The role of the human capital and investment in human capital within the sustainable socio-economic development. How labour force migration affects competitiveness?

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Abstract. *The research aims to analyse the role played by the human capital investment in shaping international migration trends and influencing socio-economic development for the EU New Member States during the last decade. Our analysis is based on developing double-log macro-econometric models that combine cross-sections and time series in a panel structure, by using a set of indicators specific for the migration process, as well as for the economic activity and education, as main explanatory variables. Furthermore, the study focuses on a comparative approach for New Member States, our random and fixed effects models using several quantitative and qualitative proxies in order to highlight the relationship and interdependence between emigration, human capital investment and socio-economic development.*

Keywords: education; international migration; economic development; competitiveness; macro-econometric modelling.

**JEL Classification:** J01, J08, O15.
REL Classification: 12I, 8G.

1. Introduction

International labour migration is seen as a challenge in Europe, especially concerning unskilled labour (Zimmermann, 2005). At the same time, human capital, especially the highly skilled labour, represents one of the main resources, developed countries facing a surplus of demand for skilled workers that can't be covered by the local labour force trained within the national educational system. Thus, developing countries become extremely competitive in providing skilled labour to cover this gap. Nevertheless, unlike North America, Australia or New Zeeland, Europe does not hold a certain specific place in the international labour market for tertiary educated workers.

At the same time, unfavourable demographic conditions, the lack of skills, competencies, as well as the persistence of high unemployment have led to a reconsideration of restrictive international labour migration policies by the policy makers in Europe. Moreover, structural changes of the political European economy have a significant impact on international migration policies and strategies. The process of European integration generated various changes in the structure, origin and destination of the migrant flows, while the anxiety towards emigrants from Central and Eastern Europe highlighted the importance of a gradual approach of migration, focused on those issues that don't reveal controversies.

The process of labour emigration within the European Union encountered increasing trends during the last decade. On average, between 2004 and 2008, net increase of immigrants in the EU-15 reached 250,000 people from the eight New Member States (NMS) in 2004, especially from Poland, and approximately 300,000 persons from the two New Member States in 2007, mainly from Romania (Brucker et al., 2009, pp. 23-27). Overall, in 2007 the European Union (EU-27) hosted about 29.1 millions of foreign citizens, of which 10.6 million were intra-EU migrants (European Commission, 2008, p. 115). Approximately 40% of those migrants were citizens of the EU New Member States, mostly coming from Romania (1.6 million), Poland (1.3 million) and Bulgaria (310,000). These statistics point out that about 7.2% persons of the Romania's population, 4.1% of Bulgaria's population and 3.4% of Poland's population benefits from the free movement right to live in a different country than the origin one, as citizens of the European Union (Menz, Caviedes, 2010, p. 129).

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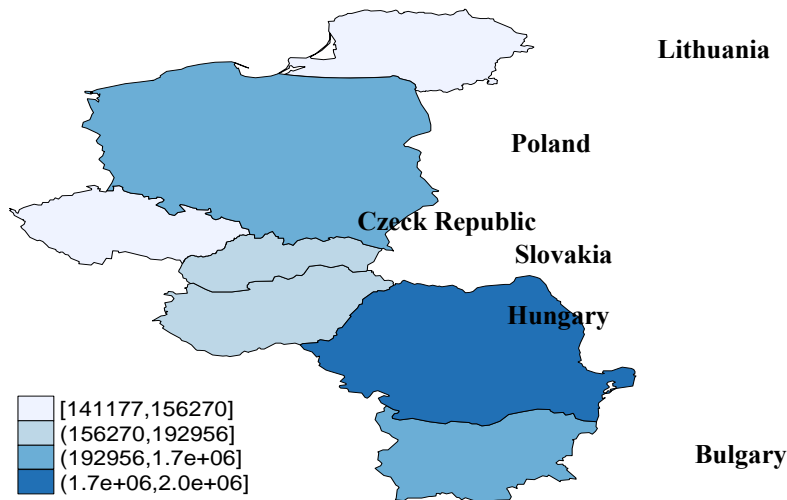
Source: own process of panel data through Stata 11 econometric package.

