LABOR et EDUCATIO
8·2020
ISSN 2353-4745 e-ISSN 2544-0179
RESEARCH
DOI: 10.4467/25439561LE.20.013.13004
pp. 219–243

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Risk of Investment in Human Capital and Skills Mismatch[2]

Ryzyko inwestowania w kapitał ludzki a niedopasowanie kompetencyjne

Introduction

Today's focus of many European countries' education policy is on promoting individual employability through education and lifelong learning, and on encouraging firms to invest in employees' skills development. This fits an agenda of knowledge-intensive, innovative, and hence competitive economic development in the times of accelerated technological change. As the World Economic Forum's "Future of Jobs" report predicts, by 2022, 59% of surveyed employers expect that they will make significant modifications in the way of producing and distributing goods (World Economic Forum,

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[2] The study is a result of a research visit to the HIVA – Research Institute for Work and Society (Leuven), made possible through a visiting grant of the InGRID project (Inclusive Growth Research Infrastructure Diffusion, funded by EU-FP7, grant agreement ID 312691).

The preliminary version of this paper was presented during the VI International Conference ESPAnet Polska (26-27 September 2019, Warsaw).

2018). This means that in a few years, many of occupations and jobs will not be requiring skills that are in demand today. OECD estimates that in the next 15–20 years, "14% of existing jobs could disappear as a result of automation, and another 32% are likely to change radically" (OECD, 2019). At the same time, digitalization, automation and globalization will also lead to the emergence of new occupations and jobs (Tytler, 2019). In this challenging context, the problem of the match between workers' skills and the individual roles (tasks) they will perform in near future seems to become a matter of great concern. One of the possible solutions to the gap between workers' human capital and their jobs is reskilling and upskilling (World Economic Forum, 2018) by boosting investment in job-related training. While some of today's core jobs will remain unchanged (World Economic Forum, 2018) and therefore will not need so much investment in obtaining new skills, individuals are highly likely to have multiple careers and experience several job changes during their working life. With skill requirements becoming less predictable and education heading towards self-directed learning (Grewiński, Kawa and Lizut, 2019), the relationship between the level of investment in human capital and returns may become less obvious. For these reasons, it becomes increasingly important that decisions on investment in work-related training are analyzed in terms of shortening of the investment implementation period and possibility of gaining the expected return on investment.

Since every investment decision is associated with risk-taking, the actual returns from the work-related training can be higher or lower than the expected ones. From the worker's perspective, a risk of investment in job-related skills occurs, since there are unknown objective external and internal factors that will have an impact on the final benefits of the training. These factors include: stage of the worker's life cycle at the moment of investment; quality of training (approaches and methods); poor management and/or errors in production process that limit worker's productivity growing; lack of encouraging working environment necessary to increase productivity; low employees morale; unknown future demand in the labor market and employment opportunities, etc. Other risk factors can be described as subjective in nature as they primarily depend on employee's personality: psycho-emotional instability; variability of individual career aspirations and purposes in the short- and long-term perspective; speed of learning new things which depends on worker's

intellectual abilities and motivation; workers' physical capacities and health which deteriorate in time (Zakharova, Kratt, 2014).

There has been growing research on the risk of investment in human capital with most attention on the impact of the earnings risk on educational decisions (Brown, Fang and Gomes, 2012; Cheng, 2007; Diaz Serrano, Hartog, 2007; Hartog, Ding and Liao, 2011) and occupational choices (Guiso, Jappelli and Pistaferri, 2012; Hartog, Diaz-Serrano, 2004). Several other research developed the concept of country-risk and explored its impact on education enrolment (Sequeira, Ferraz, 2009; Sequeira, 2009). However, very little is known about the risk of investment in human capital for different groups of workers. Hartog and Diaz-Serrano (2004) found that risk of investment in human capital is higher for high-skilled occupation groups that are more intellectually demanding and include high responsibility and autonomy, decision making, human resources management, etc. Differences are also observed between women and men. Women tend to be employed in less risky occupations as they are more risk-averse than men (Hartog, Diaz-Serrano, 2004). Bonin, Dohmen, Falk, Huffman and Sunde (2007) provided empirical evidence that more risk-averse individuals tend to choose occupations with lower earnings variability and working in a public sector is associated with lower earnings risk. Hartog and Vijverberg (2007) showed empirically that different combinations of skills can either increase or decrease the risk. They found that combining mathematical and language skills increases the risk relative to specialization in one of these two skills both for men and for women with college education. Still, no attention has been paid to studying whether skills mismatch occurrence affects the risk of investment in human capital. To our knowledge, this is the first study that addresses the problem of the impact of workers' skills mismatch on the risk of investment in skills development through work-related training.

