

# International Collaboration in Higher Education Research: A Gravity Model Approach

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# Motivation

- ▶ Geographical distance has become less relevant in co-authorship for monodisciplinary fields (Newman, 2004; Adams, 2013; Wagner, 2017)
- ▶ Increased multidisciplinary research requires the involvement of researchers from different disciplinary backgrounds (Leahey, 2016; Gates, 2019)
- ▶ Little is known about international collaboration in multidisciplinary fields such as higher education

## Geographical proximity

- ▶ The average collaboration distance per publication has increased from 334 km in 1980 to 1553 km in 2009 (Waltman, 2011)
- ▶ Countries located in close physical proximity profit from each other through knowledge spillovers (Almeida et al., 2009)
- ▶ The establishment of the European Research Area has stimulated international collaboration (Leydesdorff, 2008; Hoekman, 2009; Wagner, 2015)

# Linguistic commonality

- ▶ Researchers are biased towards international collaboration with partners who speak the same language (Adams, 2012)
- ▶ Co-publication intensity is higher within regional, national, and linguistic areas (Hoekman, 2010)

# International collaboration in multidisciplinary fields

- ▶ Different disciplines operate under different norms and paradigms (Henriksen, 2016)
- ▶ Social scientists are less likely to collaborate with people from different countries (Waltman, 2011)
  - ▶ Economics and business (1939 km), psychology (1478 km), sociology and anthropology (1063 km), educational sciences (969 km)

## Higher education as a multidisciplinary field

- ▶ Higher education is defined by its object of research (Tight, 2004)
- ▶ Scholars from different fields come to research higher education with their methods and theories (Altbach, 2014)
- ▶ Higher education researchers remain unreflective about the structure of their collaboration (Yokoyama 2016)

## Research question

- ▶ This paper studies collaboration patterns in higher education research using the Scopus database with the application of the gravity model

Model



# Data

- ▶ Scopus database
- ▶ “Articles” and “reviews” from 24 key higher education journals
- ▶ Period: 2000—2017
- ▶ 1,157 papers that have been published with the cooperation of at least two different countries

# Data

- ▶ Spatial econometrics framework
- ▶ For each capital its geographical coordinates are found
- ▶ Negative binomial and zero-inflated count models
- ▶ 4 datasets: Worldwide, Europe, North America, Asia

# Empirical model

$$\ln I_{ijt} = \beta_0 + \beta_1 \ln MASS_{it} + \beta_2 \ln MASS_{jt} + \beta_3 \ln DISTANCE_{ij} + \beta_4 LANG_{ij} + \varepsilon_{ijt}$$

- ▶  $I_{ijt}$  is the total number of co-authored papers between country  $i$  and country  $j$  in year  $t$
- ▶  $MASS_{it}$  and  $MASS_{jt}$  is the number of authors in country  $i$  and country  $j$  in year  $t$
- ▶  $DISTANCE_{ij}$  is the Euclidean distance between capitals of country  $i$  and country  $j$
- ▶  $LANG_{ij}$  is a dummy variable equal to 1 if country  $i$  and country  $j$  have a common official or de facto official language/languages

