Returns-to-education gaps between native and migrant workers: the influence of economic integration on their drivers. Are Active Labour Market Policies (ALMPs) an effective remediation tool? A case comparison: Italy, Germany, Denmark and Cyprus

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Abstract. This paper answers the research question of whether economic integration influences the drivers behind returns to education for native, EU and non-EU workers in the selected countries. It fills two gaps in the literature, assessing the role of economic integration in determining differences in returns on investments in education and testing whether ALMPs can bridge them.

The literature has identified that returns to education vary between national and foreign workers. Differences among nationality groups regarding the quality of their educational background, their knowledge of the hosting labor market, or the mismatch between the qualifications and skills acquired abroad and those demanded by the local economy have been put forward to explain the gaps in returns to education. This paper contends that those factors might be economic reasons behind the differences in the returns to education but that their effect is mediated by the different degrees of economic integration between the host country and workers' home country.

Contents:

1. Introduction

The present article adds to the labor migration literature. It researches the drivers behind the differences in labor market outcomes obtained by nationals and foreign workers, a topic that has recently been investigated across EU Member States (Cebolla-Boado et al., 2019; Amo-Agyei, 2020). Differences in salaries between national and foreign workers that are unfair, i.e., not following an economic rationale, impede citizens ability to maximize the potential gains of economic integration (Amo-Agyei, 2020). Moreover, they hinder labor migration, which should cushion asymmetric shocks and reallocate workers to the most productive activities, increasing the efficiency and resiliency of the EU (Coca Gamito & Rodríguez-Pose, 2018). This study contributes to the creation of a fairer and more resilient EU by identifying up to what point returns to education for nationals, EU and non-EU workers are not due to economic reasons and by providing evidence to the design of policies aiming to correct these market failures (Amo-Agyei, 2020).

Recently, Cebolla-Boado et al. investigated the heterogeneity in unemployment rates between native and foreign workers in some EU Member States. They conclude that, despite the risk of unemployment being larger for foreigners, differentials vary across countries, being more acute among high-skilled workers (Cebolla-Boado et al., 2019). They also find that the quality of education does not explain the differences in unemployment rates among workers of different nationalities (Cebolla-Boado et al., 2019). Previous studies delivered similar findings regarding migrants' pay gaps. In the USA, there is evidence that natives tend to have higher returns to education than equivalent foreign workers (Bernt & Ragan, 2002). Also in Canada, researchers contend that returns to education are lower for immigrants, even after controlling for the quality of the match between the job positions and workers qualifications (Aydede & Dar, 2017). In the EU, the mean hourly migrant pay gap has been estimated as 8.61%, out of which 14.24% remains unexplained (Amo-Agyei, 2020).

The literature has offered several reasons in an effort to account for the unexplained differences in returns to education between native and foreign workers. One reason that has been put forward is the lack of transferability of skills and knowledge acquired within a national educational system to another country's labor market. Some studies contend that the lack of transferability is artificially created by legal norms hindering the recognition of foreign credentials (Chapman & Iredale, 1993; Aydede & Dar, 2017). Although that could be at the root of the gap in returns to education between EU and non-EU workers, it would not explain differences between natives and EU workers since, for the latter, recognition is nearly automatic. Nevertheless, the return-to-education gap of EU workers could be due to cultural issues hindering the transferability of skills and knowledge. Such issues remain unaddressed by legal reforms, and they could still cause differences in labor market outcomes among workers from different nationalities with the same educational background (Kaushal & Neeraj, 2011; Kanas & Van Tubergen, 2009; Bernt & Ragan, 2002; Reitz, 2001). Education and training in the host country might be an effective tool to solve the transferability issue (Bernt & Ragan, 2002). This would be the case if a national curriculum is missing some country-specific competencies that are demanded as essential by the hosting labor market (Lam & Kit-Chun, 1986) or if immigrants are working in economic sectors that require a country-specific knowledge (Lam & Liu, 2002).

Unobservable differences in the quality of the education have been presented as another possible reason behind the unexplained differences in returns to education obtained by workers of different nationalities but the same educational profile (Chiswick & Barry, 1978; Bratsberg & Terrell, 2002; Weiss et al., 2003). Differences in quality of education could explain the differences in returns to education of foreign workers sharing the cultural background of native workers – something that happens to a large extent between natives and EU workers. For example, think about the cultural proximity between a Portuguese and a Spanish worker or between a Danish and a Finnish worker. In any case, although there is evidence of the influence of quality of education (Bernt & Ragan, 2002), recent studies failed to find correlation between this variable and the unemployment risk

differential between foreigners and nationals in EU labor markets (Cebolla-Boado et al., 2019).

Finally, other studies have argued that labor market failures are the driver behind the unexplained gaps in returns to education between native and foreign workers. This is typically linked to the fact that immigrants do not have good information about the hosting labor market (Chiswick & Barry, 1978; Borjas 1985, 1995; Lam & Liu, 2002; LaLonde & Topel, 2007). Nonetheless, differences that originated from an asymmetry of information should vanish over time as immigrants become acquainted with the labor market (Eckstein & Weiss, 1998; Lam & Liu, 2002; Weiss et al., 2003). More persistent could be the differences arising from local firms lacking quality information regarding foreign credentials. Enterprises reward workers depending on their productivity and effort capacity, but, because they cannot easily observe such variables, they use educational credentials to proxy them (Spencer, 1973; Stiglitz, 1975). Thus, better knowledge of national credentials can lead companies to favor national workers.

This paper is included in a PhD project that researches how labor market policies work in different development contexts. The paper's goal is to analyze whether economic integration influences the drivers behind returns to education for native, EU and non-EU workers (Adsera & Chiswick, 2004; Shutes, 2016) in the selected EU countries. The differences in returns to education between the three groups of workers are presented, and potential reasons that could account for the unexplained gaps are hypothesized and tested. Thus, the order logit econometric model assesses the role of economic integration and other factors in determining differences in the returns to education (Oksuzler, 2008; Mohammadi et al., 2015). Finally, the paper tests whether education and training, a traditional skills enhancement ALMP (Kluve et al., 2017), is an effective tool to reduce the unexplained return-to-education gap between the three categories of workers.

The study fills several gaps identified in the literature. Firstly, it is the first time, to our knowledge, that the influence of economic integration on returns to education is analyzed dividing a country's labor force into native, EU and non-EU workers (Amo-Agyei, 2020), although other studies have previously looked at discrimination on different topics across these three groups (Adsera & Chiswick, 2004; Shutes, 2016). Secondly, the study complements and extends the recent findings of Cebolla-Boado et al. It will be particularly interesting to assess whether quality of education is not correlated with returns to education. Thirdly, previous studies did not analyze how active labor market policies might tackle unexplained differences in returns to education.

2. Material and research methods

The research question is whether economic integration between immigrants' countries of origin and their host country are correlated with the returns to education that they get in EU hosting labor markets. Moreover, the research explores whether the transferability of studies, quality of education and labor market failures account for the unexplained differentials in returns to education of workers from different nationality groups. Finally, it tests whether education and training in the host country can be used to bridge the gap.

For this purpose, we have designed a micro econometric model based on data gathered from the European Union Labor Force Survey (EU-LFS). Limitations regarding computational capacity, data comparability and availability of some crucial variables – essentially, workers' income decile – led us to adopt a cross-section design. We use data from the 2018 EU-LFS in our analysis because it was the most recent data available when the project started. The 2018 EU-LFS is organized in a set of cross-section datasets, one per EU country and year of data collection, while the observations are presented at the worker's level.

The sample under analysis is composed of four EU countries (Cyprus, Italy, Germany and Denmark) and was selected taking into account two criteria. First, the sample was chosen to be representative of the diversity of EU Member States. Second, when selecting the countries that represent each one of the groups that form the EU (core EU, Southern Europe, Eastern Europe, big countries, small countries, etc.) data availability on workers' income and origin constrained our choice. If a country did not report workers' income deciles in the EU-LFS when the study started and/or the number of

observations for EU and/or non-EU workers was low, it was automatically excluded from the sample. The final sample has 433,568 observations.

Two databases were used to conduct the present study. The main database is the EU-LFS 2018. The variables gathered can be classified into three categories:

- Dependent variable: the dependent variable that our study aims to explain is labor income. Unfortunately, there is not a continuous variable registering labor income in the EU-LFS but only information about the decile of the labor income distribution to which the worker belongs. This variable is named INCDECIL and it is only available for waged employees. The values range from 1, if the workers' monthly take-home pay from their main job is below the first decile of the distribution, up to 10, if it is equal or above the ninth decile.

