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Quantitative Methods Inquires

BRAIN DRAIN - BRAIN GAIN, EVIDENCE FROM THE EUROPEAN UNION

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Abstract
The migration of skills is one of the most important and complex socio-economic phenomena. The mobility between the European Union countries gains more and more attention in the specialty literature. The migration process has strong economic implications – people are attracted by the better living and working conditions within the destination countries. Besides the economic, social and political implications this phenomenon presents ethical and moral implications too.
The direction of the migration for highly skilled persons is mainly from developing countries to the developed countries. The migration process can imply a loss and a gain at the same time. The countries of origin will suffer a loss of highly skilled/ educated people, while the receiving countries will gain without making any investment.

Keywords: *brain drain; brain gain; migration; European Union*

1. Introduction

The exodus of talented students to study abroad is the result of two factors. Firstly, the quality of domestic education; and secondly, it is a way for extraordinarily talented students to gain recognition of their skills. Even if the education received abroad is tangential to their ultimate employment, students may still choose foreign study to signal their exceptional quality.[1]

For young people that choose to continue their studies outside the country (higher education), the decision to migrate can be based on their expectations for future benefits. They either want a professional accomplishment; or they wish that when they return to their country of origin, to earn higher wages. In this case the temporary migration phenomenon is present and the diploma obtained represents a strong signal and an advantage over the candidates competing for the same position in the labor market. Alternatively, they want to

settle in another country in which case the higher education achieved can increase their chances to be employed accordingly with their level of education. So, no matter if the labor mobility of the higher educated people is temporary or it is permanent, it attracts a series of advantages and disadvantages.

In terms of benefits from migration of highly skilled people (and not only) for the country of origin, here are some of the advantages: the labor market is stabilized, the unemployment rate decreased, the remittances are send in the country of origin which means an increase of the GDP for those countries. Generally, for the country of origin the disadvantages of the migration of the highly skilled people exceed the advantages.

As disadvantages we have: the quality and the number of higher education graduates that work in the country of origin decreases (the demand of highly skilled people falls) – phenomenon that lowers the chances for the country of origin to progress on medium and long term; the country of origin will only loose as long as it invests in education and it cannot make use of the future benefits.

In order to reduce the number of highly skilled people that leave their country, the state and the companies must take action. The curriculum of higher education institutions and demand in the labor market must be closely related. The young people must be prepared in order to adapt to the permanent changes that occur in the labor market – in this way the higher education institutes will have to review their curricula to the requirements of the labor market, so the young people can face the competition and find a job in line with their level of education. Another method by which the state or companies can stop the migration is adopting some laws in order to convince the highly skilled people to remain in their country. An example can be the IT domain in Romania. As an incentive to minimise the migration, the people that work in this field are exempted from paying income taxes.

There are cases in which we are confronted with the brain drain phenomenon, but not with the brain gain phenomenon too. If the highly skilled people worked in their country of origin on a position that reflects their level of education, but in the destination country they have a job that does not require higher education, we can say that only the brain drain phenomenon is present.

For the destination countries the number of advantages is bigger than the number of disadvantages. The main advantage is that the destination country wins without making any effort or investment. Hence, it benefits from highly skilled people. In this case we are facing with ethical implications as well. On the opposite side, the main disadvantage is that as long as the labor demand will be satisfied from the migration then on the long term this phenomenon can lead to a decrease in quality of the internal workforce.

If we are facing temporary migration, we can signal the presence of the brain exchange phenomenon, instead of the brain drain – brain gain phenomenon. When the brain exchange phenomenon is present we may say that we have a win-win situation for both countries of origin and destination.

If a person chooses to migrate only "virtual" – due to the advanced technologies, we can signal the presence of brain exchange phenomenon. In this way, the persons that are in this situation are living with their family without having to leave the country. They also bring benefits to their country – they spend the salary here and not in the "virtual" host country.

Attracting and keeping the performing labor force on the national market represents a condition of competitiveness, of ensuring sustainable development at local and national level.[2]

The main purpose of this study is to discuss the principal factors that lead people with tertiary education to migrate. Based on statistical analysis, we will investigate the flow of the migration process in the European Union (EU) countries for the highly educated people and determine what are the countries classified as countries of origin and what are the countries classified as destination countries.

The paper findings can be considered a good starting point for a better overview of the accuracy of the system.

