MAPPING EUROPEAN UNIVERSITY CITIES: CLASSIFICATION OF THE EU REGIONS BASED ON THEIR BRAIN DRAIN OUTCOMES

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OBJECTIVES

- Map the European University Cities (city level).

- Show the Human Capital Production Map at NUTS-3 level.

- Classify EU regions according to their brain drain outcomes.

- **Identify the brain drain regions at NUTS-2 level.**

MAPPING HUMAN CAPITAL PRODUCTION
AT CITY AND NUTS-3 LEVEL

NUMBER OF EUROPEAN UNIVERSITY CITIES (2019)

Number of University Cities in each MS			
DE	179	**AT**	20
IT	97	**FI**	20
FR	71	**HU**	20
PL	70	**BG**	15
ES	48	**SK**	15
PT	38	**IE**	13
NL	28	**RO**	13
EL	27	**LV**	9
SE	23	**LT**	8
DK	22	**CY**	5
BE	21	**MT**	4
CZ	21	**EE**	3
HR	21	**LU**	1
Total = 812			

* Siovenia is not included due to data inavailability for 2019

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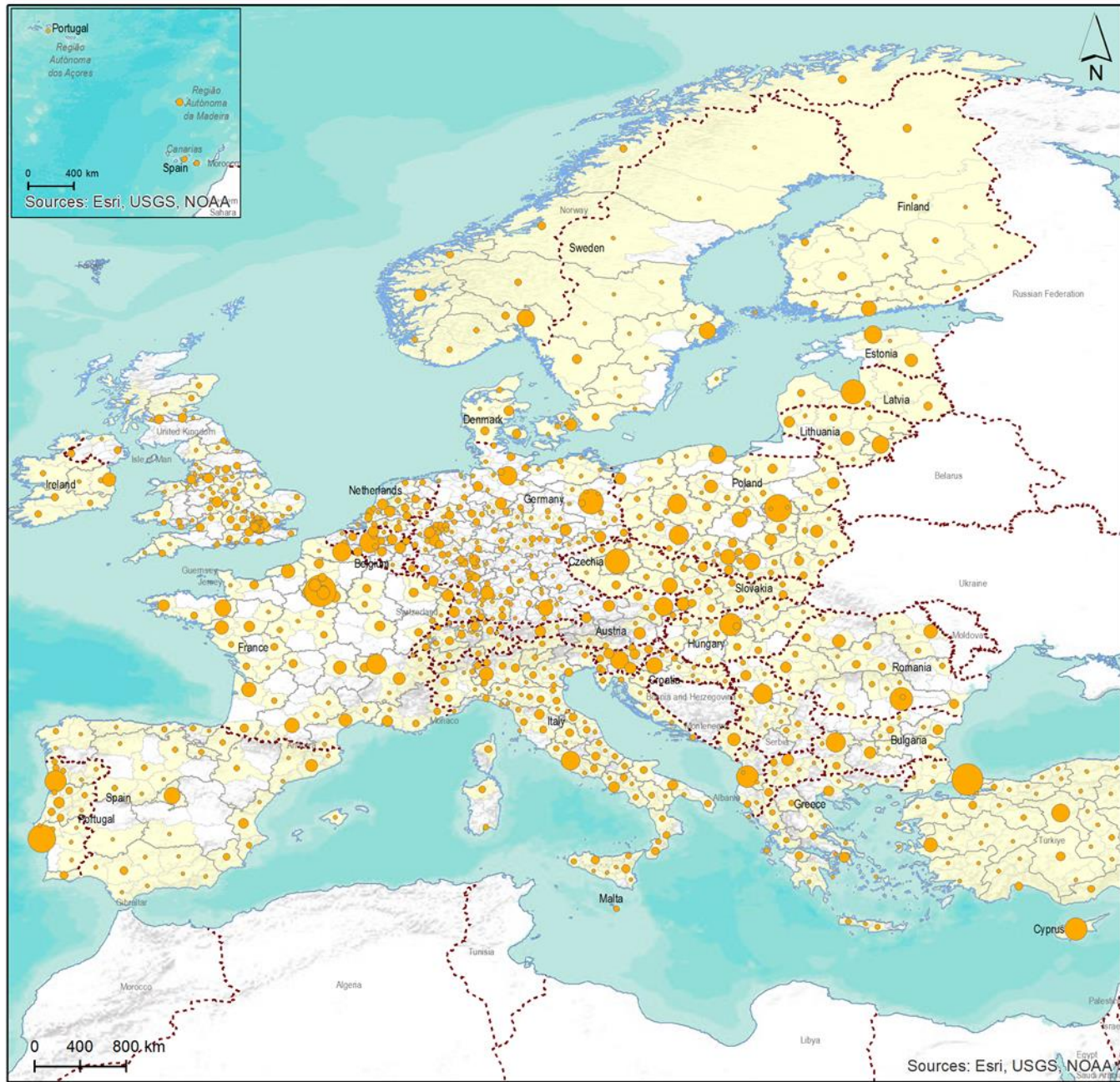
Legend