Figure 1. *Estimations of the emigrant stocks for migrant sending countries within the panel, 2010*

Males and females have equal shares in migrant flows from the eight EU New Member States since 2004, while females have a larger share in the case of Romanian and Bulgarian migrants, especially due to a significant demand for domestic workers from these countries within the EU-15. At the same time, migrant workers from Central and Eastern Europe have jobs in industry, constructions or personal assistance, that are placed at the bottom of the occupational hierarchy, with more than 35% of the migrants holding these types of low skilled jobs (European Commission, 2008, p. 130). The statistics point out that there is a positive selection of emigrants from the New Member States of the European Union according to their educational level (Brucker et al., 2009, p. 92), so that the higher wage obtained in the host country was adopted along with a decline in the social status.

2. Highly skilled labour emigration literature review – a critical analysis

The economic literature concerning the international labour migration impact on sending and receiving countries focuses on the effects of immigration on natives, especially in terms of unemployment, job choices and wages (Borjas, 1989, Zimmermann, 2005). The impact of labour emigration for the sending country is less and, usually, slightly analysed.

For the origin country, the emigration of one part of its labour force has two major implications: (i) first, the emigration process modifies the size and structure (education, skills) of the labour force; (ii) second, emigration, through remittances, affects consumption and investment in the source economy, generating at the same time significant positive effects upon economic growth and poverty reduction. On these lines, economic growth and international labour migration relationship analysis takes into account the direct and indirect emigration effects. The main direct effect is represented by the remittances contribution to national income, while the indirect effects refer to production changes due to labour losses and to the remittances impact on internal savings and investments.

Following the perspective of a developing migrant sending country, the emigration of a certain part of its population, like the highly skilled labour, can determine a productivity reduction for the other workers, this particularly effect reducing the overall welfare gains from emigration (Clemens, 2011, p. 89). However, the conditions that would lead highly skilled labour emigration to result in a diminishing, at equilibrium, in the stock of sending country's skilled workers, are not accurately determined by the literature. Mountford (1997) highlights that when emigration towards countries with higher wages is possible, then the expected value of human capital increases for all potential migrants, even if the process involves uncertainty and high costs. Thus, due to the fact that not all of those who were encouraged to invest in order to improve their skills will emigrate, the simple existence of this option could increase the human capital stock in the migrant sending countries.

Taking into consideration all these aspects, the main objective of the performed research is described by the macroeconometric analysis of the shaping factors of labour emigration within the main sending countries from Central and Eastern Europe, members of the European Union. In order to accomplish this objective, the research is based on developing macroeconometric models that highlight, through the explanatory variables used within the analysis, the main determinants and shaping factors of labour emigration within a panel of seven countries from Central and Eastern Europe.

3. Developed models: equations, specifications, hypotheses and testing

In order to analyse the relationship between labour emigration, human capital investment and socio-economic development for migrant sending countries, New Member States of the European Union, we developed and tested macroeconometric models, which combines cross-sections with time-series, using panel data during 2000-2010 for a group of seven Central-European countries, members of the European Union since 2004 (Poland, Czech Republic, Hungary, Slovak Republic and Lithuania) and 2007 (Romania and Bulgaria).

The main reasons for choosing the seven specific emigration countries from Central and Eastern Europe consist of significant evolutions of the process during the last decade, studies such as the one performed by Brucker et al. (2009) pointing out that by the end of 2007, the data on international migration captured from the host countries statistics reveal a stock of 3.8 million emigrants from the New Member States of the European Union that live in EU-15. The main sending countries are Romania (1.6 millions) and Poland (1.3 millions).

The emigration data are taken from a relatively new and complex set of indicators developed by Brucker *et al.* (2009), while for the other indicators regarding the economic activity and the labour market we used data series from Eurostat and the World Bank.

The model is developed as a simple regression model, respectively a double-log and a semi-log regression model, focusing on random and fixed effects within the panel.

General form of the model

The model developed for the analysis of the relationship between labour emigration and human capital investment, with a significant impact on sending country's competitiveness, has the general form of a simple regression model with panel data. Thus, for panel data, the general linear representation of the model is described as follows (Baum, 2001, p. 219):

$$y_{it} = \sum_{k=1}^{k} x_{kit} \beta_{kit} + \varepsilon_{it}$$

$$i = 1,..., N \qquad (1)$$

$$t = 1,..., T$$

where:

N represents the number of panel units (countries), while *T* signifies the number of periods (time).