- Main explanatory variables: these are the variables under analysis in the study. The most important ones are related to the workers' nationality and their educational attainment. Anonymization techniques in the EU-LFS have opted for aggregating workers in 15 country groups under the variable NATIONAL. This is a setback for the purpose of matching workers' credentials with measures of their quality, but it still allows us to classify workers as native, EU and non-EU workers without complication. The highest educational attainment is recorded in HAT11LEV for all the individuals aged 15 years old or more taking the survey. We recode the variable to make it correspond to ISCED levels from 1 to 8 following the International Standard Classification of Education (ISCED 2011). We decided to use this variable to measure educational attainment instead of years of schooling (Bernt & Ragan, 2002) because, firstly, the anonymized data in the EU-LFS does not allow us to retrieve the latter, and, secondly, workers can accumulate years of schooling without achieving further educational attainment, for example if they are stuck in one course for several years before dropping out.

- The other main explanatory variables are linked to the hypothesis that we test to explain differentials in returns to education among native, EU and non-EU workers. These variables identify the workers' field of study, their years of residence in the host country, the size of the firm for which they work, and the fact that they have recently received education or training in the host country. The field of study is recorded under the variable HATFIELD, which we used to create a dummy variable that takes the value 1 for studies within the STEM field and 0 otherwise. Years of residence are recorded under the variable YEARESID, but it is aggregated in five-year intervals when the stay is longer than 10 years. We estimate the midpoint of the interval and exclude natives when recoding the variable. The variable SIZEFIRM allows us to proxy the size of the firm, but we can only differentiate between small firms with fewer than 10 workers and bigger firms with more than that. Finally, EDUC4WN informs us whether individuals in the database aged 15 years or older have received some education or training in the host country in the last four weeks.

- Controls: controls are identified in the literature previously analyzed. The controls included are broadly accepted as drivers of labor income. They are the number of hours per week usually worked in the main job (HWUSUAL), worker's gender (SEX), whether the worker has a supervisory role or not (SUPVISOR), and the experience of the worker in their current job (STARTIME), recoded as years of experience. The control variables are significant with p-values close to 0 and they present the expected signs in all the models that we have estimated, with the exception of Sup_i in some Cypriot models. H_i, Exp_i, Sup_i and $Years_{in}$ are negatively correlated with lower-income deciles but positively correlated with high-income ones, while the opposite happens with $Gender_i$. Moreover, we have run joint F tests for the estimated models and the null of all the control variables' coefficients being

0 is always rejected with p-values below 0.0000.

The secondary database is the UNESCO Institute for Statistics (UIS), which was only used to analyze the correlation between the quality of education and its returns. Data on national average pupil–teacher ratios for primary, secondary and tertiary levels of education were gathered from UIS. The database is organized in three wide panel datasets, one for each pupil–teacher ratio's variable, with observations displayed at the country level in each year for which data is available. We used that data, with a sample size of 18,524 observations, to calculate the averages ratio for each one of the regions defined in the NATIONAL variable in the EU-LFS, following the "Country codification in the EU LFS from 2012 onwards". However, the UIS data present three limitations. Firstly, they do not have points estimates for all the countries in each region in every year. Secondly, the time range of the data is only from 1970 to 2018, while some workers in the EU-LFS obtained their highest level of educational attainment before this period. Finally, pupil–teacher ratios are reported for primary, secondary and tertiary education and not for ISCED level, which is the classification system used in the EU-LFS for workers' highest educational attainment. Considering all those limitations, we matched each worker in the EU-LFS with the pupil–teacher ratio of its region of origin and highest level of educational attainment in the year that they finished their studies. That means that if an EU-15 worker's highest educational attainment is an ISCED 6 diploma obtained in 1984, it was matched with the average EU-15 pupil–teacher ratio for tertiary education in 1984. Limitations caused the loss of observations after merging UIS and 2018 EU-LFS data, resulting in a final combined sample size of 204,067 observations.

The results are displayed in tables and figures for ease of understanding. The figures and tables displayed show the probability of being in a particular income decile implied by the regression coefficients evaluated at the means of the regressors. As previously stated, coefficients should not be interpreted as the impact of the variable on the marginal probability of being in a certain income decile but as the correlation between the former and the latter.

3. Results

3.1. Characterization of the returns to education of native, EU and non-EU workers in Denmark, Cyprus, Germany and Italy

The research question is whether economic integration between immigrants' countries of origin and their EU host country are correlated with the returns to education that they get. Moreover, the paper explores whether transferability of studies, quality of education and labor market failures account for unexplained differentials in returns to education of workers from different nationality groups. Finally, it tests whether education and training in the host country can be used to bridge the gap.

For this purpose, we have designed a cross-sectional micro econometric model. The applied model is an ordered logit, and the basic specification is the following:

$$Y_i^* = X_i'\beta + u_i$$

$$INCDECIL_i^j = \beta_{1i}H_i + \beta_{2i}Gender_i + \beta_{3i}Exp_i + \beta_{4i}Sup_i + \beta_{5in}Years_{in} + \beta_{6in}ISCED_{in} + u_i \ where \ j \in [1,10] \ and \ n \in [1,3] \quad (1)$$

where j represents the income decile, i the observed individual in the sample and *n* the category to which the worker belongs being, 1 for nationals, 2 for EU citizens and 3 for non-EU citizens. H_i represents the usual weekly working hours, $Gender_i$ the sex of the individual, Exp_i the years of experience in the current job position, Sup_i whether the job position has a supervisory role or not, $Years_{in}$ the number of years of residence in the country if the individual is a foreigner, and $ISCED_{in}$ the maximum level of educational attainment reached by the individual.

The estimated coefficients show the correlation between the marginal probability of being in an income decile and the left-hand variables evaluated

at their sample means. Our first hypothesis is that there is a positive correlation between educational attainment and income. As educational attainment increases, the probability of reaching an upper income decile increases, while the probability of being in lower ones decreases. This hypothesis implies that worker's productivity increases with educational attainment and, also, that the labor market efficiently rewards increases in labor productivity. Nevertheless, differences in the transferability and/or quality of human capital, as well as market failures, might lead to different returns to education for the same ISCED levels depending on workers' nationality. In this sense, the second hypothesis states that returns to education are higher for native than for EU workers, and also higher for EU workers than for non-EU ones. A corollary stemming from the confirmation of the second hypothesis is that economic integration reduces the gap in returns to education among foreign workers and their native counterparts.

Figures 1 and 2 show that the first hypothesis holds for native workers in Denmark, Cyprus, Germany and Italy. The first figure shows that the probability of being in the lower income deciles decreases as educational attainment increases. It can be observed that as we move upward in the income distribution, workers with higher ISCED diplomas have more probability of reaching them. Similarly, Fig. 2 shows that highly educated workers have more chance of being in the high-income deciles.

Interestingly, the degree of correlation between educational attainment and income varies across the different countries, as it shows by marginal probabilities in the Y-axis associated with each ISCED level in the X-axis. Thus, the figures show that, in Germany and Italy, educational attainment can represent an important factor to be in some income deciles; for example, workers with ISCED 8 levels have a 25% additional marginal probability of being in the 10th income decile. In Denmark, the correlation is smaller but still high. Following the previous example, workers with ISCED 8 diplomas have a 20% positive marginal probability of being in the 10th income decile. On the other hand, in Cyprus, education is a less important factor in determining worker income. ISCED 8 native workers have less than a 2% extra probability of being in the 10th income decile.

Despite the existence of a positive correlation between educational attainment and income for native workers, it is important to note that the relationship is not strictly monotonic. Except in Cyprus, ISCED 4 diplomas imply lower marginal probabilities of being in the lower income deciles than ISCED 5 and, in some countries, ISCED 6 diplomas. Similarly, ISCED 4 diplomas are also correlated with larger probabilities of being in the higher income deciles than ISCED 5 and 6. A potential explanation for that is that education follows a linear progression from ISCED 1 to ISCED 3 and afterward from ISCED 5 to ISCED 8, but ISCED 4 implies a different educational path. ISCED 4 diplomas are those obtained after successfully completing a post-secondary non-tertiary education cycle, while ISCED 5 diplomas are linked to short-cycle tertiary education. In other words, ISCED 5 is not, regarding human capital acquisition, a "step up" from ISCED 4. Rather, ISCED 4 and 5 are each a step onwards from ISCED 3 – just in different directions.

Also, for EU citizens, the correlation between educational attainment and income is positive in the four countries under analysis. However, Fig. 3 and Fig. 4 show different patterns than in the case of national workers. The intensity of the correlation again varies across countries. In this sense, now Italy shows the strongest correlation, followed by Germany and Denmark, while in Cyprus it is the smallest. Moreover, while regarding income deciles 1 to 5 the correlation is stronger for EU than for native workers, it is the other way around regarding income deciles 6 to 10. Exemplifying these two remarks, EU workers with ISCED 8 diplomas have more than a 60% probability of not being in the first income decile in Italy, more than 30% in Germany, almost 15% in Denmark, and around 6% in Cyprus.