The concept of skills mismatch has been also widely examined in the literature. It seems that well documented are the negative consequences for workers who are mismatched to their jobs in terms of wage penalties, job satisfaction (O'Leary, Sloane, McGuinness and Mavromaras, 2010; Salahodjaev, 2015), career progress, job (in)security, health (O'Leary et al., 2010), job mobility (Fredriksson, Hensvik and Skans, 2018), work productivity (Velciu, 2017), job-related learning and skills development (Ferreira, Künn-Nelen and De Grip, 2017). However, there could be other important consequences of

skills mismatch. In particular, this study addresses the effect of workers' skills mismatch on the risk of investment in work-related training, which has been omitted in the empirical research so far. When an individual performs a job that does not match his/her skills, the investment in specific human capital (job-related training) is expected to associate with higher worker's risk. This is because an imperfect match might generate more uncertainty about workers' real qualities and their motivation to develop work-related skills and complete the training course, as well as their future efforts and work productivity. It could be more difficult to indicate what type, scope and duration of job-related training are desired. This in turn allows for making estimation of training effects and return on investment less accurate. Hence, it can be hypothesized that there is a higher risk of investment in work-related training for employees who are mismatched to their jobs than for well-matched employees.

To test the research hypothesis, we used the data from the 5th European Working Conditions Survey that cover the period from January to June of 2010. The main focus was on the risk considered from an individual's perspective. We obtained the occupation-specific risk as the dispersion of earnings residuals computed based on the Mincer-type earnings regression within different occupation groups and with respect to participation in work-related training. Apart from financial risk, in the empirical part of the study we explored several non-financial aspects of the worker's risk, such as career prospects, perceived job insecurity and employment opportunities. The data on skills mismatch were based on self-reported information. In this article, the terms "job-related training" and "work-related training" are used interchangeably.

The article is organized as follows: the second section presents data and research techniques, the third section presents reports and discusses results, and the last one serves as a conclusion to the paper.

Data and methods

In the empirical section of the paper, quantitative methods were used. The data was obtained from the fifth edition of the European Working Conditions Survey (EWCS), carried out by the European Foundation for the Improvement of Living and Working Conditions (Eurofound). The data for the 5th edition of EWCS were collected between January and June of 2010. The research sample

was restricted to full-time workers[3] from the 27 EU Member States, employed in the private sector. Skills mismatch was identified based on answers to the following question:

Which of the following alternatives would best describe your skills in your own work?

- I need further training to cope well with my duties;
- My duties correspond well with my present skills;
- I have the skills to cope with more demanding duties.

The first and the third responses indicate a mismatch between workers' skills and their jobs, while the second respond points to a lack of skills mismatch. Clearly, these alternatives do not allow to measure objective mismatch, but rather perceived levels of actual matching.

To examine the relationship between skills mismatch and risk of investment in job-related training, we considered worker's financial risk associated with investment in job-related training. To estimate earnings risk, we applied the same procedure as in several previous studies (Berkhout, Hartog and Webbink, 2010; Hartog et al., 2003; McGoldrick, 1995). We first estimated Mincer earnings equation, where logarithm of hourly earnings is a dependent variable. Apart from the standard human capital variables (age and level of education), we incorporated several control variables in the earnings regression: sex, type of position, type of contract, firm size, branch, occupation, tenure, country dummies.