- - - - Countries [NUTS 0]

——— Regions [NUTS 2]

——— NUTS 3

Number of Higher Education Institutes, 2016
Reference: NUTS 3

at least one   • 5   ● 20   ⬤ 60

Sources: Esri, USGS, NOAA
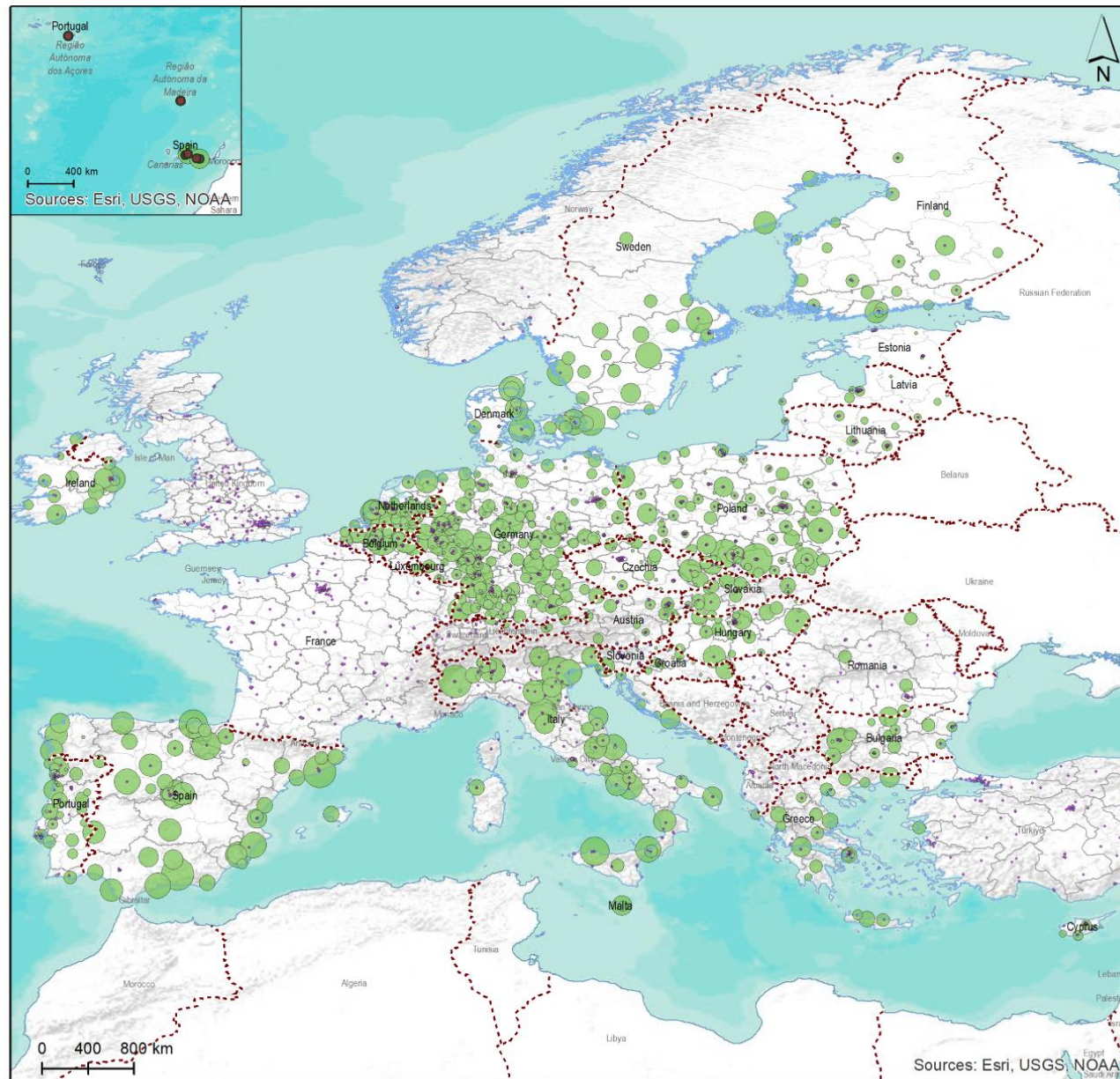
Legend

- - - - Countries [NUTS 0]
———— Regions [NUTS 2]
———— NUTS 3

Total graduates ISCED [5-8] levels, 2016
Reference: HEIs

· *not available*   ● 500   ● 5.000   ● 19,337

Sources: Esri, USGS, NOAA

CLASSIFYING NUTS-3 UNIVERSITY REGIONS BASED ON THEIR POPULATION SIZE

Number of NUTS-3 level region based on their population size			
	with up to 0.05% of the total EU population	with 0.05% to 0.15% of the total EU population	with more than 0.15% of the total EU population	Total
AT	4	9	2	15
BE	1	9	5	15
BG	2	10	2	14
CY	0	0	1	1
CZ	0	1	12	13
DE	60	81	19	160
DK	0	4	6	10
EE	0	1	1	2
ES	2	7	29	38
FI	6	10	2	18
FR	1	10	43	54
GR	11	11	4	26
HR	3	4	10	17
HU	0	8	6	14
IE	0	5	3	8
IT	3	39	38	80
LT	2	3	2	7
LU	0	0	1	1
LV	0	5	1	6
MT	0	1	0	1
NL	0	10	11	21
PL	0	22	32	54
PT	6	14	2	22
RO	0	2	11	13
SE	2	12	3	17
SK	0	0	8	8
Total	**103**	**278**	**254**	**635**

* Slovenia is not included due to data unavailability for 2019

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DOES REGION'S SIZE MATTER?
HUMAN CAPITAL PRODUCTION BY BROADER POPULATION SIZE CATEGORIES