As before, the relationship is not strictly monotonic, although the breaks are not always between ISCED 4 diplomas and ISCED 5 and 6. Indeed, in Cyprus, ISCED 2 diplomas are correlated with higher (lower) probabilities of being in the lower (upper) income deciles than ISCED 1. In Italy, ISCED 5 diplomas are correlated with lower (higher) probabilities of being in the lower (upper) income deciles than ISCED 6 and/or 7. Moreover, increments in educational levels do not always lead to higher probabilities of being in the top part of the

Fig. 1. Probability of native workers reaching income deciles 1 to 5 according to educational level in Denmark, Cyprus, Germany and Italy
Source: own elaboration

Fig. 2. Probability of native workers reaching income deciles 6 to 10 according to educational level in Denmark, Cyprus, Germany and Italy
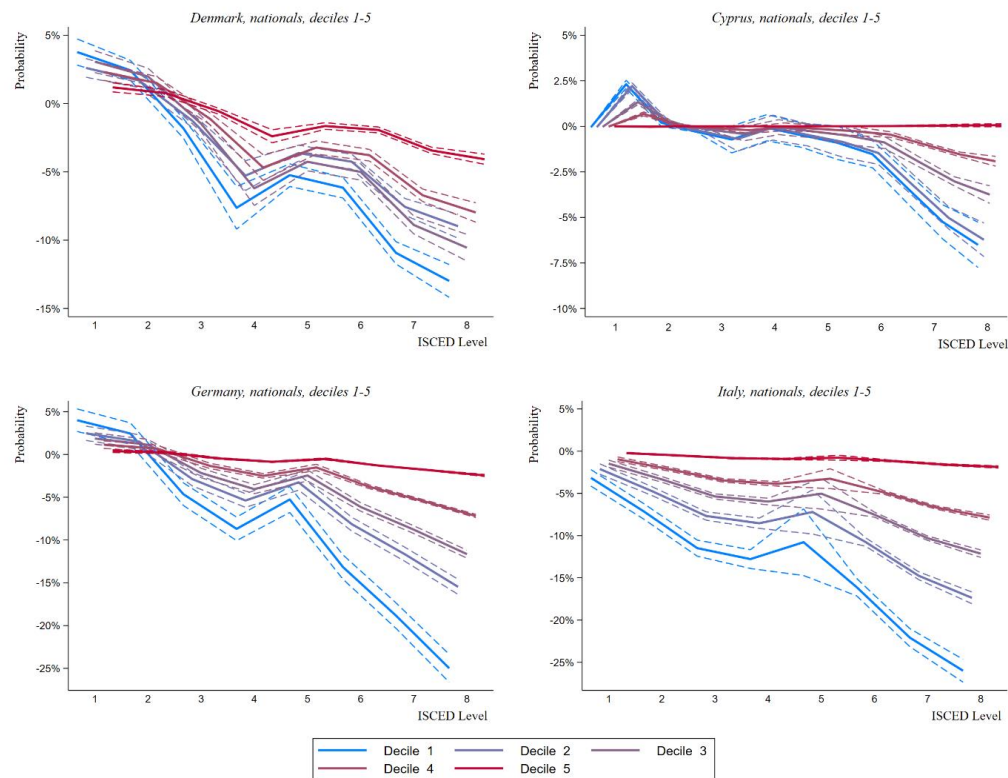Source: own elaboration

Fig. 3. Probability of EU workers reaching income deciles 1 to 5 according to educational level in Denmark, Cyprus, Germany and Italy
Source: own elaboration

Fig. 4. Probability of EU workers reaching income deciles 6 to 10 according to educational level in Denmark, Cyprus, Germany and Italy
Source: own elaboration

Fig. 5. Probability of non-EU workers reaching income deciles 1 to 5 according to educational level in Denmark, Cyprus, Germany and Italy
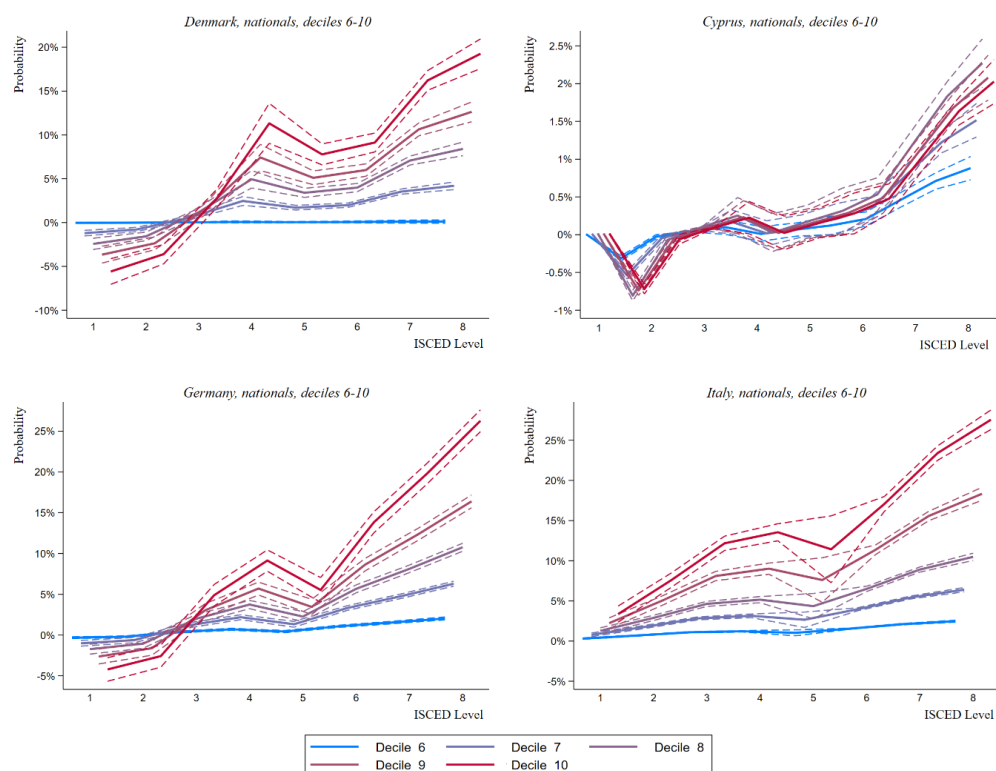Source: own elaboration