2. Literature review and general framework

Some researchers think that the migration in the European Union shouldn't be seen as a disadvantage from the country of origin's perspective and that the main loss is that highly educated people leave the European continent and migrate to another continent, for example from Europe to USA. They say that Europe has to be considered as a whole.[3]

From our perspective, taking Europe's countries as a whole is almost impossible. In Europe there are developed countries, developing countries and undeveloped countries. The loss of highly educated people would mean a huge disadvantage, a loss that would diminish the chances of the countries of origin to accede to a higher level of education and livelihood.

According to the authors of the article "Brain Drain and Brain Gain Migration in the European Union after enlargement", you must fulfill two conditions in order to be included in the category of highly educated people from the migration perspective. The first condition refers to the level of the education achieved. According to this parameter, the highly educated people are included in the highly skilled or highly trained category. The second condition is strictly related to the profession and refers to the job that is practiced in the country of destination. Even if at a first glance the difference between these two parameters seems elusive, in reality it is not so. A highly educated person that works in the destination country as a taxi driver is framed in terms of education as an educated person, but not from the professional point of view too.[4]

3. Research goal, methodology and data issues

In the first part of the next section we tried to create a general framework of the migration process. To attempt to clarify which are the countries for which it is important to keep their highly educated people and which are the countries for which it is important to attract the highly educated people from abroad.

We collected the data from the Global Competitiveness Report for the period, 2013-2014. The two indices of interest are "Country capacity to retain talent" and "Country capacity to attract talent". They are included in the 7th pillar "Labor market efficiency" and have the codes 7.08 and 7.09. In the previous report there was only one index "Brain Drain" with code 7.07.

In the second part of the next section we developed a logistic regression model. Based on the above two indices we created a binary variable by taking into account the rank of the country of each of the two indices. The statistical tool used to perform the logistic regression is SPSS. The countries included in the analysis are: Austria, Belgium, Bulgaria, Czech Republic, Denmark, Germany, Greece, Spain, France, Italy, Hungary, Netherlands, Poland, Portugal, Romania, Slovenia, Slovakia, Finland, Sweden, United Kingdom, Norway and Switzerland.

4. Empirical results

The first step in our analysis is to create an image of the country ranking taking into account the "Country capacity to retain talent" and "Country capacity to attract talent".

According to the first index "Country capacity to retain talent" we have Finland on the second place (out of 148), followed by Switzerland (third place) and Norway (fifth place). On the opposite side we have Slovakia (130th place), Romania (138th place) and Bulgaria (142nd place).

If we take a look at the "Country capacity to attract talent" index we have top three countries as follows: Switzerland (first place), United Kingdom (fourth place) and Norway (11th place). At the end of the ranking we have Greece (127th place), Romania (132nd place) and Bulgaria (144th place).

If we analyze these two indices in parallel we can conclude that we have almost the same ranking position for most of the countries. The exceptions are Greece and Finland – for these two countries the capacity to retain talent is higher than the capacity to attract talent. For Greece the difference is 41 places in the ranking and for Finland are 66 places in ranking.

For Belgium we have a difference of 20 places in ranking, the capacity to retain talent being higher than he capacity to attract talent. For Czech Republic and Portugal we have as well at least 20 places in ranking between the two indices, but for these countries we have the index "Country capacity to attract talent" higher than the index "Country capacity to retain talent". For Czech Republic we have 22 places and for Portugal we have 23 places in ranking.

Table 1. Country capacity to retain talent ranking & Country Capacity to attract talent ranking

Country	Country capacity to retain talent Rank	Country	Country capacity to attract talent Rank
Finland	2	Switzerland	1
Switzerland	3	United Kingdom	4
Norway	5	Norway	11
Germany	9	Netherlands	18
Sweden	10	Germany	20
United Kingdom	13	Sweden	25
Netherlands	14	Austria	30
Austria	23	France	44
Belgium	26	Belgium	46
Denmark	43	Denmark	52
France	57	Finland	68
Greece	86	Czech Republic	87
Slovenia	107	Portugal	88
Spain	108	Spain	102
Czech Republic	109	Hungary	115
Portugal	111	Slovakia	119
Italy	117	Slovenia	120
Poland	119	Poland	121
Hungary	126	Italy	126
Slovakia	130	Greece	127
Romania	138	Romania	132
Bulgaria	142	Bulgaria	144

Source: Global Competitiveness Report for 2013-2014

In the next part we performed a correlation between all the indices included in our analysis. The "Country capacity to retain talent" index is strongly positively correlated with the indices "Life expectancy, years" (0.922), "Quality of overall infrastructure" (0.654) and "Quality of the educational system" (0.729). The index "Country capacity to attract talent" is positively correlated with "Quality of the educational system" (0.324).