# Results

Figure: The share of international papers in 1978–2017

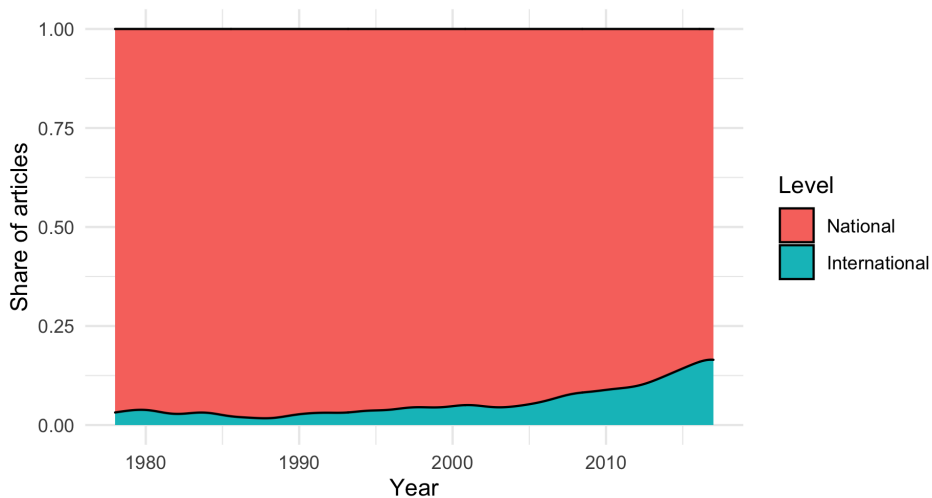


Figure: The number of international papers in 1978–2017

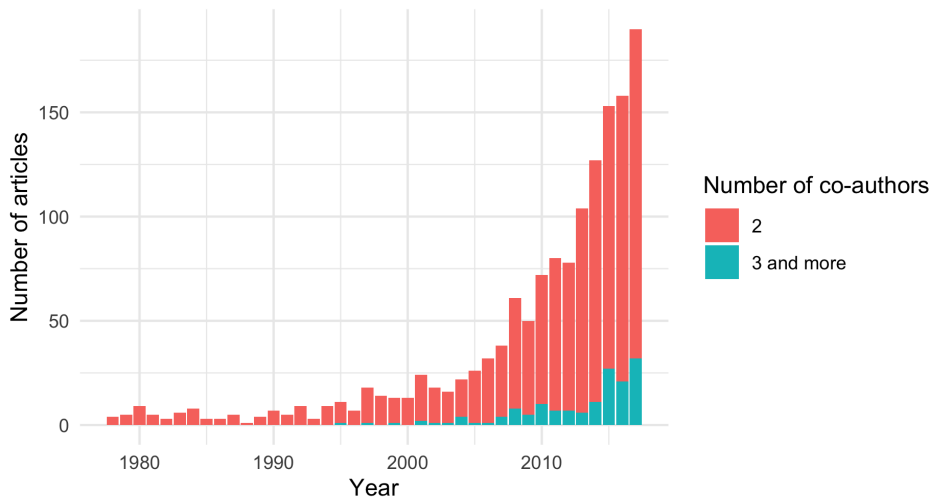


Figure: The share of international papers by region

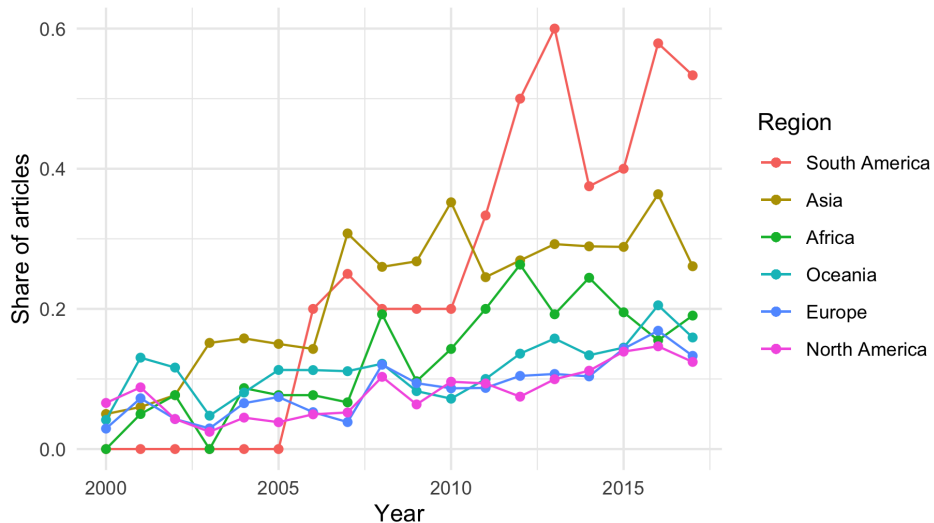


Table: The share of international papers by country in 2000–2017

N	Country	Share	N	Country	Share
1	Vietnam	0.71	21	the Netherlands	0.33
2	Brazil	0.56	22	Russia	0.31
3	Romania	0.56	23	Turkey	0.30
4	UAE	0.54	24	Hong Kong	0.30
5	Cyprus	0.53	25	Japan	0.29
6	China	0.53	26	Portugal	0.28
7	South Korea	0.47	27	Canada	0.28
8	Switzerland	0.46	28	Taiwan	0.26
9	Czech Republic	0.44	29	Sweden	0.26
10	Austria	0.44	30	Italy	0.25
11	Belgium	0.41	31	Spain	0.24
12	Malaysia	0.40	32	India	0.24
13	Greece	0.39	33	New Zealand	0.23
14	Singapore	0.39	34	Finland	0.21
15	France	0.38	35	Ireland	0.21
16	Denmark	0.38	36	Australia	0.14
17	Germany	0.38	37	South Africa	0.14
18	Chile	0.37	38	the UK	0.14
19	Norway	0.36	39	Israel	0.12
20	Mexico	0.35	40	the US	0.09



# Results

**Table:** The descriptive statistics for variables

Variables	N	Mean	St. Dev.	Min	Max
N of co-authored papers	1,157	1.46	1.30	1	21
N of authors in country i	1,157	30.92	50.79	1	233
N of authors in country j	1,157	99.08	111.56	1	336
Distance, km	1,157	6,472	5,143	60	19,576
Common language, 1 = Yes	1,157	0.22	0.41	0	1