Regions' human capital production by broader population size categories (2019)			
Regions' population size categories	# NUTS-3 University regions	Number of Graduates in 2019	Number of Graduates in 2019 per 1,000 inhabitants
with up to 0.05% of the total EU population	103	144,495	12.6
with 0.05% to 0.15% of the total EU population	278	688,453	8.1
with more than 0.15% of the total EU population	254	2,432,954	10.2
Total	**635**	**3,265,902**	**9.8**

CLASSIFY EU REGIONS ACCORDING TO THEIR BRAIN DRAIN OUTCOMES.

IDENTIFY THE BRAIN DRAIN REGIONS AT NUTS-2 LEVEL.

DEFINING BRAIN DRAIN

- *"The region's loss of individuals with **high skills** and/or competencies (workers/students) due to permanent emigration"* (Cavallini et al. 2018).

- *"The university graduates and **highly skilled** individuals that after living their countries **to study** abroad, often do not return to their homeland preferring to live and work in the country of their studies"* (Tansel & Gungor, 2002).

- *"The movement of people with **tertiary level education** living in a country other than his/her place of birth"* (Docquier & Rapoport, 2012).

- *"**The university graduates and highly skilled** that have left their countries to study abroad and do not return to their countries to home preferring to live and work abroad"* (Boc, 2020).