We have correlations between the rests of the indices as well. The index "Life expectancy, years" is strongly positively correlated with "Quality of the educational system" (0.781), the index "Quality of overall infrastructure" is positively correlated with "Quality of the educational system" (0.798).

In the next part we developed a logistic regression model. The logistic regression model is used when the dependent variable is binary or qualitative and the independent variables are a mix of quantitative and qualitative variables.

The general form of the *Logit* model is:

$$\ln\left(\frac{p}{1-p}\right) = \alpha + \beta x + e \qquad (1)$$

- p, represents the probability that the event y to occur: $p(y = 1)$
- ODD = $p/(1- p)$ it's called "odds ratio"
- $\ln(p/(1- p))$ are logarithms of odds ratio or logit[5]

In our analysis the dependent variable is "retain_attract2" variable which is obtained from the following formula:

- if retain_talent_rank-attract_talent_rank <= 7 then retain_attract2 = 0
- if retain_talent_rank-attract_talent_rank > 7 then retain_attract2 = 1

The value 0 for the new variable means "Attract" and value 1 means "Retain". The dependent variables are "life_expectancy" and "quality_education". Below we have our first output of this analysis – the "Classification Table".

Table 2. Classification Table

Observed			Predicted		
			retain_attract2		Percentage Correct
			Attract	Retain	
Step 0	retain_attract2	Attract	16	0	100.0
		Retain	6	0	.0
	Overall Percentage				72.7

Source: Author's work

Assuming that every country included in our analysis is an "Attract" country we get 72.7% classification accuracy. The model is also testing the hypothesis if the 6 of "Retain" and 16 of "Attract" countries are actually significant one from each other. If we have had the number of "Attract" equal with the number of "Retain" countries we would have an equal probability of being "Attract" and "Retain" countries. The next output tests that as a hypothesis.

We are rejecting the null hypothesis as we have the Sig.= 0.040 < 0.05, that there is an equal number of countries in each of the two groups. The odds ratio is calculated by dividing the number of "Retain" countries at the number of "Attract" countries. We have around 62.5% (1-0.375) chance that a country will not be an "Attract" country.

Table 3. Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 0	Constant	-.981	.479	4.198	1	.040	.375

Source: Author's work

The last output from the first block is the "Variables not in the Equation". We can notice that if we take each independent variable separately, they are not statistically significant for this analysis, but if we take them together they are significant (Sig.= 0.045 < 0.05).

Table 4. Variables not in the Equation

			Score	df	Sig.
Step 0	Variables	life_expectancy	2.599	1	.107
		quality_education	.006	1	.941
	Overall Statistics		6.199	2	.045

Source: Author's work

The next output if from block 1 and it's called "Omnibus tests of Model Coefficients". This output shows us the Chi-square and the Sig. values and tells us if you have at least some predictive capacity in the regression equation. Due to the fact that all the values for Sig. are significant we can assume that the independent variables are good predictors.

Table 5. Omnibus Tests of Model Coefficients

		Chi-square	df	Sig.
Step 1	Step	6.692	2	.035
	Block	6.692	2	.035
	Model	6.692	2	.035

Source: Author's work

The output below shows us the predictive capacity of the model. This output is common to a lot of statistical analysis. We have the "-2 Log likelihood" which is similar to the "Chi-square", the "Cox & Snell R Square" and the "Nagelkerke R Square" values. The difference between the last two indices is the range; the "Cox & Snell R Square" index has a maximum value of 0.75, while the "Nagelkerke R Square" index has a maximum value of 1, so the last index will always have a larger value compared to the second index.

The most important index is the last one, being similar with the R Square from the linear regression (the calculation being different). We have 38% of the variance of the dependent variable is predicted by the independent variables.

Table 6. Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	19.090	.262	.380

Source: Author's work

The "Hosmer and Lemeshow Test" gives us an idea of how good the model is. This time we want to have the Sig. value greater than 0.05, which is the case in our analysis (Sig.= 0.742) - so we can affirm that we have a good and significant model.