The general form of the developed models used for the emigration impact analysis on education and competitiveness is expressed as a simple regression model for considered panel countries:

$$Y_{it} = \beta_1 + \beta_2 X_{it} + \varepsilon_{it}, \, i = 1,......,N, \, t = 1,.......,T \tag{2}$$

This simple linear regression model is extremely useful for *(i)* the analysis of the dependence between two variables, the labour market and human capital investment specific endogenous variable, respectively the exogenous variable specific for the emigration process, and *(ii)* for characterizing the dependence between the two variables in a certain time horizon (2000-2010).

The proposed model uses the logarithm of the variables in order to capture a precise estimation of parameters, respectively of the emigration process influence on labour force educational level, thus taking the general form of a *double-log model*, with the following configuration:

$$\log(Y_{it}) = \beta_1 + \beta_2 \log(X_{it}) + \varepsilon_{it}, \, i = 1,......,N, \, t = 1,.......,T \tag{3}$$

The main hypotheses of the simple regression models deveoped within the paper are based on general hypotheses of the regression models (Moffat, 2011), expressed as: (i) correct model specification; (ii) data series are not affected by measurement errors; (iii) the residuals are random variables with zero mean: $E[\varepsilon_i | X = x_i] = 0$, for every i; this property reveals the fact that other unregistered factors, except for the exogenous characteristic, have no systematic influence on the mean of endogenous characteristic; (iv) the variance of residual variables is time invariant or constant, defining the property of homoscedasticity. This hypothesis is extremely restrictive for the developed model, due to the fact that the panel data are gathered for a group of countries; (v) there is no first order autocorrelation or serial correlation of residuals: $\text{cov}(\varepsilon_i, \varepsilon_j) = 0, \, i \neq j$.

A high level of precision is ensured for the developed models through validating these hypotheses, as well as the robustness of parameters estimated through least squares and maximum likelihood methods, both being used for random (RE – random effects) and fixed (FE – fixed effects) effects models.

We performed a complex set of tests in order to verify the statistical significance of the coefficients and to validate the hypotheses of the model, thus: the

differentiation of the coefficients estimated through both types of models with random and fixed effects was performed by implementing the Hausman test; the hypothesis of no serial correlation of the residuals was performed through the Wooldridge – Lagram Multiplier test; the homoscedasticity hypothesis was validated through Breusch-Pagan Lagrangian Multiplier test for random effects models, respectively through the modified Wald test for group-wise heteroscedasticity in the fixed effects models; the assumption of no multicollinearity was tested with the help of the explanatory variables correlation matrix and by performing the auxiliary regressions, while the validation of individual and jointly influence of exogenous variables on the dependent variable was accomplished through Wald, Fisher and t-statistic testes, as well as through the analysis of variance (ANOVA).

The model and associated data were processed with the Stata 11 econometric package, using variables with panel data for the seven emigration countries and a time dummy variable (from 1 to 77) for the 2000-2010 period. In order to estimate the parameters of the random effects model we used the GLS method (GLS – Generalized Least Squares) and for the fixed effects we used OLS – Ordinary Least Squares. The main objective of the empirical regression analysis is to explain as much as possible from the variation of the dependent variable through the variation of the explanatory variables used within associated models.

4. Results and discussions

Based on our specific methodology, we developed various regression models with cross-section and time series combined on panel data, using random effects (RE) through least squares method (GLS – Generalised Least Squares). At the same time, we processed our developed models based on the fixed effects (FE) method and the Hausman test applied in order to choose between the two categories of parameters has validated the results of the random effects models.

The models have been tested and assessed based on their validated hypotheses, generating accurate conclusions adequate for identifying and analysing the impact of the emigration process on human capital investment and competitiveness for considered countries assessed within the panel.

In order to capture the emigration effects on the educational level in the source country, we implemented three double-log simple linear regression models, having the stock of emigrants as exogenous variable; within these models, the

endogenous variables are represented by: the crude rate primary and secondary education enrolment (model 1), the crude rate of tertiary education enrolment (model 2), respectively the drop-out rate or early school leavers (model 3).