CONCEPTUAL ISSUES

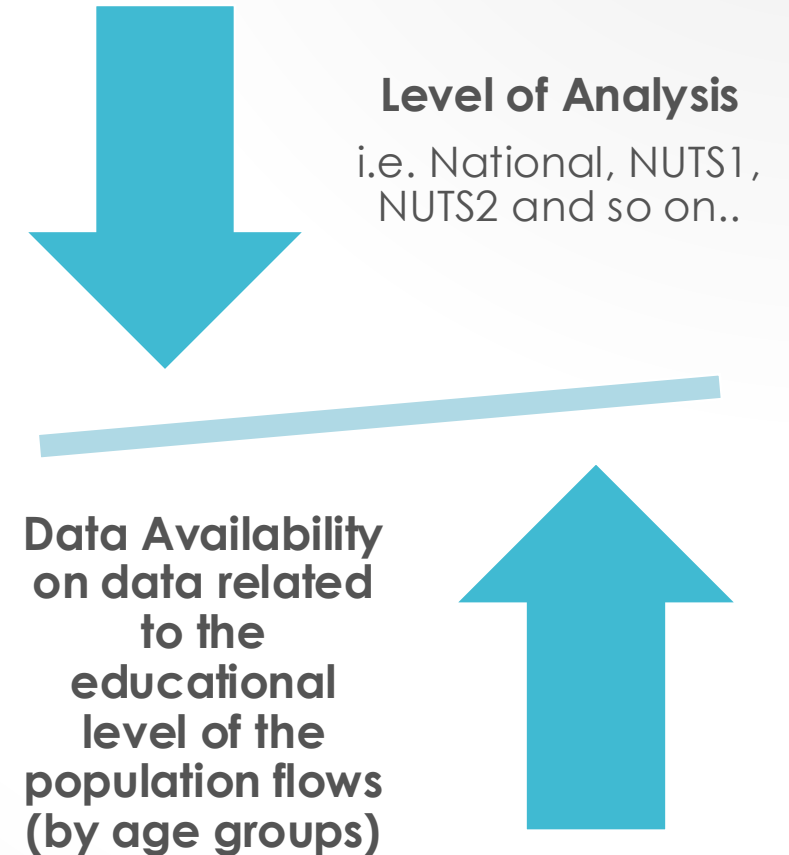- **Changes in population stock** is a necessary, albeit not sufficient condition <u>to define brain drain</u>.

- Information on **the skills & and educational level** of the observed flows is certainly needed.

Limitation: The limited availability of such information:

- Eurostat provides information on population by sex, age & region of residence (NUTS-2 & NUTS-3 level).
- **ALBEIT without any further disaggregation by educational level.**
- This means that any information for the magnitude of brain drain at regional can not be DIRECTLY obtained from existing EU official data sources.

- → **A need for a methodology that might bypass the unavailability of the directly available statistical information for brain drain.**

DEALING WITH AN INEVITABLE TRADE-OFF

- **Information on tertiary education outcomes is available only in NUTS-2 level.**

- **There is a trade-off between:**

  - **The (disaggregated) level of geographical analysis (and classification of the location areas)**

  - **… and an approach that incorporates the dimension of the educational level in the definition of brain drain.**

- **The employed approach:**

  - **Aggregated the level of analysis at NUTS-2 (instead of more disaggregated level)**

  - **In order to include the dimension of educational level in the identification of the brain drain regions.**

Level of Analysis
i.e. National, NUTS1, NUTS2 and so on..

Data Availability on data related to the educational level of the population flows (by age groups)

METHODOLOGY: AN INDIRECT APPROACH TO DEFINE THE BRAIN DRAIN REGIONS (1A)

- To bypass the unavailability of the directly available statistical information for brain drain, we have employed the following **two-step methodology**.

Step 1a: Estimate the Production of Human Capital in each location.

(based on data obtained from the ETER dataset)

- Calculate the Number of Graduates in 2016 each local unit.
- Calculate the Number of Graduates per 10,000 persons aged 20-34 in 2016 in each local unit.
  - To make this information comparable across regions → allows for making the ranking of the EU regions.
- Calculate each region's share (%) to the Total Number of EU Graduates in 2016, defined as follows:

$$\frac{Number\ of\ Graduates\ in\ region\ X_1}{Total\ Number\ of\ Graduates\ in\ EU}$$

METHODOLOGY: AN INDIRECT APPROACH TO DEFINE THE BRAIN DRAIN REGIONS (1B)

- **Step 1b: Estimate the Stock of Human Capital in each location.**

  (based on data obtained from EUROSTAT)

- Number of Persons aged 25-34 with tertiary education in 2021 each local unit.

- Calculate the Number of persons aged 25-34 with tertiary education per 10,000 persons in 2021 in each local unit.

- Calculate each region's share (%) to the total number of EU persons aged 25-34 with tertiary education in 2021, defined as follows:

$$\frac{Number\ of\ Persons\ aged\ 25-34\ years\ in\ region\ X_1\ in\ 2021}{Total\ Number\ of\ Persons\ aged\ 25-34\ years\ in\ 2021\ in\ the\ EU}$$

METHODOLOGY: AN INDIRECT APPROACH TO DEFINE THE BRAIN DRAIN REGIONS (2)

- ## Step 2: Estimate a proxy for the brain drain

- Calculate a proxy that's stands for the brain drain performance of each region, defined according to the following ratio:

$$\frac{\textit{Region's share (\%) to the total number of EU persons aged 25-34 with tertiary education in 2021}}{\textit{Region's Share (\%) to the Total Number of EU Graduates in 2016}}$$

Ranges from 0 to ∞.