## Results: Worldwide

	<i>N of co-authored papers (log)</i>			
	negative binomial		zero-inflated count data	
	(1)	(2)	(3)	(4)
N of authors in country i (log)	0.605*** (0.050)	0.541*** (0.057)	0.491*** (0.051)	0.416*** (0.055)
N of authors in country j (log)	0.486*** (0.046)	0.463*** (0.047)	0.434*** (0.042)	0.413*** (0.040)
Distance, km (log)	−0.262*** (0.053)	−0.262*** (0.053)	−0.208*** (0.050)	−0.205*** (0.042)
Common language, 1 = Yes		0.325** (0.149)		0.364*** (0.131)
Observations	1,157	1,157	1,157	1,157
Log Likelihood	−527.147	−524.780	−584.310	−580.905

Robust standard errors in parentheses.

\* $p < 0.1$ ; \*\* $p < 0.05$ ; \*\*\* $p < 0.01$

## Results: Europe

	<i>N of co-authored papers (log)</i>			
	negative binomial		zero-inflated count data	
	(1)	(2)	(3)	(4)
N of authors in country i (log)	0.636*** (0.069)	0.558*** (0.075)	0.645*** (0.066)	0.435*** (0.151)
N of authors in country j (log)	0.432*** (0.059)	0.403*** (0.060)	0.245*** (0.068)	0.680*** (0.117)
Distance, km (log)	−0.233*** (0.069)	−0.248*** (0.069)	−0.177*** (0.066)	−0.317*** (0.109)
Common language, 1 = Yes		0.445** (0.200)		1.031*** (0.349)
Observations	776	776	776	776
Log Likelihood	−350.015	−347.626	−389.954	−178.125

Robust standard errors in parentheses.

\* $p < 0.1$ ; \*\* $p < 0.05$ ; \*\*\* $p < 0.01$

## Results: North America

	<i>N of co-authored papers (log)</i>			
	negative binomial		zero-inflated count data	
	(1)	(2)	(3)	(4)
N of authors in country i (log)	0.559*** (0.072)	0.481*** (0.095)	0.514*** (0.120)	0.428** (0.194)
N of authors in country j (log)	0.390*** (0.114)	0.395*** (0.117)	0.629** (0.304)	0.678** (0.276)
Distance, km (log)	−0.334*** (0.106)	−0.280** (0.113)	−0.363*** (0.137)	−0.304* (0.169)
Common language, 1 = Yes		0.326 (0.281)		0.287 (0.437)
Observations	350	350	350	350
Log Likelihood	−191.206	−190.540	−114.720	−114.795

Robust standard errors in parentheses.

\* $p < 0.1$ ; \*\* $p < 0.05$ ; \*\*\* $p < 0.01$

## Results: Asia

	<i>N of co-authored papers (log)</i>			
	negative binomial		zero-inflated count data	
	(1)	(2)	(3)	(4)
N of authors in country i (log)	0.680*** (0.122)	0.670*** (0.122)	0.454*** (0.115)	0.442*** (0.116)
N of authors in country j (log)	0.745*** (0.119)	0.760*** (0.123)	0.619*** (0.092)	0.627*** (0.096)
Distance, km (log)	−0.570** (0.227)	−0.540** (0.233)	−0.457*** (0.045)	−0.427*** (0.034)
Common language, 1 = Yes		0.312 (0.351)		0.274 (0.321)
Observations	379	379	379	379
Log Likelihood	−150.860	−150.490	−166.353	−166.025

Robust standard errors in parentheses.

\* $p < 0.1$ ; \*\* $p < 0.05$ ; \*\*\* $p < 0.01$

# Conclusion

# Conclusion

- ▶ International publications have grown exponentially
  - ▶ The majority of the articles are still produced by co-authors from the same country
- ▶ The intensity of collaboration is negatively associated with geographical distance
- ▶ Geographical proximity differs to a great extent between various world regions
  - ▶ The dense clustering of European countries makes the intensity of international collaboration far less dependent on geography and more on language commonality
- ▶ Linguistic proximity plays a significant role mostly for European researchers, leaving North American and Asian scholars less connected with international co-authors

## Discussion

- ▶ International collaboration have proliferated in higher education
- ▶ Despite the encouragement of multidisciplinary research by increasing funding opportunities, the substantial role of geography remains
- ▶ International collaboration in the higher education community include many places around the world, but still show a core-periphery picture
- ▶ More institutional support for early and junior higher education scholars is needed
- ▶ More focus on methodological issues that researchers face while conducting multidisciplinary research projects is needed