

Ad hoc Question prepared for the European Commission:
***'Brain Drain' within the European Union from the perspective of investment in
education***

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The aim of this review is to assess the costs of *brain drain* in EU Member States in terms of loss of initial investment in tertiary graduates, with a reference to the intra-EU migration of highly skilled workers. The analysis proceeds as follows. First, a brief discussion of the methodology used is presented. Second, an overview of studies related to the different categories of skilled workers is provided. Third, estimates of the detrimental and beneficial effects are discussed. Finally, an overall appraisal and concluding remarks are provided.

1] Methodology

The studies presented in this review have been selected according to the following criteria: a) they rely on a rigorous methodology (e.g. estimation of 'stocks' and 'rates'; use of bilateral information; estimation of net migration balances); b) they use high quality data; c) they are published in international peer-reviewed journals/leading working paper series.

There are several methodological issues that complicate the measurement of high-skilled migration and lead to studies that are often neither consistent nor comparable. There is no single definition of 'high-skilled' that has been agreed upon or that is commonly used by the international community. For example, defining highly skilled on the basis of 'education' raises

issues about the comparability of educational attainment across countries, the heterogeneity in terms of quality of education, the recognition of qualifications across countries, and the availability of information about where an individual completed his/her education. Yet using a definition that relies on the concept of ‘occupation’ raises concerns about different classifications according to skill level and skill specialisation, or area of activity and work performed, and may lead to varying results in different studies.

2| Brain Drain in the EU and around the world

While historically there are several examples of large-scale migratory flows (e.g. see the discussion in Bandiera, Rasul and Viarengo, 2013), the current migratory flow of highly skilled individuals has no precedent. The global competition for talent (Kerr et al., 2016) and the search for ‘the best and the brightest’ (e.g. Kapur and McHale, 2005) are significant concerns in many advanced economies. In the European context, rigorous studies are relatively recent. Evidence on three specific categories, the highly skilled, health professionals, and researchers and STEMs, are discussed below. While they generally concern European Union countries (either as destinations, sources or both), where appropriate we refer to studies with a more global focus, particularly ones that look at OECD countries, of which eEU member states form a majority.

a) The Highly Skilled

The studies reviewed in this sub-section focus on the migratory flows of the highly skilled from European countries, and within Europe. The studies selected rely on data that go back to the 1990s and make it possible to examine aspects related to the dynamics of these migratory flows.

Saint Paul (2004) presents stylised facts related to highly skilled European migrants in the United States. He presents evidence on the relative size of this group; notably that they are over-represented among entrepreneurs. He further discusses the potential impact on the sending economies, which is potentially large given the contribution of these individuals to technological innovation.

Docquier et al. (2014), by relying on data by skill level, estimate the effects of immigration and emigration flows during the 1990s and 2000s on native wages in 35 OECD countries. They document significant differences in terms of emigration rates and migrants' skill composition among the countries studied (see appendix Tables A and B).

Mayir and Peri (2009) examine migratory flows within Europe by focusing on migration from east to west European countries. They calibrate an overlapping-generations model that captures the possibility of return migration and heterogeneity in individuals' ability in school. Their findings suggest that, conditional on an average degree of openness of the economy, return migration along with increased investment in human capital to improve migration prospects, can lead to a reverse *brain drain* for east European countries.

b) Health Professionals

Bhargava et al. (2011) examine the emigration of physicians and its impact on different outcomes such as vaccination rates and child mortality. It is the first study that provides a harmonised longitudinal data set on physician emigration rates. It also includes information on where the medical personnel was trained. The authors present physician immigration data over 1991-2004 for all countries in the world, from 18 major destination countries, and compare the migration of physicians from the home country with the total numbers of physicians trained. They also examine whether the expectation to migrate, measured in terms of propensity to migrate and having better labour market opportunities, has a beneficial effect on individuals' investment in their human capital.