- **If the ratio >1**

→ the region has more STOCK of human capital, compared to what it Produces → brain gain region.

- **If the ratio <1**

→ the region has less STOCK of human capital, compared to what it Produces → brain drain region

DATA

- European Tertiary Education Register (ETER)
  - Data for 2400 Universities in 27 EU countries for 2016.
  - Allow for calculating the Production of Human Capital (Number of Graduates), for each european University City,
  - ..and the aggregate the estimated information at NUTS-2 level.

- **Eurostat → Data on Educational Outcomes: (%) of persons with tertiary education at NUTS-2 level.**

- Having excluded 48 NUTS-2 regions, for which the number of graduates per 10,000 is less than 250,

- **The final sample of the analysis consists of 184 NUTS-2 regions.**

EMPIRICAL FINDINGS

As brain drain regions are defined 76 out of the 184 NUTS-2 regions.

EMPIRICAL FINDINGS: THE MOST BRAIN DRAIN REGIONS (RANKED 1 TO 15)

rank	Country	NUTS_2	N2_LABEL	Brain Drain Ratio	Rank in H.C. Stock	Rank in H.C. Production
1	ES	ES23	La Rioja	0.250	69	1
2	SK	SK01	Bratislavsky kraj	0.364	22	2
3	CZ	CZ03	Jihozapad	0.371	164	10
4	BE	BE31	Prov. Brabant wallon	0.478	21	4
5	GR	EL63	Dytiki Ellada	0.479	104	13
6	HR	HR05	Grad Zagreb	0.516	41	6
7	NL	NL11	Groningen	0.543	28	8
8	PL	PL91	Warszawski stoleczny	0.546	4.5	3
9	PL	PL41	Wielkopolskie	0.547	145	22
10	IT	ITI4	Lazio	0.553	147	36
11	BG	BG32	Severen tsentralen	0.556	139	20
12	DK	DK05	Nordjylland	0.560	84	17
13	GR	EL54	Ipeiros	0.566	117	26
14	SI	SI04	Zahodna Slovenija	0.582	37	7
15	IT	ITF1	Abruzzo	0.607	156	54

EMPIRICAL FINDINGS: RELATIVELY HIGH BRAIN DRAIN REGIONS (RANKED 16 TO 30)

rank	Country	NUTS_2	N2_LABEL	Brain Drain Ratio	Rank in H.C. Stock	Rank in H.C. Production
16	PL	PL21	Malopolskie	0.614	47	9
17	BG	BG33	Severoiztochen	0.614	170.5	57
18	CZ	CZ01	Praha	0.621	13	5
19	IT	ITF3	Campania	0.630	178	94
20	FR	FRK1	Auvergne	0.656	78	28
21	PL	PL71	Lodzkie	0.663	127	40
22	FR	FRJ1	Languedoc-Roussillon	0.667	73	24
23	FI	FI1D	Pohjois- ja Itae-Suomi	0.683	124	46
24	PL	PL63	Pomorskie	0.705	94	33
25	PL	PL51	Dolnoslaskie	0.713	50	15
26	DK	DK04	Midtjylland	0.721	48	23
27	FI	FI1C	Etelae-Suomi	0.721	122	53
28	FR	FRI3	Poitou-Charentes	0.729	93	45
29	BE	BE24	Prov. Vlaams-Brabant	0.735	15	12
30	DK	DK03	Syddanmark	0.746	95	49

EMPIRICAL FINDINGS: MIDDLE-RANKED BRAIN DRAIN REGIONS (RANKED 31 TO 45)

rank	Country	NUTS_2	N2_LABEL	Brain Drain Ratio	Rank in H.C. Stock	Rank in H.C. Production
31	IT	ITI3	Marche	0.746	152	75
32	IT	ITH5	Emilia-Romagna	0.749	136.5	61
33	IT	ITC4	Lombardia	0.754	153	78
34	FR	FRH0	Bretagne	0.754	51	32
35	PL	PL61	Kujawsko-Pomorskie	0.756	118	50
36	FR	FRC2	Franche-Comte	0.762	111	60
37	FI	FI19	Laensi-Suomi	0.764	107.5	55
38	IT	ITI1	Toscana	0.764	162	86
39	PL	PL81	Lubelskie	0.771	97.5	42
40	IE	IE05	Southern	0.781	11.5	16
41	ES	ES41	Castilla y Leon	0.787	62	37
42	PL	PL62	Warminsko-Mazurskie	0.791	167	90
43	DE	DE72	Giessen	0.796	115	64
44	IT	ITH2	Provincia Autonoma di Trento	0.803	151	88
45	DE	DE50	Bremen	0.803	146	77