The results obtained after processing these three models, based on the stock of emigrants, highlight the fact that the statistical significance level of the estimated coefficients through least squares method is relatively low in the case of the third (10%) and first (5%) models, while the parameters of the second model are extremely significant, at 0.1% level. At the same time, the R-squared obtained for the second model based on fixed effects highlights that approximately 74.6% in the variation of tertiary education enrolment rate can be explained through the annual variation in the stock of emigrants. The random effects models reveal a slightly low impact of the emigration process on tertiary education enrolment level (of only 10.2%). Nevertheless, Wald and Fisher tests enable the coefficients of the second model, respectively the positive impact of the emigration process on tertiary educational level.

Concurrently, the values of the two tests performed for the first and third models point out the necessity of carefully assessing the associated coefficients, their estimation being not as accurate as in the case of the second model.

Table 1. *Results of developed models based on the logarithm of the emigrant stock for the analysis of emigration impact on educational level, Random and Fixed effects, GLS and OLS Methods*

Random Effects (RE)

	Model 1			Model 2			Model 3		
	b/se	p	t	b/se	p	t	b/se	p	t
Log Emigrants	0.009*	0.044 (0.00)	2.010	0.352***	0.000 (0.03)	11.980	0.082	0.332 (0.08)	0.970
Constanta	4.453***	0.000 (0.06)	78.347	-0.377	0.305 (0.37)	-1.026	-0.101	0.923 (1.05)	-0.096
R-squared		0.061			0.102			0.073	
Wald		4.040			143.510			0.940	
N observations		77.000			77.000			77.000	

Fixed Effects (FE)

| | Model 1 | | | Model 2 | | | Model 3 | | |
	b/se	p	t	b/se	p	t	b/se	p	t
Log Emigrants	0.011*	0.024	2.314	0.392***	0.000	14.228	0.072	0.426	0.801
	(0.00)			(0.03)			(0.09)		
Constanta	4.430***	0.000	76.814	-0.866*	0.012	-2.591	0.017	0.988	0.015
	(0.06)			(0.33)			(1.09)		

R-squared		0.072			0.746			0.009	
F		5.355			202.441			0.642	
N observations		77.000			77.000			77.000	

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* $p<0.05$, ** $p<0.01$, *** $p<0.001$

Note: The standard errors are presented in brackets; the models are estimates through random and fixed effects for each country within the panel and comprise a time dummy variable.

Source: own process of panel data with Stata 11 econometric package.

Concluding, the emigration process leads to positive effects on the educational level of sending country's population, through its improvement towards upper-secondary and tertiary education. More precisely, the annual 1% growth of the emigrant stock generates a 0.392% (fixed effects) and 0.352% (random effects) increase in the crude rate of tertiary education enrolment, respectively a slight increase (0.011%) in the primary and secondary education enrolment rate for the origin countries analysed within the panel. At the same time, the emigrant stock increase can have negative consequences on education, highlighted by the slight increase in the drop-out rate, of about 0.7%

In order to support these conclusions, we processed three double-log models using the flow of immigrants from the main EU destination countries that have the citizenship of our considered panel sending countries, as main explanatory variable.

The level of statistical significance of the estimated coefficients is extremely high (0.1%) in the case of the second model, these enabling the positive (growth) impact of emigration on tertiary education enrolment rate. At the same time, an increase in the flow of immigrants generates a slight growth in primary and secondary education enrolment rate, the positive effects having a lower intensity in this case. Also, the results validate the main hypothesis of the previous model,

according to which the drop-out rate can register a slight increase as a result of the emigration process.

Table 2. *Results of developed models based on the logarithm of the immigrant flows for the analysis of emigration impact on educational level, Random and Fixed effects, GLS and OLS Methods*

Random Effects (RE)

	Model 1			Model 2			Model 3		
	b/se	p	t	b/se	p	t	b/se	p	t
Log Imigrants total	0.003 (0.01)	0.535	0.620	0.290*** (0.04)	0.000	6.456	0.190 (0.10)	0.051	1.952
Constanta	4.527*** (0.06)	0.000	76.567	0.835 (0.48)	0.083	1.736	-1.114	0.292	-1.053
R-squared		0.114			0.023			0.079	
Wald		0.380			41.680			3.810	
N observations		77.000			77.000			77.000	

Fixed Effects (FE)

	Model 1			Model 2			Model 3		
	b/se	p	t	b/se	p	t	b/se	p	t
Log Imigrants total	0.006 (0.01)	0.318	1.005	0.390*** (0.05)	0.000	8.470	0.194 (0.11)	0.072	1.826
Constanta	4.501*** (0.06)	0.000	72.501	-0.218 (0.48)	0.654	-0.449	-1.149 (1.12)	0.308	-1.028
R-squared		0.014			0.510			0.046	
F		1.010			71.734			3.334	
N observations		77.000			77.000			77.000	

* $p<0.05$, ** $p<0.01$, *** $p<0.001$

Note: The standard errors are presented in brackets; the models are estimates through random and fixed effects for each country within the panel and comprise a time dummy variable.