Fig. 6. Probability of non-EU workers reaching income deciles 6 to 10 according to educational level in Denmark, Cyprus, Germany and Italy
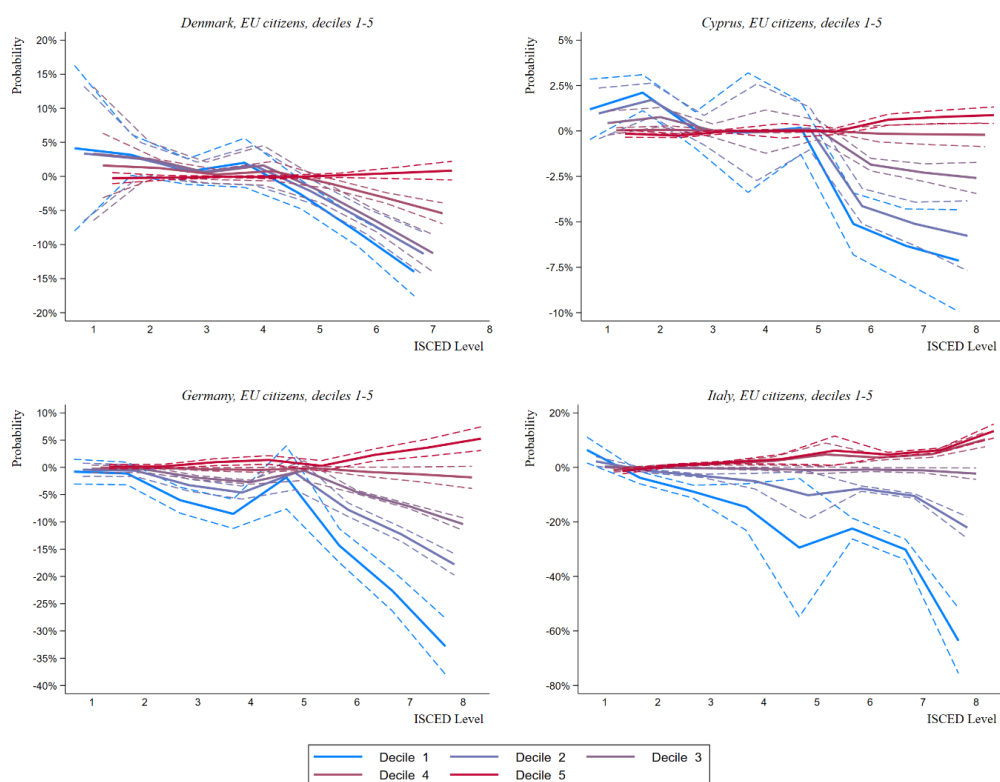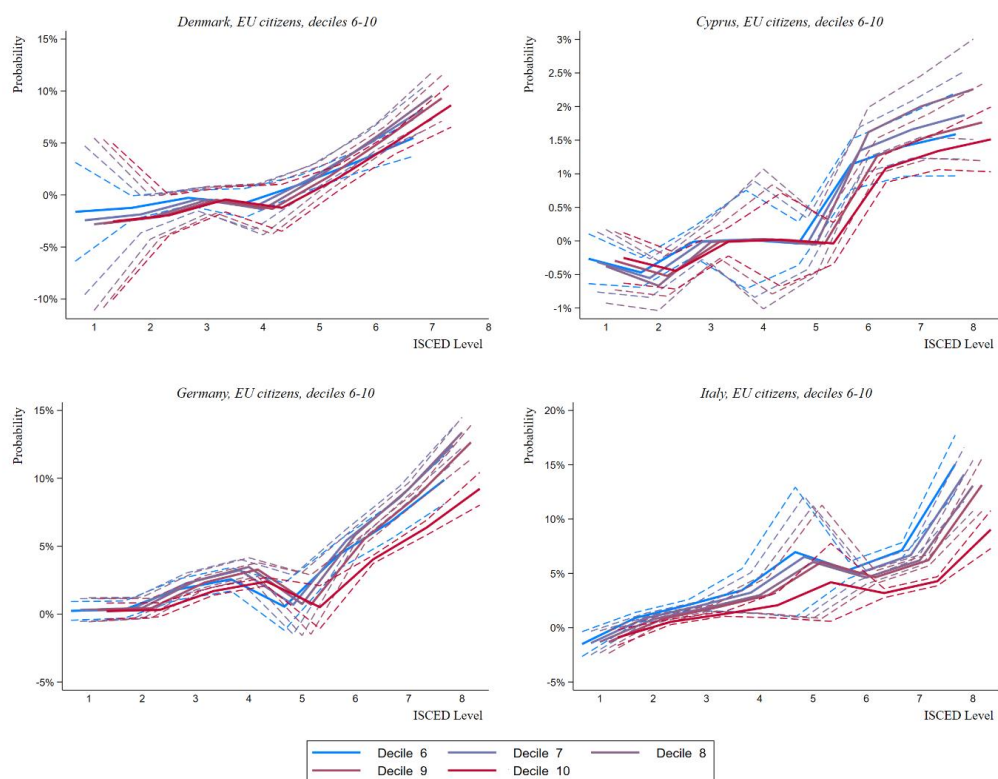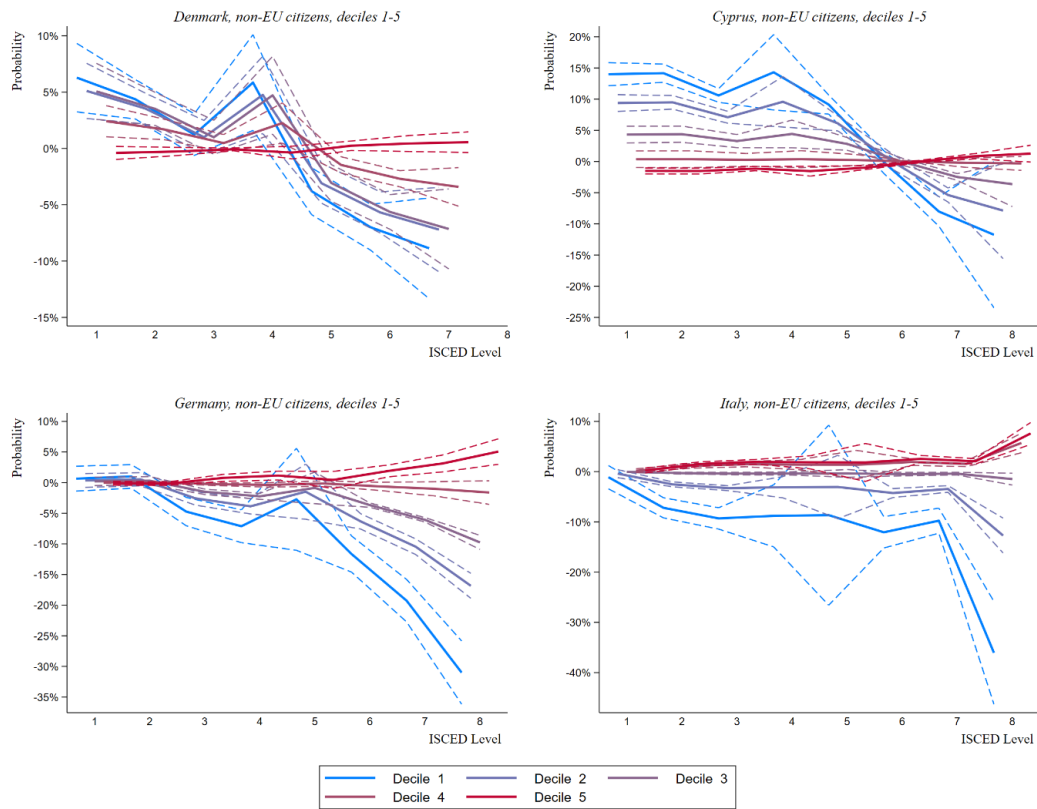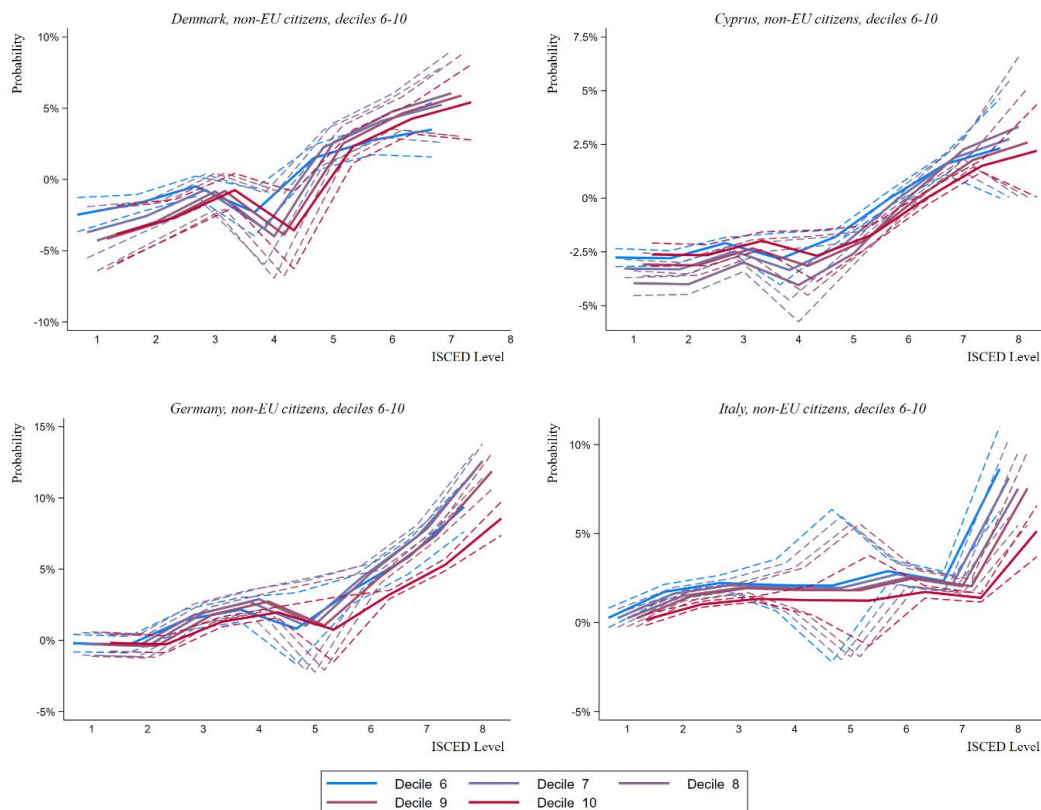Source: own elaboration

Table 1. Wald-Tests aggregated results of testing differences in returns to education between nationals, EU and non-EU workers