In previous studies focused on formal education (Berkhout et al., 2010; Hartog, Diaz Serrano, 2006), it was assumed that an individual can hardly know what type of employment and working conditions they would take up after their education is completed. This is not the case for job-related training. At the time of deciding on training, the information about the firm, type of position and other characteristics of working environment is already known to the individual. Thus, it was necessary to extend the list of control variables by including branch, firm and job characteristics. In the empirical analysis, we focused on work-related training provided or financed by employer. We did not consider other types of training as the expected benefits may go beyond the development of worker's work-specific skills. For example, worker-financed training could be associated with some positive effects outside of the

[3] Individuals who work 30 or more hours per week in their main paid job.

workplace, such as improving personal life through developing consciousness, talents and abilities.

To provide estimates for 27 EU Member States, it was necessary to weight the data. In order to reflect the differences of size among analyzed countries, we incorporated weights provided with the EWCS data set (variable w5_eu27). Table 1 presents operationalizing definitions of all research variables used in the earnings regression.

Table 1. Operationalizing definitions of variables used in the earnings regression

Variables	**Definition**	**Type of variable/scale**
Outcome variable		
ln_hwage	Logarithm of net hourly wage Net hourly wage: hwage = y10_e_33/ (y10_ q18*4.3), where y10_e_33 is net monthly earnings from the main paid job, and y10_q18 is the number of hours the respondent usually works per week in their main paid job	Numerical
Independent variables		
age	Respondent's age as a proxy variable for work experience	Numerical
age*age	Age squared	Numerical
edlevel1-edlevel7	The highest level of education or training that respondent has successfully completed (with reference to ISCED)	Categorical: edlevel1 "Pre-primary education" (ref.) edlevel2 "Primary education or first stage of basic education" edlevel3 "Lower secondary or second stage of basic education" edlevel4 "(Upper) secondary education" edlevel5 "Post-secondary non-tertiary education" edlevel6 "First stage of tertiary education" edlevel7 "Second stage of tertiary education"

female	Takes value 1 if the respondent is a female	Dichotomous
manager	Takes value 1 if the respondent is employed on a managerial position and 0 if otherwise	Dichotomous
typecontract	Takes value 0 if the respondent has indefinite employment contract and 1 if otherwise	Dichotomous
fsize1-fsize6	Firm size (number of employees)	Categorical: fsize1 "1-9 employees" (ref.) fsize2 "10-49 employees" fsize3 "50-99 employees" fsize4 "100-249 employees" fsize5 "250-499 employees" fsize6 "500 and over employees"
isco1-isco9	Occupation group[4] (with reference to ISCO, 1-digit level)	Categorical: isco1 "Legislators, senior officials and managers" isco2 "Professionals" isco3 "Technicians and associate professionals" isco4 "Clerks" isco5 "Service workers and shop and market sales workers" isco6 "Skilled agricultural and fishery workers" isco7 "Craft and related trades workers" isco8 "Plant and machine operators and assemblers" isco9 "Elementary occupations" (ref.)
branch1-branch11	Branch	Categorical: branch1 "A-B Agriculture, hunting, forestry, fishing" (ref.) branch2 "C-D Mining, quarrying, manufacturing" branch3 "E Electricity, gas, and water supply" branch4 "F Construction"

[4] The group "Armed forces" was omitted in the analysis.

branch1-branch11	Branch	branch5 “G Wholesale and retail trade; repair of motor vehicles and motorcycles” branch6 “H Hotels and restaurants” branch7 “I Transport, storage and communication” branch8 “J Financial intermediation” branch9 “K Real estate activities” branch10 “L Public administration and defence; compulsory social security” branch11 “M-N-O-P-Q Other services”
tenure	The total number of years tenure with the current employer	Numerical
training_emp	Takes value 1 if the respondent has undergone work-related training provided or financed by the employer and 0 if otherwise	Dichotomous
country1-country27	Country	Categorical: country1 “Belgium” (ref.) country2 “Bulgaria” country3 “Czech Republic” country4 “Denmark” country5 “Germany” country6 “Estonia” country7 “Greece” country8 “Spain” country9 “France” country10 “Ireland” country11 “Italy” country12 “Cyprus” country13 “Latvia” country14 “Lithuania” country15 “Luxembourg” country16 “Hungary” country17 “Malta” country18 “Netherlands” country19 “Austria” country20 “Poland” country21 “Portugal” country22 “Romania”

country1 -coun- try27	Country	country23 “Slovenia” country24 “Slovakia” country25 “Finland” country26 “Sweden” country27 “The United Kingdom”
w5_eu27	Weighting variable	N/A

Source: own elaborations based on the EWCS data.