There is no analysis with more recent data but Frederic Docquier and his team are currently producing new statistics on the brain drain of physicians. See <http://perso.uclouvain.be/frederic.docquier/oxlight.htm>

c) Researchers and STEMs

Docquier and Rapoport (2009) provide a case study of the exodus of European researchers to the United States. They provide country-level figures on the emigration of PhD graduates and researchers in science and technology. The authors estimate the share of PhD holders in the US, which is very high for some European countries, such as Slovenia, Finland, Slovakia and Hungary. They also provide figures on the share of PhD graduates who completed their studies in their home countries and are living in the US. In terms of 'stock' of foreign PhD holders, the top nationalities in the US include advanced economies and large countries (e.g., China and Russia). On the other hand, in terms of 'rates', that is by focusing on the proportion of PhDs, top nationalities include countries such as Slovenia and Georgia. In terms of a *brain drain* in science and technology, the authors provide analogous estimates of the proportion of all the researchers in this sector who have at least completed their college education and who are employed in the US, showing that some southern and eastern European countries have very high rates of researchers working abroad.

3] Estimates of Gains and Losses

Existing studies have focused on different aspects associated with potential gains and losses resulting from the emigration of the highly skilled. In most cases, they are not directly comparable as they focus on different outcome variables, analytical samples of countries, time periods, and rely on different methodologies. Among the effects examined in different studies, 'losses' have been found to relate to the reduction of the stock of human capital, as well as to potential negative effects on the capacity to innovate and adopt more advanced technologies. Nevertheless, possible 'gains' appear to be associated with return migration; remittances; diaspora effects; incentives for investment in education and training; improvement of governance; and transfer of norms (e.g., Tritah 2008; Spilimbergo 2009; Beine et al. 2011).

Beine et al. (2008) examine the impact of *brain drain* on human capital formation on the basis of a cross-section of 127 countries. Specifically, they examine to what extent the propensity to migrate encourages individuals to invest in their own education. Their results suggest that the

overall impact depends on the size of the emigration rates and the stock of human capital. That is, only countries with relatively low emigration rates and low levels of human capital experience a *brain gain*.

In terms of assessment of the overall impact of out-migration flows on sending countries, existing studies have focused on different effects. However, there is no study that examines all detrimental and beneficial effects together. A recent study by Aubry et al. (2016) attempts to address this issue by developing an integrated multi-country model to estimate the impact of net migration (i.e., in-flow of foreign born – out-flow of native-born) on different welfare measures of non-migrants' welfare in the OECD countries, by also taking into account the extent to which the different effects are interrelated and interdependent among countries. Specifically, they include the labour market effect, the fiscal effect, and the market-size effects. Labour-market effects are related to how citizens' wages and employment react to international migration; fiscal effects are related to how migrants contribute to national budgets and collect social transfers; market-size effects capture the effects of migration on aggregate demand for goods and services in the receiving and sending countries. The Authors' calibration exercise suggests mixed evidence in terms of the effects and their magnitude, with welfare losses mainly explained by the (intra-OECD) emigration of a country's nationals. They also provide calibrated country-specific parameters. The authors' findings suggest that there are heterogeneous effects that vary by country, especially with respect to labour market and fiscal effects. Overall, the largest beneficial effects are explained by market-size effects.

Di Giovanni et al. (2015) also examine possible benefits from migration by estimating a quantitative multi-sector model of the world economy calibrated to aggregate and firm-level data. They find that natives in countries with very large emigration rates are better off because of remittances. However, as found in previous studies, the relationship between remittance behaviour and migrants' level of educational attainment appears to be complex as there is no conclusive evidence as to whether more educated individuals remit more and for a longer time.

Another possible channel through which migratory flows have an impact on sending economies is related to the length of the migration spell, and, therefore, through return migration. In this regard, Tritah (2008), using census data, documents that starting from 1990, “emigrants are increasingly selected from the upper tail quality distribution of their source country workforce in terms of education, scientific knowledge and, unobservable skills”. The author also finds that those who come back to Europe have on average lower levels of skills and further provides country-specific figures for a selected sample of Member States.

4] Appraisal and Concluding Remarks

While the phenomenon of *brain drain* has become a central issue for many Member States, there is still limited comparable and rigorous research in the field of the economics of education in the European context. Existing research in this area has mainly focused on cross-country comparisons of migrant stocks by level of educational attainment. In the European context, the evidence currently available regarding STEM and highly skilled professional occupations is limited. There is no study that includes an assessment of all detrimental and beneficial effects of the *brain drain*. As a result, given the current state of research on this topic and the limited rigorous evidence available, an analytical report would appear to be premature at this stage.