ISCED	$H_0: \beta_{6,1} < \beta_{6,2}$ Decile 1-5 Or $H_0: \beta_{6,1} > \beta_{6,2}$ Decile 6-10				$H_0: \beta_{6,1} < \beta_{6,3}$ Decile 1-5 Or $H_0: \beta_{6,1} > \beta_{6,3}$ Decile 6-10				$H_0: \beta_{6,2} < \beta_{6,3}$ Decile 1-5 Or $H_0: \beta_{6,2} > \beta_{6,3}$ Decile 6-10				TOTAL
	DK	CY	DE	IT	DK	CY	DE	IT	DK	CY	DE	IT	
1	90	90	10	90	80	90	10	100	100	90	90	20	_71.7_
2	80	90	10	100	80	90	20	90	100	90	90	20	_71.7_
3	100	100	50	90	100	90	80	90	100	90	90	90	_89.2_
4	NA	100	80	90	NA	90	80	100	NA	90	90	100	_91.1_
5	100	100	100	70	100	90	100	100	100	90	100	80	_94.2_
6	90	40	80	70	90	100	80	90	100	90	90	80	_83.3_
7	80	70	50	70	90	60	80	100	100	90	90	80	_80.0_
8	70	90	50	50	90	100	50	70	100	100	100	80	_79.2_
Subtotal	_87.1_	_85.0_	_53.8_	_78.8_	_90.0_	_88.8_	_62.5_	_92.5_	_100.0_	_91.3_	_92.5_	_68.8_	**82.5**
TOTAL	**76.2**				**83.4**				**88.1**				

Source: authors' own study

income distribution. Regarding this second point, Italy's Fig. 4 clearly exemplifies the point. For each educational level, EU workers in Italy have higher probabilities of being in the income decile 6 than 7, 7 than 8, 8 than 9, and 9 than 10. Nevertheless, it should also be noted that the confidence intervals are now wider, indicating more uncertainty in the precision of the estimated coefficient, although most of them are still significant.

Finally, for non-EU citizens, despite the positive correlation between education and income still holding, things get more blurred. It is less clear in which countries the correlation is stronger. For example, in the lower income deciles, non-EU workers in Italy with ISCED 8 diplomas have almost a 40% probability of not being in income decile 1, while in Germany this does not reach 30% probability. On the other hand, the Y-axes of Fig. 6 show that the correlation is stronger in Germany than in Italy for upper income deciles. It

should be noted also that the correlation between education and income is stronger for EU than for non-EU workers, something in line with the second hypothesis previously stated. Cyprus constitutes an exception though, and there the correlation is, in general, stronger for non-EU than for EU workers.

The lack of monotonicity in the relationship between educational level and income affects non-EU workers. This issue is severe in the case of Italy, where there are several breaks in monotonicity, as Fig. 5 displays. Also, as with EU workers, further educational achievements are not linked to higher probabilities of being in the top part of the income distribution. Additionally, the estimated coefficients and confidence intervals overlap even more than in the case of EU workers, even though significancy is still high. Therefore, results must be interpreted with caution.

Table 2. P-values for Wald-Tests of differences in returns to education between nationals, EU and non-EU workers with STEM certifications

INCOME DECILE	$H_0: \beta_{6,1} = \beta_{6,2}$				$H_0: \beta_{6,1} = \beta_{6,3}$				$H_0: \beta_{6,2} = \beta_{6,3}$			
	DK	CY	DE	IT	DK	CY	DE	IT	DK	CY	DE	IT
DECILE 1	0.407	0.725	0.250	0.187	0.055	0.000	0.000	0.429	0.044	0.000	0.001	0.571
DECILE 2	0.423	0.710	0.218	0.181	0.052	0.000	0.000	0.383	0.044	0.000	0.001	0.581
DECILE 3	0.417	0.691	0.221	0.174	0.053	0.000	0.000	0.350	0.044	0.000	0.001	0.587
DECILE 4	NA	0.642	0.323	0.162	NA	0.000	0.000	0.297	NA	0.000	0.001	0.597
DECILE 5	0.370	0.338	0.908	0.123	0.069	0.001	0.000	0.142	0.047	0.004	0.001	0.632
DECILE 6	0.037	0.776	0.000	0.230	0.930	0.000	0.000	0.585	0.194	0.000	0.000	0.553
DECILE 7	0.464	0.727	0.056	0.187	0.043	0.000	0.000	0.409	0.043	0.000	0.001	0.577
DECILE 8	0.417	0.707	0.178	0.178	0.053	0.000	0.000	0.372	0.044	0.000	0.001	0.583
DECILE 9	0.397	0.696	0.319	0.174	0.059	0.000	0.000	0.358	0.045	0.000	0.001	0.585
DECILE 10	0.384	0.690	0.499	0.172	0.063	0.000	0.000	0.356	0.045	0.000	0.001	0.584
Subtotal (%)	89	100	80	100	11	0	0	100	11	0	0	100
Total (%)	92				28				28			

Source: authors' own study

The evidence suggests that returns to education differ across nationality groups, i.e., the same ISCED level diploma provides a different chance of reaching a certain income decile to nationals, EU citizens and non-EU citizens, *ceteris paribus*. In this context, we have hypothesized that economic integration reduces the differential. Therefore, nationals and EU citizens must get better and more similar returns than non-EU citizens.

In mathematical terms, that can be formalized as follows:

- Income deciles 1 to 5

Nationals vs. EU citizens ⟶ $H_0: \beta_{6,1} < \beta_{6,2}$ and $H_A: \beta_{6,1} \geq \beta_{6,2}$
Nationals vs. non-EU citizens ⟶ $H_0: \beta_{6,1} < \beta_{6,3}$ and $H_A: \beta_{6,1} \geq \beta_{6,3}$
EU citizens vs. non-EU citizens ⟶ $H_0: \beta_{6,2} < \beta_{6,3}$ and $H_A: \beta_{6,2} \geq \beta_{6,3}$

- Income deciles 6 to 10:

Nationals vs. EU citizens ⟶ $H_0: \beta_{6,1} > \beta_{6,2}$ and $H_A: \beta_{6,1} \leq \beta_{6,2}$
Nationals vs. non-EU citizens ⟶ $H_0: \beta_{6,1} > \beta_{6,3}$ and $H_A: \beta_{6,1} \leq \beta_{6,3}$
EU citizens vs. non-EU citizens ⟶ $H_0: \beta_{6,2} > \beta_{6,3}$ and $H_A: \beta_{6,2} \leq \beta_{6,3}$

Table 1 aggregates the results of Wald Tests based on the previous hypothesis for each income decile and educational level. The hypothesis is met in 82.5% of the cases. Thus, in general, nationals obtain the highest return on their investments in education, followed by EU citizens, leaving non-EU citizens in last place. Across educational levels, the degree of fulfillment varies. It is lower for the first ISCED levels (1–2), peaks for middle skilled workers (ISCED 3–5), and slightly decreases again for the highest ISCED levels (6–8). Therefore, it seems that returns to education converge for the different nationality groups for the lowest educational levels.

Regarding the differences in returns among nationality groups, the results show that nationals have a lower (higher) probability of being in the lower (higher) income deciles than EU citizens for a given educational level, *ceteris paribus*, in 76.2% of the cases. This percentage rises up to 83.4% when native workers are compared to non-EU ones. This evidence, together with the differences in the size of the returns previously observed in Fig. 1 to 6, supports the idea that economic integration tends to reduce the gap in returns to education among Member States' workers within a national labor market. The fact that EU workers have lower (higher) probability than non-EU ones of being in the lower (upper) part of the income distribution for a given educational level, *ceteris paribus,* in 88.1% of cases supports this too.