After running earnings regression, we used estimated residuals to calculate the risk of investment in job-related training. The risk was measured as the distribution of earnings residuals for trained and for non-trained employees within occupation groups that were defined with reference to The International Standard Classification of Occupations ISCO-88. The equation for the measure of worker's risk is taken from (Berkhout et al., 2010):

$$R_j = \frac{1}{N_i} \sum_i (e_{ij} - e_j)^2 \quad , \quad (1)$$

where i denotes individuals; j is an occupation group the individual belongs to; **e** is the exponential of the estimated residuals from earnings equation; **N** is a numer of individuals in the group. In order to capture the essence of financial risk associated with investment in job-related training, we used occupation groups instead of education groups, assuming that training is related rather to occupation characteristics than to the education profile. It allowed to obtain the measure of the risk of investment in work-related training that is occupation-specific. The higher values of R_j mean higher earnings risk.

In the following step, we computed the mean level of risk of investment in job-related training in skills mismatch and no mismatch conditions. In order to compare the means for the two groups (mismatched and well-matched employees), we used an independent t-test.

Additionally, apart from financial risk, we explored several aspects that can potentially reflect the non-financial risk associated with investment in job-related training: career prospects, job insecurity and employment opportunities. In the EWCS, respondents were asked whether they agree or disagree with several statements describing different aspects of their job[5]. The original statements used in the empirical analysis are the following:

[5] Agree/disagree rating scale included following answers: strongly disagree, disagree, neither agree nor disagree, agree, strongly agree.

- I might lose my job in the next 6 months
- My job offers good prospects for career advancement
- If I were to lose or quit my current job, it would be easy for me to find a job of similar salary

We used the first statement to describe non-financial risk related to job insecurity; the second statement was used to define non-financial risk related to career prospects; the third statement was used to describe employment opportunities. The next section reports and discusses results.

Results

To initiate, summarizing statistics for earnings regression are presented in Table 2. Appendix 1 provides results of Mincer equation estimation.

Table 2. Descriptive statistics

Variable	Mean	Std. Dev.	Min	Max
ln_hwage	1.788487	.752523	.0028146	5.102639
age	40.07448	11.27793	15	81
c.age#c.age	1733.143	930.4013	225	6561
edlevel1	.0029427	.0541692	0	1
edlevel2	.042618	.2020045	0	1
edlevel3	.2179604	.4128813	0	1
edlevel4	.4537798	.4978844	0	1
edlevel5	.0498224	.217589	0	1
edlevel6	.2288179	.420093	0	1
edlevel7	.0040589	.0635829	0	1
female	.4348047	.4957565	0	1
manager	.148757	.3558668	0	1
typecontract	.1703704	.3759769	0	1
fsize1	.3521055	.4776509	0	1

fsize2	.3185185	.4659254	0	1
fsize3	.102689	.3035676	0	1
fsize4	.104414	.3058124	0	1
fsize5	.0503298	.2186356	0	1
fsize6	.0719432	.2584069	0	1
isco1	.0575342	.2328724	0	1
isco2	.0764079	.2656631	0	1
isco3	.1407407	.3477716	0	1
isco4	.1303907	.3367498	0	1
isco5	.1791984	.3835378	0	1
isco6	.010553	.1021896	0	1
isco7	.1855911	.388796	0	1
isco8	.12552	.3313245	0	1
isco9	.0940639	.2919324	0	1
branch1	.0250634	.1563257	0	1
branch2	.2476915	.4316936	0	1
branch3	.0135972	.1158173	0	1
branch4	.1047184	.3062058	0	1
branch5	.2186707	.4133657	0	1
branch6	.0541857	.2263952	0	1
branch7	.0703196	.2556979	0	1
branch8	.0410959	.1985221	0	1
branch9	.0941654	.2920735	0	1
branch10	.0070015	.0833859	0	1
branch11	.1234906	.3290162	0	1
tenure	8.64414	8.700687	1	49
training_emp	.3105023	.4627227	0	1