Table 7. Hosmer and Lemenshow Test

Step	Chi-square	df	Sig.
1	5.143	8	.742

Source: Author's work

Table 8. Contingency Table for Hosmer and Lemenshow Test

		retain_attract2 = Attract		retain_attract2 = Retain		
		Observed	Expected	Observed	Expected	Total
Step 1	1	2	1.941	0	.059	2
	2	2	1.924	0	.076	2
	3	2	1.847	0	.153	2
	4	2	1.822	0	.178	2
	5	1	1.792	1	.208	2
	6	2	1.697	0	.303	2
	7	2	1.486	0	.514	2
	8	1	1.236	1	.764	2
	9	1	.955	1	1.045	2
	10	1	1.301	3	2.699	4

Source: Author's work

The "Contingency Table for Hosmer and Lemenshow Test" output tells us how well the model is predicting certain outcomes. The main interest is for "Retain" – this will predict what country will be a "retain" or a "attract" one. If we look at the last step we have the observed number of subject value equal to 3 and our model predicted about 2.7. The closer these two values are, the better the model is.

In the "Classification table" we appreciate how good our model was in predicting the outcome. It is said that if the model is able to predict at least 65% of the categories it is a very good model.[6] Our model was able to predict 81.8% of the categories. Almost 82% of the outcomes were correctly predicted by our model. We have a greater value than the one from the null hypothesis where we had 72.7% (Classification table).

Table 9. Classification Table

Observed			Predicted		
			retain_attract2		
			Attract	Retain	Percentage Correct
Step 1	retain_attract2	Attract	14	2	87.5
		Retain	2	4	66.7
	Overall Percentage				81.8

Source: Author's work

In the last output of the analysis we have the values of the coefficients for the equation and the odds ratio Exp(B) as well. If the Exp(B) is greater than 1 the more likely the country is to be a "retain" country. For example if a country has a high quality of education value there are about 5.794 times more likely to be a "retain" country.

Table 10. Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1	life_expectancy	-2.531	1.179	4.611	1	.032	.080
	quality_education	1.757	1.032	2.897	1	.089	5.794
	Constant	.059	3.550	.000	1	.987	1.061

Source: Author's work

Our equation for this model is:

$$\log(p/(1-p)) = 0.059+1.757*\text{quality\_education}-2.531*\text{life\_expectancy}$$

The coefficient (or parameter estimate) for the variable quality education is 1.757. This means that for a one-unit increase in "quality_education", we expect a 1.757 increase in the log-odds of the dependent variable retain_attract2, holding all other independent variables constant. For every one-unit increase in "life_expectancy", we expect a 2.531 decrease in the log-odds of "retain_attract2", holding all other independent variables constant. The expected value of the log-odds of retain_attract2 when all of the predictor variables equal zero is 0.059.

5. Conclusion

Regarding the two indices "Country capacity to retain talent" and "Country capacity to attract talent" we have countries that are in the top of the ranking for both indices: Switzerland, Norway; countries that are ranked differently for each of the two indices: Finland (66 places difference), Greece (41 places difference) and countries that are at the bottom of the ranking for both indices: Bulgaria, Romania, Poland. The last three countries mentioned will always suffer because of the loss of highly educated people. People from these countries will migrate most probably to the countries included in the first group presented above.

The logistic regression conducted predicts a very accurate model, by using the two independent variables life expectancy and quality of education. These two variables explain around 38% of the variability of the model. The model is very sensitive to the increase of the quality of education index; this means that a small increase of this index will be highly observed in the predicted model.

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Appendix

Correlations

		Brain Drain Indicator	Country capacity to retain talent	Country capacity to attract talent	Life expectancy, years	Quality of overall infrastructure	Quality of the educational system
Brain Drain Indicator	Pearson Correlation	1	.945**	.158	.921**	.683**	.758**
	Sig. (2-tailed)		.000	.484	.000	.000	.000
	N	22	22	22	22	22	22
Country capacity to retain talent	Pearson Correlation	.945**	1	.110	.922**	.654**	.729**
	Sig. (2-tailed)	.000		.627	.000	.001	.000
	N	22	22	22	22	22	22
Country capacity to attract talent	Pearson Correlation	.158	.110	1	.102	.264	.324
	Sig. (2-tailed)	.484	.627		.653	.235	.141
	N	22	22	22	22	22	22
Life expectancy, years	Pearson Correlation	.921**	.922**	.102	1	.607**	.781**
	Sig. (2-tailed)	.000	.000	.653		.003	.000
	N	22	22	22	22	22	22
Quality of overall infrastructure	Pearson Correlation	.683**	.654**	.264	.607**	1	.798**
	Sig. (2-tailed)	.000	.001	.235	.003		.000
	N	22	22	22	22	22	22
Quality of the educational system	Pearson Correlation	.758**	.729**	.324	.781**	.798**	1
	Sig. (2-tailed)	.000	.000	.141	.000	.000	
	N	22	22	22	22	22	22

**. Correlation is significant at the 0.01 level (2-tailed).

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