Table 3. P-values for Wald-Tests of differences in returns to education between nationals, EU and non-EU workers with STEM certifications

Decile	$ISCED_{i1}$				$ISCED_{i2}$				$ISCED_{i3}$				PTR_i			
	DK	CY	DE	IT	DK	CY	DE	IT	DK	CY	DE	IT	DK	CY	DE	IT
1	-0.0543***	-0.0150***	-0.0655***	-0.0373***	-0.0538***	-0.0106***	-0.0702***	-0.0251***	-0.0413***	0.0446***	-0.0666***	-0.0219***	0.0008	0.0009***	-0.0073***	0.0018***
2	-0.0364***	-0.0090***	-0.0471***	-0.0272***	-0.0361***	-0.0064***	-0.0506***	-0.0183***	-0.0277***	0.0268***	-0.0479***	-0.0160***	0.0006	0.0006***	-0.0052***	0.0013***
3	-0.0183***	-0.0051***	-0.0300***	-0.0214***	-0.0181***	-0.0036***	-0.0322***	-0.0144***	-0.0139***	0.0153***	-0.0305***	-0.0126***	0.0003	0.0003***	-0.0033***	0.0010***
4	0.0054***	-0.0012***	-0.0145***	-0.0149***	0.0054***	-0.0009***	-0.0155***	-0.0101***	0.0041***	0.0037***	-0.0147***	-0.0088***	-0.0001	0.0001***	-0.0016***	0.0007***
5	0.0125***	0.0014***	0.0041***	-0.0036***	0.0124***	0.0010***	0.0043***	-0.0024***	0.0095***	-0.0043***	0.0041***	-0.0021***	-0.0002	-0.0001***	0.0004***	0.0002***
6	0.0142***	0.0031***	0.0199***	0.0048***	0.0141***	0.0022***	0.0213***	0.0032***	0.0108***	-0.0092***	0.0202***	0.0028***	-0.0002	-0.0002***	0.0022***	-0.0002***
7	0.0179***	0.0038***	0.0310***	0.0120***	0.0178***	0.0027***	0.0333***	0.0081***	0.0136***	-0.0114***	0.0316***	0.0071***	-0.0003	-0.0002***	0.0034***	-0.0006***
8	0.0187***	0.0036***	0.0393***	0.0193***	0.0185***	0.0025***	0.0422***	0.0130***	0.0142***	-0.0106***	0.0400***	0.0113***	-0.0003	-0.0002***	0.0044***	-0.0009***
9	0.0184***	0.0019***	0.0382***	0.0320***	0.0182***	0.0013***	0.0409***	0.0216***	0.0140***	-0.0056***	0.0388***	0.0188***	-0.0003	-0.0001***	0.0042***	-0.0015***
10	0.0219***	0.0009***	0.0247***	0.0364***	0.0217***	0.0007***	0.0265***	0.0245***	0.0166***	-0.0028***	0.0251***	0.0214***	-0.0003	-0.0001***	0.0027***	-0.0018***
N	5.717	13.801	84.390	100.159	5.717	13.801	84.390	100.159	5.717	13.801	84.390	100.159	5.717	13.801	84.390	100.159

Source: authors' own study

Finally, economic integration does not influence the gap in returns to education equally across all the EU countries under analysis. Germany appears to be the country where this reduction applies the most, with natives obtaining better returns than EU-workers in only 53.8% of the cases. The other countries obtain similar results across the three pairwise comparisons of workers groups, except for EU vs. non-EU workers in Italy.

3.2. Economic reasons behind the gaps in returns to education among nationality groups

The previous analysis has shown evidence of how economic integration tends to correlate with smaller gaps in returns to education in a local labor market between natives and workers from other countries within the economic area. Nevertheless, it is also clear that such gaps are persistent, and economic integration does not eliminate them. Unfair and artificially created gaps in the returns to education among nationals of an area of economic integration might have pervasive effects over that area's capacity to deliver economic benefits. On the other hand, those gaps might partially respond to economic factors, and tackling them might require further policy actions.

One economic reason for the differences in performance between natives and immigrants arises from the imperfect transferability of skills and knowledge acquired within a national educational system to another country's labor market. However, there are fields of studies associated with easier-to-export human capital. For example, STEM degrees (Science, Technology, Engineering and Mathematics), provide a universally applicable set of skills and knowledge, while degrees in humanities and social sciences are more based on national curricula that are country-specific (Cebolla-Boado et al., 2019). Therefore, in order to test the transferability hypothesis, we define a new variable, $STEM_{in}$, that gathers all the certifications within the STEM field and slightly modify the original econometric model to become:

$$INCDECIL_i^j = \beta_{1i}H_i + \beta_{2i}Gender_i + \beta_{3i}Exp_i + \beta_{4i}Sup_i + \beta_{5in}Years_{in} + \beta_{6in}STEM_{in} + u_i \ where \ j \in [1,10] \ and \ n \in [1,3] \quad (2)$$

Since STEM professionals' skills and knowledge are perfectly transferable to any labor market, the β_{6in} coefficients for the different nationality groups should be the same. Thus, the following null hypothesis is formally tested:

Nationals vs. EU citizens $\longrightarrow$ H0: $\beta_{6,1} = \beta_{6,2}$ and HA: $\beta_{6,1} \neq \beta_{6,2}$
Nationals vs. non-EU citizens $\longrightarrow$ H0: $\beta_{6,1} = \beta_{6,3}$ and HA: $\beta_{6,1} \neq \beta_{6,2}$
EU citizens vs. non-EU citizens $\longrightarrow$ H0: $\beta_{6,2} = \beta_{6,3}$ and HA: $\beta_{6,2} \neq \beta_{6,3}$

Table 2 shows that the null hypothesis that nationals and EU citizens possessing a STEM qualification have the same probability of being in a certain income decile, controlling for the other confounding factors, cannot be rejected in general. Only in Germany do nationals and EU workers with a STEM qualification seem to have different marginal probabilities of being in income deciles 6 and 7, while in Denmark the same happens for decile 6. Therefore, for highly transferable fields of study there are no differences in the returns to education of nationals and workers from the area of economic integration.

Moreover, Table 2 shows that there are differences in the returns to education between non-EU workers, on the one hand, and natives and other EU workers on the other. Thus, even for highly transferable fields of study, returns to education do not converge in the absence of economic integration. Only in Italy can it not be rejected that the returns to STEM qualifications are the same for the three nationality groups. Therefore, the differences in non-EU workers' returns cannot be explained by the lack of economic integration alone.

One possibility is that differences in quality of education across countries are at the root of such gaps. Even in highly technical fields of education, differences in schooling quality can explain why different nationalities obtain different returns for the same level and field of education (Chiswick, Barry R., 1978; Weiss et al., 2003). We use pupil–teacher ratios (PTR), available at the UNESCO Institute of Statistics Database (UIS), to test the quality hypothesis by slightly modifying the original econometric model to become:

$$INCDECIL_i^j = \beta_{1i}H_i + \beta_{2i}Gender_i + \beta_{3i}Exp_i + \beta_{4i}Sup_i + \beta_{5in}ISCED_{in} + \beta_{6in}PTR_i + u_i \ where \ j \in [1,10] \ and \ n \in [1,3] \quad (3)$$

Table 3 shows that the marginal probability of being in the low-income deciles decreases as the

Table 4. Effect of imperfect information on returns to education of nationals, EU and non-EU workers

Decile	$ISCED_{i1}$				$ISCED_{i2}$				$ISCED_{i3}$				$ISCEDxYears_{i2}$				$ISCEDxYears_{i3}$			
	DK	CY	DE	IT	DK	CY	DE	IT	DK	CY	DE	IT	DK	CY	DE	IT	DK	CY	DE	IT
1	-0.0209***	-0.0164***	-0.0330***	-0.0262***	-0.0167***	-0.0162***	-0.0291***	-0.0110***	-0.0141***	0.0052***	-0.0270***	-0.0063***	-0.0001	0.0000	-0.0001***	-0.0002***	-0.0002***	-0.0003***	-0.0001***	-0.0000*
2	-0.0117***	-0.0100***	-0.0210***	-0.0192***	-0.0094***	-0.0099***	-0.0186***	-0.0080***	-0.0079***	0.0032***	-0.0172***	-0.0046***	-0.0000	0.0000	-0.0001***	-0.0002***	-0.0001***	-0.0002***	-0.0001***	-0.0000*
3	-0.0141***	-0.0064***	-0.0167***	-0.0144***	-0.0113***	-0.0063***	-0.0148***	-0.0060***	-0.0095***	0.0020***	-0.0137***	-0.0035***	-0.0000	0.0000	-0.0001***	-0.0001***	-0.0001***	-0.0001***	-0.0001***	-0.0000*
4	-0.0125***	-0.0040***	-0.0110***	-0.0097***	-0.0100***	-0.0039***	-0.0098***	-0.0041***	-0.0084***	0.0013***	-0.0090***	-0.0023***	-0.0000	0.0000	-0.0000***	-0.0001***	-0.0001***	-0.0001***	-0.0000***	-0.0000*
5	-0.0108***	-0.0003***	-0.0043***	-0.0025***	-0.0086***	-0.0003***	-0.0038***	-0.0010***	-0.0072***	0.0001***	-0.0035***	-0.0006***	-0.0000	0.0000	-0.0000***	-0.0000***	-0.0001***	-0.0000***	-0.0000***	-0.0000*
6	-0.0063***	0.0013***	0.0023***	0.0027***	-0.0050***	0.0012***	0.0020***	0.0011***	-0.0042***	-0.0004***	0.0019***	0.0006***	-0.0000	-0.0000	0.0000***	0.0000***	-0.0001***	0.0000***	0.0000***	0.0000*
7	0.0004***	0.0027***	0.0084***	0.0072***	0.0003***	0.0026***	0.0074***	0.0030***	0.0003***	-0.0008***	0.0069***	0.0017***	0.0000	-0.0000	0.0000***	0.0001***	0.0000***	0.0001***	0.0000***	0.0000*
8	0.0109***	0.0043***	0.0148***	0.0117***	0.0087***	0.0043***	0.0131***	0.0049***	0.0073***	-0.0014***	0.0121***	0.0028***	0.0000	-0.0000	0.0000***	0.0001***	0.0001***	0.0001***	0.0001***	0.0000*
9	0.0233***	0.0042***	0.0229***	0.0203***	0.0186***	0.0041***	0.0203***	0.0085***	0.0156***	-0.0013***	0.0188***	0.0049***	0.0001	-0.0000	0.0001***	0.0002***	0.0002***	0.0001***	0.0001***	0.0000*
10	0.0417***	0.0041***	0.0377***	0.0302***	0.0333***	0.0041***	0.0333***	0.0126***	0.0281***	-0.0013***	0.0308***	0.0073***	0.0001	-0.0000	0.0001***	0.0003***	0.0004***	0.0001***	0.0001***	0.0001*
N	19.679	30.894	230.088	152.907	19.679	30.894	230.088	152.907	19.679	30.894	230.088	152.907	19.679	30.894	230.088	152.907	19.679	30.894	230.088	152.907