Source: own process of panel data with Stata 11 econometric package.

Taking into consideration the results of previous models and the guidelines of international migration theories concerning the positive selection of tertiary educated migrants (also highlighted by the previous empirical analysis), we

observe that the emigration impact on unemployment among tertiary educated persons within the origin country is negative. Thus, for this particular case, a 1% increase in the stock of emigrants leads to an approximately 0.35% annual increase in unemployment for highly skilled workers. According to the R-squared (especially in the case of fixed effects models), the emigration process largely explains the variation of the unemployment rate, the emigration stock justifying about 50% in its variation for tertiary educated persons.

For this purpose, we analysed the impact of the emigration process on the size and structure of the labour force, by developing three double-log regression models and by using the emigrant stock as exogenous variable, respectively the primary (model 1), secondary (model 2) and tertiary (model 3) educated labour force as endogenous variables.

The results obtained after processing the first model point out that emigration contributes to the reduction of the primary educated labour force within the source country, of which variation could be largely explained through the variations in the stock of emigrants, according to the R-squared (41.9% for random effects models, respectively 68.7% in the case of fixed effects models). More precisely, a 1% annual increase in the stock of emigrants reduces the unskilled labour by approximately 0.33%.

Table 3. *Results of developed models based on the logarithm of the emigrant stock for the analysis of emigration impact on the labour force size by educational level, Random and Fixed effects, GLS and OLS Methods*

Random Effects (RE)

| | Model 1 | | | Model 2 | | | Model 3 | | |
	b/se	p	t	b/se	p	t	b/se	p	t
Log Emigrants	-0.311***	0.000 (0.03)	-10.535	0.141***	0.000 (0.02)	5.683	-0.087	0.088 (0.05)	-1.706
Constanta	6.480***	0.000 (0.39)	16.667	2.413***	0.000 (0.31)	7.809	3.936***	0.000 (0.63)	6.248
R-squared		0.419			0.039			0.199	
Wald		110.990			32.300			2.910	
N observations		77.000			77.000			77.000	

Fixed Effects (FE)

| | Model 1 | | | Model 2 | | | Model 3 | | |
	b/se	p	t	b/se	p	t	b/se	p	t
Log Emigrants	-0.334***	0.000	-12.292	0.165***	0.000	6.316	-0.076	0.170	-1.386
	(0.03)			(0.03)			(0.05)		
Constanta	6.755***	0.000	20.517	2.133***	0.000	6.752	3.807***	0.000	5.736
	(0.33)			(0.32)			(0.66)		

R-squared		0.687			0.366			0.027	
F		151.100			39.896			1.920	
N observations		77.000			77.000			77.000	

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* $p<0.05$, ** $p<0.01$, *** $p<0.001$

Note: The standard errors are presented in brackets; the models are estimates through random and fixed effects for each country within the panel and comprise a time dummy variable.

Source: own process of panel data with Stata 11 econometric package.

