.111)	(0.113)
Prestigious			−0.277**	−0.311***
			(0.111)	(0.114)
_cons	−0.627	−0.759	1.023	0.990
	(1.454)	(1.447)	(1.543)	(1.538)
N	692	692	692	692
pseudo R^2	0.076	0.081	0.112	0.119
AIC	653.3	659.9	641.0	646.2
BIC	739.5	768.9	754.5	782.4

Dependent variable: Horizontal mismatch.
Standard errors in parentheses, $^*p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.
Reference category for fields of study: Engineering.
Health dropped due to perfect predictor (28 observations not used).
Coefficients for controls for occupation and economics sector not displayed (available from authors).
AIC denotes Akaike Information Criteria, BIC denotes Bayesian Information Criteria.

were trusted by employers achieved better outcomes for their graduates in terms of horizontal match.

In contrast to fields of study and program characteristics, competencies do not show any significant effect on horizontal mismatch. From individual variables, only average grade on secondary education decreases the likelihood of horizontal mismatch as expected.

Conclusions

The goal of the paper was to understand the determinants of education-labor mismatch in Poland. This paper contributes to a very scarce literature on mismatch in the Eastern Europe (Kogan and Unt 2005; Lamo and Messina 2010). Labor mismatch on Eastern Europe is inevitably affected by the transition process and the expansion of both, the demand for tertiary education and the number of tertiary education institutions.

The emerging picture is that some fields of study, notably Mathematics and Sciences as well as Social sciences have proven to be the winning horse in the race for the best education-job match in the late years of Polish transition. Also, being entrepreneurial and having executive and communication skills showed to be a good "equipment" for the graduates in those turbulent times. These observations are very similar in fact to those for the Western Europe. It could signalize that Poland indeed could be considered yet another fully capitalist society (Słomczynski, Janicka, Shabad, and Tomescu-Dubrow 2007). The bottom line is, however, that Poland unlike her western peers in the EU has a high level of under-education and under-skilling. This seems to be related to the large expansion in the number of tertiary education institutions during the last decade, which obscured the signal of educational credentials in Poland and provoked that graduates from those universities with good reputation find themselves in a relatively strongly advantageous position with respect to their peers from less prestigious schools (Galbraith 2003; Giesecke 2006). Galbraith (2003) raises several issues which might serve as explanation for our results. Primarily she points out that, private higher education institutions in Eastern Europe have grown to be a serious partner to their public peers. However, the process was not easy. Many initial attempts to establish private universities have proven to be failures and their graduates experience serious consequences of those fails in their posterior labor market careers. Although these would be a minority the myth of "bad private school" rooted deeply in the communist ideology and enforced by those failures has done the job to sink the still fragile position of private tertiary education sector in Eastern Europe. This myth of a bad private school persists according to Galbraith and makes it additionally difficult for students from private universities to compete with their peers from the public universities. Does that mean that all private schools in Poland are the proverbial "bad schools"? The answer is no, but employers may take their time to get reassured about it. As a results, we see an outburst of over-education in Poland similar to the one observed in the Western Europe. Employers being skeptical about

private schools' graduates skills assign them job posts below their education levels and frequently also below their skills levels. On the other hand graduates of public universities which Giesecke (2006) and Galbraith (2003) both describe as "drained from funding" find themselves in such an advantageous situation that some of them may achieve employment where their skills are at shortage compared to the tasks required by the job. This way we may observe under-education and under-skilling spreading through Polish labor market.

There is also a second explanation for our findings. Although majority of our sample is very young some individuals might have started working in the earlier phase of the transition and enrolled into the university studies later (Roberts 1998). This also could have added to the levels of under-education and under-skilling in our results.

Further research should be devoted to how the different types of mismatch affect labor outcomes such as wage, job satisfaction and job training in Eastern Europe.

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