Source: authors' own study

educational attainment increases, while the opposite happens in the high-income deciles. Only in Italy does the data fully support the quality hypothesis. In Italy, the correlation between educational attainment and income is larger for Italians than for EU citizens and larger for EU citizens than for non-EU ones, for a given income decile, *ceteris paribus*; and PTR_i has the expected sign. For low-income deciles, the lower the quality, the larger the marginal probability, and *vice versa* for the high-income decile. Differences in quality of education explain, partially at least, the differences in the returns between Italians, EU workers and non-EU workers.

In the other countries in the sample, there is not strong evidence of quality of education being a factor behind differences in returns to education. In Denmark, PTR_i is not significant and the correlation between education and income is virtually the same for Danish and EU workers, although it differs for non-EU ones. That supports the theory

that economic integration reduces the gaps in returns to education. In Cyprus, higher educational attainments increase the probability of non-EU workers being in the lower deciles and decrease that of being in the upper ones. Nevertheless, PTR_i is significant and has the proper sign. Perhaps, it is the quality and not the "quantity" of their educational endowment that is the critical variable determining non-EU workers' income. Finally, in Germany, the estimated model does not have a coherent economic sense. PTR_i is significant but has the wrong sign, and the correlation between education and income is almost the same for all nationality groups.

The last source of gaps in returns to education identified in the literature review are market failures. Imperfect information theories contend that immigrants do not have quality information about the national labor market on their arrival and, moreover, they tend to accept any type of employment at the beginning (Chiswick, 1978; Borjas, 1985, 1995; Lam
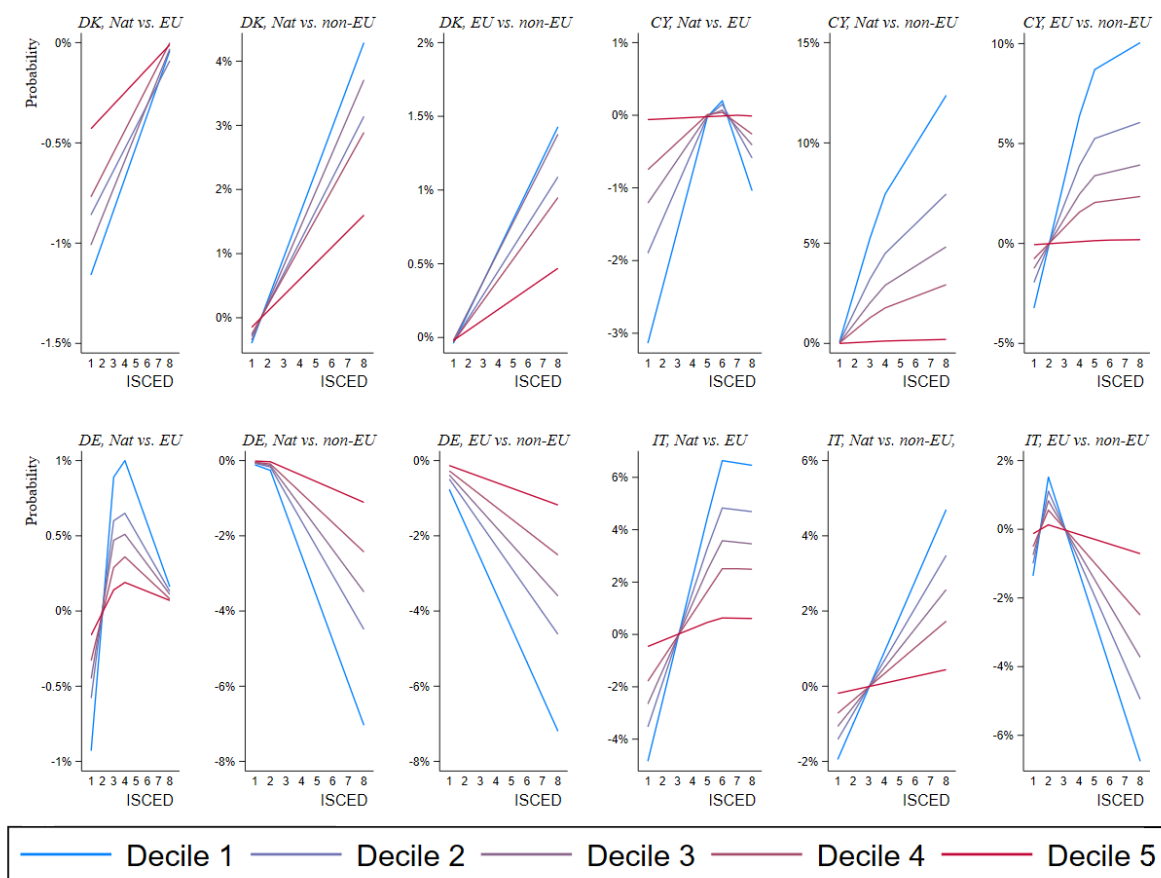

Fig. 7. Effect of education and training on the probability differentials of being in the first five income deciles
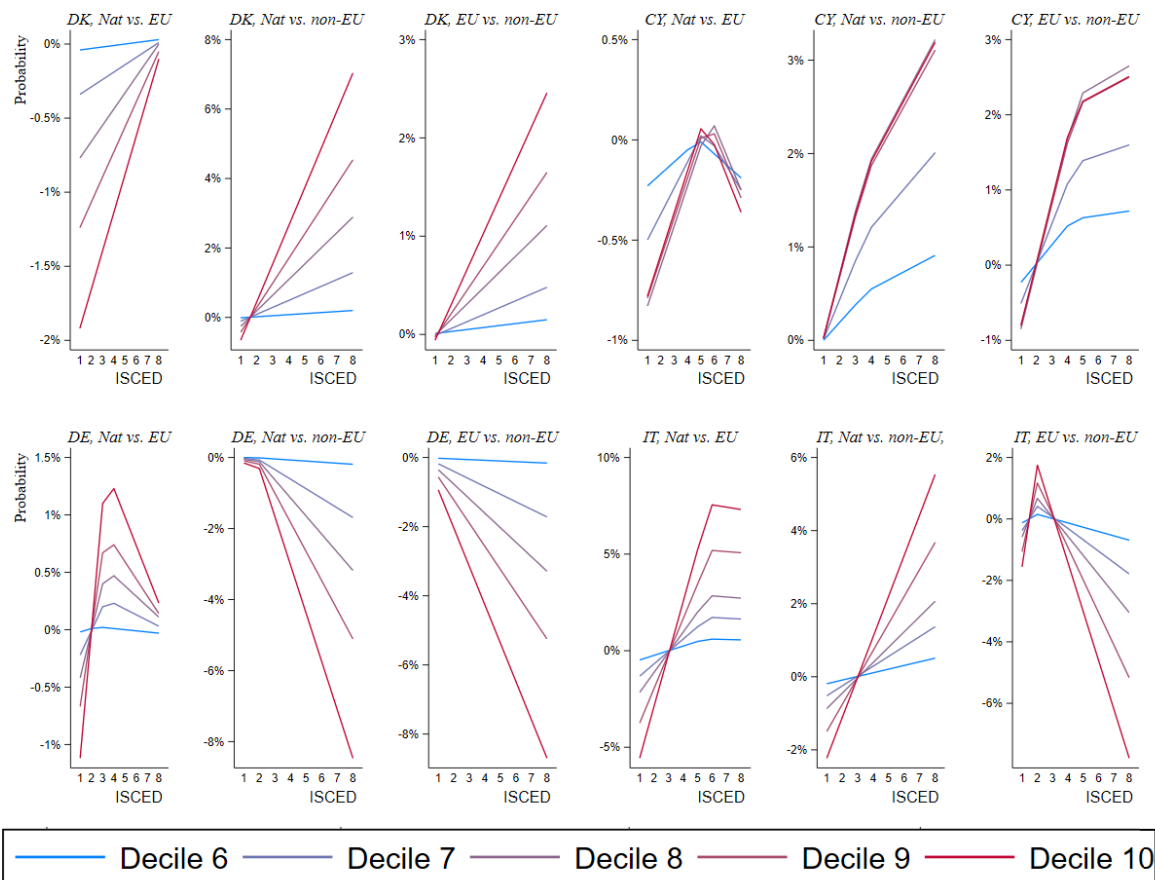Source: own elaboration