The graphical representation of labour force evolution within the panel during 2000-2010 highlights a significant reduction in the size of primary educated labour force, large discrepancies being manifested in the case of Czech Republic and Slovak Republic. Secondary educated labour force registered a slight increase during this period for every country analysed within the panel, while significant perturbations are revealed in the case of the tertiary educated labour force, both for every individual country and the overall panel.
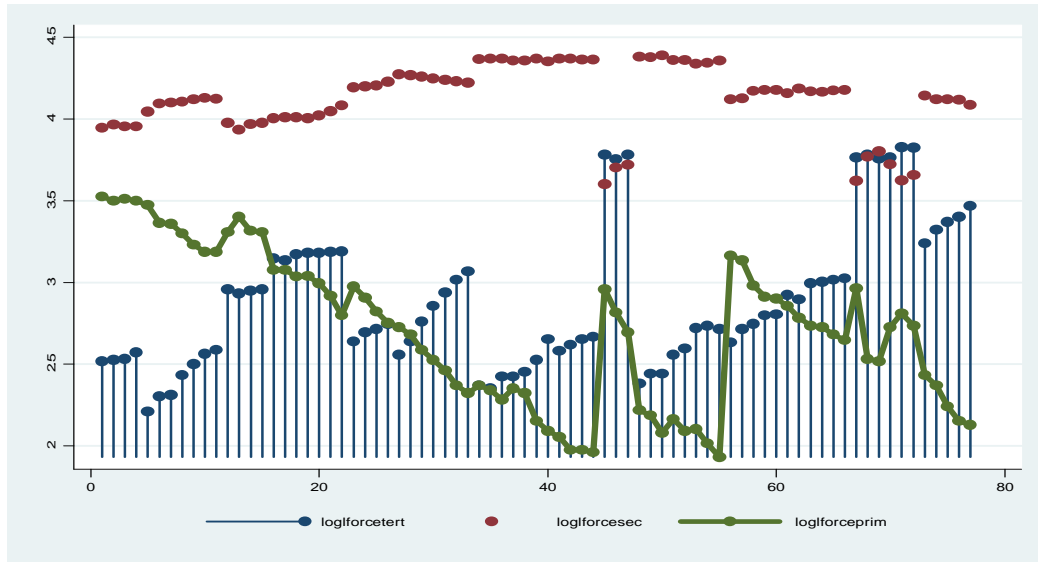
Source: own process of panel data through Stata 11 econometric package.

Figure 2. *Panel trends of the labour force by educational level – primary, secondary, tertiary, 2000-2010*

The results obtained after processing the second model reveal an increase in the secondary educated labour force due to emigration; more precisely, a 1% annual increase in the emigrant stock generates an approximately 0.165% increase in the lower and upper-secondary educated labour force. At the same time, the variation of this particular labour market indicator for the origin country can be explained in proportion of 36.6% through the variations in the emigrant stock. The major emigration impact is revealed in the case of the tertiary educated labour force, an increase of this process leading to a reduction of highly skilled labour, with major implications on host economies.

As a general appreciation, due to a significant reduction of the tertiary educated labour force, the non-migrants, respectively the persons that remain in the source country, make additional investment in education, thus improving their employment perspectives, so that labour emigration determines an increase in the number of persons with upper-secondary and tertiary education and an implicit reduction of the unemployment rate.

5. Conclusions, research limitations and opportunities

The results reveal a significant impact of emigration on the size and structure of the labour force according to its educational level. Thus, the emigration process generates a reduction of the labour force in the case of sending countries analysed within the panel and the various changes in its structure, through improving the educational level from primary to upper-secondary education. This positive effect is counter-balanced by a significant reduction of highly skilled labour. As a result, the loss of a significant part of low skilled labour (unskilled workers of those with a low educational level), respectively highly skilled labour (tertiary educated) induces medium and long term negative economic consequences on migrant sending economies, slowing down the technological progress, innovation and GDP per capita growth rate.

The hypotheses of the conceptual model concerning the educational level of sending country's population and the direct link to the emigration process highlight that its increase towards secondary education reduces labour emigration. This is due to an improvement in employment perspectives for persons with primary and lower-secondary education from the countries analysed within the panel that are facing high unemployment, as well as to a higher tendency towards emigration in the case of tertiary educated labour force, following the positive migrant selection at destination.

At the same time, the results highlight the main aspects of the macroeconomic neoclassical theory, pointing out that labour markets represent the most important mechanism through which international labour flows are induced. Also, the selection process described by Borjas (1989) is revealed by the results obtained after we introduced a new variable within the model represented by the upper-secondary or tertiary educational level of migrants. The results show that there is a positive selection of migrants, respectively an increase in highly skilled emigration flows, along with a significant reduction of this type of flows as the level of education increases for the entire population of sending countries. This is mainly due to an improvement in employment opportunities within these countries, by taking into account the fact that unemployment rate is extremely high for the population with primary and lower-secondary education.

The main limitation of the performed research is represented by the lack of comparable data concerning international labour migration, at a global level and especially within the European Union.

Concurrently, the research results have lead to identifying new opportunities and future research guidelines, through expanding the analysis of the highly skilled labour emigration determinants and by analysing the economic consequences of the process, as well as the impact on labour markets in migrant sending countries.

Acknowledgements

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