country1	.0847286	.2784915	0	1
country2	.0180619	.1331821	0	1
country3	.0371385	.1891107	0	1
country4	.0399797	.1959215	0	1
country5	.0985287	.2980433	0	1
country6	.0229325	.149696	0	1
country7	.0257737	.1584676	0	1
country8	.0303399	.1715296	0	1
country9	.1229833	.3284347	0	1
country10	.0267884	.1614728	0	1
country11	.0309488	.1731877	0	1
country12	.0224252	.1480692	0	1
country13	.0292237	.1684417	0	1
country14	.0300355	.1706937	0	1
country15	.0123795	.110578	0	1
country16	.0294267	.1690079	0	1
country17	.0210046	.1434066	0	1
country18	.0223237	.1477415	0	1
country19	.03724	.1893589	0	1
country20	.0369356	.1886132	0	1
country21	.0400812	.1961596	0	1
country22	.0164384	.1271604	0	1
country23	.0422121	.2010829	0	1
country24	.0300355	.1706937	0	1
country25	.035515	.1850868	0	1
country26	.0270928	.1623622	0	1
country27	.0294267	.1690079	0	1

Source: own computations based on the EWCS data.

From 9,855 individuals that were included to estimate earnings equation, 4,137 (42%) respondents reported that they had poor match with their job. The group of mismatched workers (N = 4,137) was associated with an average earnings risk R = 0.3637 (SD = 0.0658). By comparison, the group of well-matched workers (N = 5,718) was associated with numerically lower earnings risk R = 0.3581 (SD = 0.0632). To test the hypothesis that mismatched and well-matched workers are associated with statistically significantly different mean earnings risk, an independent samples t-test was performed. As can be seen in Table 3, the mismatched and well-matched distributions are sufficiently normal for the purposes of conducting a t-test (Gignac, 2019)[6].

Table 3. Characteristics of earnings risk distribution for mismatched and well-matched workers

Groups	Mean	Std. Dev.	Var	Skewness	Kurtosis
Mismatched workers	0.3637	0.0658	0.00432	1.8741	7.2252
Well-matched workers	0.3581	0.0632	0.00399	2.0475	8.1844

Source: own computations based on the EWCS data.

Since the assumption of equality of variances was violated ($F(5717, 4136) = 0.923$, $p = 0.0054$), we used Welch's t-test that "provides an accurate t-value and p-value, even in extreme cases of violation of the homogeneity of variances assumption and unequal sample sizes" (Gignac, 2019).

The Welch's t-test was associated with statistically significant effect, $t(8700.21) = -4.2298$, $p = 0.0000$. This implies that the mismatched workers were associated with a statistically significantly higher mean earnings risk of investment in job-related training than the well-matched ones. However, Cohen's *d* was estimated at -0.087[7], which should be considered as a very small effect size (the substantive significance), according to Sawilowsky (2009).

In the subsequent stage, we extended empirical analysis by addressing some non-financial facets of the risk of investment in work-related training,

[6] According to Gignac (2019), there are three conditions that make the independent samples of t-test robust to violations of normality: 1) skew and kurtosis are less than |2.0| and |9.0|, respectively; 2) sample sizes are 7 or more in each group; 3) skew is in the same direction for both groups. As can be seen, the distribution for well-matched workers is slightly more skewed (skewness is 2.0475), but we considered this as insignificant violation.

[7] Cohen's d indicates how far the two means need to be separated for the results to be substantively significant.

such as job insecurity, career prospects, and employment opportunities. Tables 4-6 show frequency distribution of respondents' level of agreement with three statements related to different job aspects. The sample has different number of observations due to lack of response.

Table 4. Percentage frequency distribution of respondents' level of agreement with the statement "I might lose my job in the next 6 months"

Groups	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Mismatched workers	29.05	28.46	17.74	16.21	8.54
Well-matched workers	26.56	32.59	19.66	15.08	6.1

Note: number of observations is 9,317.
Source: own computations based on the EWCS data.