Fig. 8. Effect of education and training on the probability differentials of being in the last five income deciles
Source: own elaboration

& Liu, 2002; LaLonde & Topel, 2007). This problem of asymmetric information should disappear over time as immigrants increase their knowledge of the local market and language, managing to better match their skills with the available job vacancies (Eckstein & Weiss, 1998; Lam & Liu, 2002; Weiss et al., 2003). We include an interaction effect between years of residence and educational attainment $(ISCEDxYears)$[1] to test the imperfect information hypothesis by slightly modifying the original econometric model to become:

$$INCDECIL_i^j = \beta_{1i}H_i + \beta_{2i}Gender_i + \beta_{3i}Exp_i + \beta_{4i}Sup_i + \beta_{5in}ISCED_{in} + \beta_{6in}ISCEDxYears_{in} + u_i \text{ where } j \in [1,10] \text{ and } n \in [1,3] \quad (4)$$

Table 4 shows that education is correlated with lower probability of being in the low-income deciles and higher probability of being in the upper ones. Supporting again the hypothesis that economic integration narrows gaps in returns to education, the estimated $ISCED_{in}$ coefficients are more similar between native and EU workers than between natives

and non-EU ones in all the countries. The signs and p-values of the interaction effects, $ISCEDxYears_{in}$, confirm the presence of asymmetric information, since they have the same sign as natives $ISCED_{in}$ coefficients. This supports the hypothesis of the asymmetric information problem vanishing over time, given that a foreign worker living for a long time in the host country has more or less the same probability of achieving a particular income decile as a national worker, ceteris paribus.

In Cyprus and Denmark, imperfect information only affects non-EU workers. In Cyprus, the $ISCED_{in}$ coefficients of natives and EU workers are the same, while $ISCEDxYears$ is not significant, telling us that economic integration fully closes the gaps in returns to education and, hence, asymmetric information is not an issue for EU workers. In Denmark, although economic integration does not close the gaps between Danish and EU workers, $ISCEDxYears$ is not significant either. In Italy and

Germany, imperfect information does also affect EU workers, but they need fewer years of residence in the host country than do non-EU workers to catch up with natives' returns to education. That can be observed by the fact that the absolute value of *ISCEDxYears* coefficients is larger for EU than for non-EU workers.

3.3. The role of Active Labor Market Policies in reducing the inequal returns to education

Providing formal education and vocational training to foreign workers might be a policy option to close the gaps in returns to education (Bernt & Ragan, 2002), independently of whether they arise from the lower quality of their degrees, the lack of transferability of foreign studies, or labor market failures linked to imperfect information and signaling issues. To test this, we define two new variables. *InCountry* records whether workers have received education or training during the last four weeks and aims to capture the signaling effort effect on income (Spencer, 1973; Stiglitz, 1975). *ISCEDxInCountry* is the interaction effect of receiving training and/or education and workers' original educational level. It aims to capture the effects of education and/or training on workers' original human capital endowment. The econometric model becomes:

$$INCDECIL_i^j = \beta_{1i}H_i + \beta_{2i}Gender_i + \beta_{3i}Exp_i + \beta_{4i}Sup_i + \beta_{5in}ISCED_{in} + \beta_{6in}InCountry_{in}$$
$$+ \beta_{7in}ISCEDxInCountry_{in} + u_i \; where \; j \in [1,10] \; and \; n \in [1,3] \quad (5)$$

One rationale for the EU funding lifelong learning and vocational training is linked to their capacity to reduce the gaps in returns to education among, at least, native and EU workers. To assess this capacity, we calculate the difference in absolute value of marginal probabilities of being in an income decile between native and EU workers not participating in such programs. Then, we subtract from it the difference in absolute value of marginal probabilities of being in an income decile between native and EU workers participating in them. Formally:

$$Difi = |[(\beta_{5i1}ISCED_{i1}) - (\beta_{5i2}ISCED_{i2})]| - |[(\beta_{5i1}ISCED_{i1} + \beta_{6i1}InCountry_{i1} + \quad (6)$$
$$\beta_{7i1}ISCEDxInCountry_{i1}) - (\beta_{5i2}ISCED_{i2} + \beta_{6i2}InCountry_{i2} + \beta_{7i2}ISCEDxInCountry_{i2})]|$$

The same is done for the other two pairwise groups: natives vs non-EU workers and EU vs non-EU workers. If the difference is positive, participation in lifelong learning and vocational training reduces the gap between both groups of workers, i.e., participation is correlated with a positive effect, while if the difference is negative participation in lifelong learning and vocational training increases the gap, i.e., participation is correlated with a negative effect. The i subscript refers to the income decile.

Education or training in country has a negative impact on the gap between nationals' and EU workers' marginal probabilities of being in low-income deciles in Cyprus and Denmark, as Fig. 7 shows.. Nevertheless, this perverse effect tends to revert or vanish for high educational levels. On the other hand, the policy generally reduces the gap between non-EU citizens, the ones with a worse initial position, and nationals in Denmark, Cyprus and Italy but not in Germany. Finally, between EU and non-EU workers, this type of intervention reduces the gap in Denmark and Cyprus, but not always in Italy and not at all in Germany.

Results are essentially the same for the upper-income deciles, as it can be seen in Fig. 8. However, there is a difference in the size of the effect and its relationship with the different income deciles. In this sense, for the bottom part of the income distribution, the lower the income decile, the larger the effect; meanwhile, for the upper one, the higher the decile, the larger the effect. A significant exception for this is the case of Cyprus, where formal education and vocational training have a larger effect over low-income deciles than high ones.

In conclusion, only in Italy and Germany does it seem to be rational for the EU to fund lifelong learning and vocational training programs, since only in those countries do they narrow the gap in returns to education between natives and EU workers instead of widening it.

4. Conclusions

The evidence analyzed supports the hypothesis of a positive correlation between educational attainment and income. However, the strength of such correlation depends on the characteristics of national labor markets and the nationality group to which workers belong. In this sense, we find

evidence of economic integration being a factor behind gaps in returns to education. In general, we have seen that native workers obtain the highest returns to education, followed by EU workers, thus leaving non-EU workers in last place. Nevertheless, the extent to which economic integration bridges the gaps in returns to education varies across the countries under analysis.

Moreover, there is evidence also of other factors behind the existence of gaps in returns to education among native, EU and non-EU workers. The level of transferability of the skills and knowledge acquired through education appears as one of the factors. However, except in the Italian case, even highly transferable studies are not equally rewarded in the absence of economic integration. Gaps in returns might also stem from differences in the quality of the national systems in which the workers themselves are educated. This is indeed the case in Italy, where the quality hypothesis appears to be behind the difference in the returns obtained by natives, EU and non-EU workers. Finally, asymmetric information also partially explains differences in returns to education between natives and EU workers in Germany and Italy, but not in Denmark and Cyprus. Additionally, in Cyprus, controlling for this variable leaves natives and EU workers with the same returns, suggesting that economic integration might solve labor market information asymmetries for citizens of the Member States. Indeed, asymmetric information does affect non-EU workers in the four countries and, in Germany and Italy, with more intensity than EU workers.

However, the evidence does not support a strong rationale for the EU funding of active labor market policies based on life-long learning and vocational training in the Member States. In this sense, participation in these types of programs is not clearly correlated with closing the gaps in returns to education of natives and EU workers. There is some partial evidence that, for some levels of education, it can have such effect in Germany and Italy, but never in Cyprus or Denmark. Curiously, there is evidence that such programs help bridge the gaps in returns to education between natives and non-EU workers in Cyprus, Denmark and Italy.

Notes

1. There is not an interaction term for nationals, since their learning process about the labor market is simply proxied by years of working experience.

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