EMPIRICAL FINDINGS: RELATIVELY LOW BRAIN DRAIN REGIONS (RANKED 46 TO 60)

rank	Country	NUTS_2	N2_LABEL	Brain Drain Ratio	Rank in H.C. Stock	Rank in H.C. Production
46	HU	HU11	Budapest	0.806	9.5	11
47	FR	FRF3	Lorraine	0.807	74	43
48	BE	BE10	Region de Bruxelles-Capitale	0.818	20	14
49	FR	FRD1	Basse-Normandie	0.820	109.5	68
50	HU	HU33	Del-Alfoeld	0.831	181.5	153
51	PL	PL72	Swietokrzyskie	0.832	128	66
52	IT	ITG2	Sardegna	0.833	183	158
53	BG	BG41	Yugozapaden	0.834	59	31
54	IT	ITC1	Piemonte	0.836	165	114
55	FR	FRE1	Nord-Pas-de-Calais	0.837	77	56
56	FR	FRJ2	Midi-Pyrenees	0.839	25	27
57	SE	SE33	Oevre Norrland	0.839	55	41
58	HU	HU23	Del-Dunantul	0.847	176	140
59	BG	BG42	Yuzhen tsentralen	0.849	173	120
60	FR	FRF1	Alsace	0.850	39	35

EMPIRICAL FINDINGS: THE LEAST BRAIN DRAIN REGIONS (RANKED 61 TO 76)

rank	Country	NUTS_2	N2_LABEL	Brain Drain Ratio	Rank in H.C. Stock	Rank in H.C. Production
61	IT	ITG1	Sicilia	0.862	184	171
62	DK	DK02	Sjaelland	0.864	150	101
63	PL	PL52	Opolskie	0.865	157	92
64	IE	IE04	Northern and Western	0.875	17	25
65	FR	FRK2	Rhone-Alpes	0.877	24	30
66	FR	FRI2	Limousin	0.881	53	51
67	DE	DEA5	Arnsberg	0.881	159.5	117
68	FR	FRI1	Aquitaine	0.884	56	48
69	IT	ITH4	Friuli-Venezia Giulia	0.888	155	118
70	FR	FRL0	Provence-Alpes-Cote d'Azur	0.891	54	44
71	PL	PL84	Podlaskie	0.899	121	70
72	PT	PT17	Area Metropolitana de Lisboa	0.923	29	39
73	IT	ITF6	Calabria	0.944	181.5	167
74	HR	HR03	Jadranska Hrvatska	0.954	135	98
75	IT	ITI2	Umbria	0.955	142	106
76	FR	FRG0	Pays-de-la-Loire	0.958	46	58

AMENDMENT: SEVEN CASES OF BRAIN DRAIN REGIONS (FOR THOSE COUNTRIES THAT THERE IS NO BRAIN DRAIN REGION)

Country	NUTS_2	N2_LABEL	Brain Drain Ratio	Rank in H.C. Stock	Rank in H.C. Production
AT	AT22	Steiermark	1.194	103	122
LV	LV00	Latvija	1.212	68	74
LT	LT02	Vidurio ir vakaru Lietuvos regionas	1.418	44	110
EE	EE00	Eesti	1.343	76	108
RO	RO11	Nord-Vest	1.092	177	170
CY	CY00	Kypros	1.671	166	100
MT	MT00	Malta	1.567	79	146

CONCLUSIONS AND DISCUSSION

- The map of the EU provides a large dispersion of HUI across EU territory

- HEI and higher education opportunities yield a reshuffling of young age population across space

- Medium and small University cities attract a large proportion of students and could act as catalyst for the improvement of age structure of localities

- Retention rate and long term engagement at the location of the graduation is asymmetrical across cities and regions

- Medium University cities graduates could increase the empower local labor market and entrepreneurial activity could play a critical role

Thank you very much for your attention

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