Table 5. Percentage frequency distribution of respondents' level of agreement with the statement "My job offers good prospects for career advancement"

Groups	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Mismatched workers	18.56	28.39	21.44	25.25	6.37
Well-matched workers	16.7	32.46	23.89	22.39	4.55

Note: number of observations is 9,672.
Source: own computations based on the EWCS data.

Table 6. Percentage frequency distribution of respondents' level of agreement with the statement "If I were to lose or quit my current job, it would be easy for me to find a job of similar salary"

Groups	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Mismatched workers	22.09	25.99	18.57	24.93	8.41
Well-matched workers	20.51	29.88	20.57	23.23	5.81

Note: number of observations is 9,402.
Source: own computations based on the EWCS data.

As can be observed from Table 4, mismatched workers were most likely, and those well-matched least likely, to agree and strongly agree that they might lose their job in the next 6 months. From Table 5 and 6, it can be seen that mismatched employees were more likely to report good prospects for career development and easiness of finding a new job than well-matched workers.

As the next step, we wanted to know the effect of the skills mismatch on mean levels of agreement between mismatched and well-matched workers. First, we performed the robust test for equality of variances (*robvar* command in STATA) in order to check the homogeneity of variances. As the null hypothesis was rejected, we chose the Welch's test to compare means between two groups[8]. Table 7 presents results of comparing mean levels of agreement for each of three statements.

Table 7. Mean levels of agreement between mismatched and well-matched workers

Variable	Mean level of agreement (SD)		Mean difference	t(df)	p-value
	for mismatched workers	for well-matched workers			
I might lose my job in the next 6 months	2.4674 (1.2911)	2.4156 (1.2009)	-0.05175	-1.9659 (8055.85)	0.0493
My job offers good prospects for career advancement	2.7247 (1.2075)	2.6563 (1.1317)	-0.06836	-2.8218 (8423.7)	0.0048
If I were to lose or quit my current job, it would be easy for me to find a job of similar salary	2.7157 (1.2841)	2.6394 (1.2059)	-007632	-2.9173 (8181.04)	0.0035

Note: SD – standard deviation
Source: own computations based on the EWCS data.

As can be seen, there was a significant difference in the levels of agreement with the statement related to job insecurity for mismatched workers (M = 2.467, SD = 1.291) and well-matched workers (M = 2.416, SD = 1.201); t(8055.85)= -1.9659, p = 0.0493. This indicates that workers from mismatched group were more likely than those from the well-matched group to agree that they might lose their job in the next 6 months. The results suggest that investment in work-related training poses a greater risk for mismatched workers because of their higher level of job insecurity. The possibility of job loss can prevent them from utilizing improved work-related skills and abilities in current employment.

[8] Welch's t-test can be applied on ranked data (Gignac, 2019).

A statistically significant difference was also found within statements related to career prospects and employment opportunities, but the results were somewhat surprising. Particularly, it can be expected that mismatched workers would have worse prospects for career advancements (CIPD 2018) and would be less sure about finding a new employment than their well-matched counterparts (Mavromaras, McGuinness, Richardson, Sloane and Wei, 2011; McGuinness, Wooden 2009). Contrary to expectations, we found that mismatched workers (M = 2.725, SD = 1.208) were more likely than well-matched ones (M = 2.656, SD = 1.132) to report good prospects for career advancement; t(8423.7)= -2.8218, p = 0.0048. Furthermore, mismatched workers (M = 2.718, SD = 1.284) were more optimistic than their well-matched counterparts (M = 2.639, SD = 1.206) about finding a new employment of similar salary; t(8181.04)= -2.9173, p = 0.0035.

The above results are inconclusive. While mismatched workers feel more insecure in their current employment, they appear to be more optimistic about finding new job of similar salary in the external labor market. It seems that the effect of skills mismatch on the worker's risk of investment in job-related training might depend on whether the training effects will be used in the internal or external labor market. The value of skills acquired by mismatched workers through job-related training might be lower for the current employer compared to skills developed by those with well-matching jobs. A possible explanation for this is uncertainty about mismatched workers' future attachment to the firm and a possibility that they will be able to use their improved skills in future jobs. Another reason could be that over-skilled workers benefit less from participating in training and on-the-job informal learning compared to the well-matched ones, as found by Ferreira et al. (2017). Their results also indicate that for under-skilled workers, participating in training is more beneficial in terms of skills development. Clearly, over-skilled and under-skilled workers need to be analyzed separately.