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APPENDIX

A] Immigration Rates, 1990 - 2000

Table extracted from Docquier et al. (2014, page 1119)

Table 1
Immigration Rates, 1990-2000 (Ranked by Total Immigration Rate)

Country	Total immigration rates from all countries (%)	College-educated immigration rates from all countries (%)	Total immigration rates from non-OECD countries (%)	College-educated immigration rates from non-OECD countries (%)
Israel	14.35	60.19	15.14	47.03
Luxembourg	12.53	16.47	3.03	2.17
Austria	9.35	7.87	3.42	2.11
Ireland	7.60	28.02	1.65	6.12
United States	5.71	6.50	3.40	4.71
New Zealand	5.61	7.61	4.79	8.11
Iceland	5.25	16.44	2.17	5.41
Canada	5.21	10.81	5.59	9.06
Cyprus	4.76	15.07	2.50	5.95
Australia	3.79	13.70	3.66	6.82
Spain	3.32	5.80	2.02	3.28
Malta	2.84	18.73	0.59	4.41
Sweden	2.66	6.63	2.59	4.29
Germany	2.64	3.91	0.90	1.65
Belgium	2.63	5.68	1.69	2.40
Denmark	2.54	2.95	1.82	1.57
Netherlands	2.39	6.60	1.77	3.16
United Kingdom	2.13	11.26	1.64	6.13
Finland	1.74	2.34	0.65	0.70
Switzerland	1.61	9.29	2.63	2.96
Portugal	1.55	2.99	1.23	1.76
Bulgaria	1.06	2.52	0.62	1.56
Italy	1.00	1.08	0.73	0.57
France	0.81	3.38	1.01	1.89
Turkey	0.71	7.10	0.06	1.27
Japan	0.46	0.78	0.39	0.54
Czech Republic	0.39	5.35	0.07	1.02
Slovakia	0.35	1.24	0.08	0.29
Greece	0.24	0.34	0.19	0.21
Chile	0.13	0.26	0.12	0.15
Mexico	0.11	1.09	0.03	0.36
Korea	0.00	0.15	0.00	0.11
Romania	-0.04	0.27	-0.02	0.13
Slovenia	-0.09	1.31	-0.08	0.84
Hungary	-0.12	0.17	-0.03	0.04
Poland	-1.14	-0.87	-0.77	-0.63
Lithuania	-2.96	0.36	-2.71	0.34
Latvia	-15.58	-17.93	-16.88	-19.79
Estonia	-16.73	-25.46	-16.60	-25.80

Note. Immigration rates are equal to the net change in the stock of immigrants within the group in the period 1990-2000 divided by the population of natives and immigrants within the group in 1990.

B] Emigration Rates, Total and College Graduates, 1990 - 2000

Table extracted from Docquier et al. (2014, page 1120)

Table 2
Emigration Rates, Total and College Graduates, 1990–2000
(Ranked by College Emigration Rates)

Country	Total emigration rates (%)	College graduates emigration rates (%)
Cyprus	1.78	29.31
Malta	-1.77	27.99
Ireland	-4.23	23.30
Mexico	11.58	19.76
New Zealand	6.82	16.85
Portugal	3.09	12.57
Estonia	4.89	9.89
Romania	1.23	9.89
Latvia	2.42	9.17
Slovenia	4.90	9.15
Slovakia	1.04	8.74
Poland	0.49	8.32
Korea	1.76	8.20
Lithuania	0.76	7.51
Bulgaria	2.50	7.19
United Kingdom	0.40	6.36
Iceland	2.68	5.99
Turkey	2.43	5.57
Greece	0.25	4.57
Chile	1.24	4.05
Luxembourg	0.73	3.92
Switzerland	2.13	3.64
Finland	0.02	2.95
Netherlands	0.61	2.94
Spain	0.06	2.92
Belgium	0.51	2.91
Sweden	0.82	2.30
Denmark	0.30	2.22
Austria	0.32	2.03
Australia	1.07	1.70
Canada	0.17	1.65
Italy	-0.29	1.63
Czech Republic	0.74	1.48
Germany	0.20	1.37
France	0.44	1.31
Hungary	0.04	0.37
Japan	0.06	0.36
United States	0.10	0.23

Note: Emigration rates are equal to the net change in the stock of emigrants in the period 1990–2000 divided by the total population of natives and immigrant residents in 1990.