Discussion and Concluding Remarks

In this paper, we attempted to answer the question whether there is a significant difference in the level of risk of investment in job-related training for mismatched workers and for those who are well-matched to their job. Consistent with the expectations, we found a statistically significant difference

in earnings risk of investment in work-related training with respect to workers' skills mismatch. The mean difference between the two groups was large enough to allow for rejecting the null hypothesis. The difference confirms our predictions, that is, mismatched workers had higher mean earnings risk than those who did not report being mismatched. Although the data analysis shows that skills mismatch may be associated with higher level of the worker's financial risk associated with investment in job-related training, the effect size was estimated as very small. It should be noted that statistically significant result obtained in the study could mean only that a huge sample size was used (Sullivan, Feinn, 2012). The analysis was deepened by addressing some non-financial aspects of the risk of investment in job-related training, though the results were ambiguous.

While this research contributes to scarce literature, it is subject to several limitations. The first one is the imperfect measure of risk of investment in work-related training. In this study, we did not account for worker's heterogeneous abilities, therefore residuals variance can overestimate or underestimate earnings risk. However, as Koerselman and Uusitalo (2013) admit, "whether unobserved heterogeneity can be separated from risk is still subject to considerable controversy". The second limitation concerns skills mismatch measure that is based on self-assessment. As Chłoń-Domińczak and Żurawski (2017) pointed out, "employees may be overly optimistic in their skills assessment as well as skills required at the workplace". The problem with using self-reported information could also arise because of increasing hiring standards that are simply reproduced by workers, while the actual skills content of jobs remain the same (Sala, 2011). Such a measure does not take into account the objective requirements for a specific occupation. The third limitation is related to the problem of selection of higher-skilled individuals into training. In the analysis, we did not apply any correction for self-selection bias.

Obviously, more research needs to be carried out using more complex estimating techniques and measures. Better knowledge about the risk of investment in human capital with respect to different levels of skills mismatch is crucial to make proper decisions on worker's skills development and utilize job-related training effects.

Abstract: This paper uses data from the fifth edition of the European Working Conditions Survey to examine the relationship between workers' skills mismatch and risk of investment in work-related training. Apart from financial (earnings) worker's risk, the study addresses also some non-financial facets of the investment risk. The results indicate that while mismatched workers have higher earnings risk than well-matched ones, they also perceive their jobs as more insecure. Surprisingly, mismatched workers are also relatively more optimistic of having good career prospects and finding similarly paid employment. These findings did not allow a conclusion about the difference in non-financial risk between mismatched and well-matched workers.

Keywords: earnings risk, investment in human capital, job-related training, skills mismatch

Streszczenie: W artykule wykorzystano dane pochodzące z piątej edycji badania European Working Conditions Survey. Celem opracowania jest zbadanie relacji między poziomem niedopasowania kompetencji pracowników do wykonywanej pracy (skills mismatch) a ryzykiem inwestowania w szkolenia związane z pracą. Oprócz ryzyka finansowego (zarobkowego) pracownika, w badaniu przeanalizowano również wybrane niefinansowe aspekty ryzyka inwestycyjnego. Wyniki wskazują, że niedopasowani pod względem kompetencji pracownicy są bardziej narażeni na ryzyko związane z inwestycjami w szkolenia niż pracownicy dobrze dopasowani. Co więcej, postrzegają oni swoją pracę jako bardziej niepewną. Zaskakujące jest to, że niedopasowani pracownicy są również bardziej optymistyczni, jeśli chodzi o perspektywy zawodowe i możliwości znalezienia podobnie płatnego zatrudnienia. Wyniki przeprowadzonej analizy nie pozwoliły zatem na wyciągnięcie jednoznacznych wniosków dotyczących potencjalnego wpływu poziomu niedopasowania kompetencji na niefinansowe ryzyko inwestowania w szkolenia.

Słowa kluczowe: inwestowanie w kapitał ludzki, ryzyko wynagrodzeń, szkolenia związane z pracą, niedopasowanie kompetencji

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Date of the submission of article to the Editor: 15.04.2020
Date of acceptance of the article: 10.11.2020

Appendix 1. Results of Mincer regression estimation

	(1)
VARIABLES	ln_hwage
hh2_b. Age - Respondent	0.0324***
	(0.0037)
c.age#c.age	-0.0004***
	(0.0000)
Primary education or first stage of basic education	0.1495***
	(0.0438)
Lower secondary or second stage of basic education	0.2624***
	(0.0375)
(Upper) secondary education	0.2469***
	(0.0357)
Post-secondary non-tertiary education	0.2559***
	(0.0387)
First stage of tertiary education	0.3745***
	(0.0389)
Second stage of tertiary education	0.3335***
	(0.0726)
hh2_a. Sex - Respondent	-0.1609***
	(0.0110)
manager	0.0362*
	(0.0156)
q7. What kind of employment contract do you have?	-0.1344***
	(0.0157)
10-49	0.0405***
	(0.0119)
50-99	0.0458**
	(0.0173)
100-249	0.0670***
	(0.0177)
250-499	0.0676**
	(0.0208)
500 and over	0.1470***
	(0.0266)
Legislators, senior officials and managers	0.3080***
	(0.0367)

Professionals	0.3046***
	(0.0291)
Technicians and associate professionals	0.2179***
	(0.0198)
Clerks	0.1334***
	(0.0184)
Service workers and shop and market sales workers	0.0433*
	(0.0195)
Skilled agricultural and fishery workers	0.0212
	(0.0376)
Craft and related trades workers	0.0737***
	(0.0188)
Plant and machine operators and assemblers	0.0526**
	(0.0180)
C-D Mining, quarrying, manufacturing	0.0684*
	(0.0330)
E Electricity, gas, and water supply	0.0875
	(0.0449)
F Construction	0.0798*
	(0.0371)
G Wholesale and retail trade; repair of motor vehicles and motorcycles	0.0314
	(0.0334)
H Hotels and restaurants	-0.0006
	(0.0386)
I Transport, storage and communication	0.0626
	(0.0352)
J Financial intermediation	0.1934***
	(0.0409)
K Real estate activities	0.1027**
	(0.0372)
L Public administration and defence; compulsory social security	0.0630
	(0.0599)
M-N-O-P-Q Other services	0.0008
	(0.0346)
q12. How many years have you been in your company or organisation?	0.0033***

	(0.0007)
q61_a. Past 12 months, have you undergone any training – Training paid for by you	0.0232*
	(0.0118)
Bulgaria	-1.7248***
	(0.0303)
Czech Republic	-1.0097***
	(0.0206)
Denmark	0.3803***
	(0.0231)
Germany	-0.1274***
	(0.0196)
Estonia	-1.2277***
	(0.0318)
Greece	-0.5528***
	(0.0264)
Spain	-0.2266***
	(0.0208)
France	0.0063
	(0.0141)
Ireland	0.1781***
	(0.0314)
Italy	-0.2663***
	(0.0187)
Cyprus	-0.2349***
	(0.0298)
Latvia	-1.5382***
	(0.0315)
Lithuania	-1.4728***
	(0.0300)
Luxembourg	0.2903***
	(0.0359)
Hungary	-1.5542***
	(0.0246)
Malta	-0.4941***
	(0.0241)
Netherlands	0.0331
	(0.0223)
Austria	-0.0814***

	(0.0241)
Poland	-1.3193***
	(0.0234)
Portugal	-0.7999***
	(0.0267)
Romania	-1.7378***
	(0.0310)
Slovenia	-0.7966***
	(0.0239)
Slovakia	-1.1643***
	(0.0234)
Finland	0.1390***
	(0.0197)
Sweden	0.1532***
	(0.0218)
The United Kingdom	-0.1395***
	(0.0293)
Constant	1.1036***
	(0.0868)
Observations	9,855
R-squared	0.7940
RMSE	0.299
LogLikelihood	-2070

Robust standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05
Sourse: Own computations based on the EWCS data