

Quantitative View of the Structure of Institutional Scientific Collaborations

Example of Berlin vs. Halle-Jena-Leipzig

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Introduction

A [simplistic] dichotomy of *bottom-up* vs. *top-down* initiation of institutional scientific collaborations

Scientific and complex economic activities are concentrated in urban and metropolitan areas¹

A selective process of spatial proximity between knowledge producing and demanding institutions²

Remnants of a historical divide putting distance between institutions³

Multi-organizational collaborations != simple agreements among researchers⁴

Example of Berlin vs. Halle-Jena-Leipzig

- [1] Balland, P.-A., Jara-Figueroa, C., Petralia, S. G., Steijn, M. P. A., Rigby, D. L., & Hidalgo, C. A. (2020). Complex economic activities concentrate in large cities. *Nature Human Behaviour*, 4(3), 248–254. <https://doi.org/10.1038/s41562-019-0803-3>
- [2] Rammer, C., Kinne, J., & Blind, K. (2020). Knowledge proximity and firm innovation: A microgeographic analysis for Berlin. *Urban Studies*, 57(5), 996–1014. <https://doi.org/10.1177/0042098018820241>
- [3] Abbasiharofteh, M., & Broekel, T. (2020). Still in the shadow of the wall? The case of the Berlin biotechnology cluster: Environment and Planning A: Economy and Space. <https://doi.org/10.1177/0308518X20933904>
- [4] Shrum, W., Genuth, J., Carlson, W. B., Chompalov, I., & Bijker, W. E. (2007). *Structures of Scientific Collaboration*. MIT Press.

Why these cases? (historical development)

- Berlin: (I) divide/competition, (II) mutually exclusive identity, (III) cooperation
 - (examples of III): HU/FU shared faculty in Charité from 2003; Berlin University Alliance (BUA) from 2018¹
- Halle-Jena-Leipzig (HJL): **Unibund** from 1995, established **iDiv** with DFG fund in 2012

BUA members

- Freie Universität Berlin (FU)
- Humboldt-Universität zu Berlin (HU)
- Technische Universität Berlin (TU)
- Charité – Universitätsmedizin Berlin (CH)

Unibund and iDiv members

	Institution	Unibund member?	iDiv Member?
	Martin Luther University Halle-Wittenberg	Y	Y
	Friedrich Schiller University Jena	Y	Y
	Leipzig University	Y	Y
	Helmholtz Centre for Environmental Research – UFZ		Y
	German Centre for Integrative Biodiversity Research (iDiv) Halle-Jena-Leipzig		Y
	Max Planck Institute for Biogeochemistry (MPI BGC)		Y
	Max Planck Institute for Chemical Ecology (MPI CE)		Y
	Max Planck Institute for Evolutionary Anthropology		Y
	Leibniz Institute German Collection of Microorganisms and Cell Cultures (DSMZ)		Y
	Leibniz Institute of Plant Biochemistry (IPB)		Y
	Leibniz Institute of Plant Genetics and Crop Plant Research (IPK)		Y
	Leibniz Institute Senckenberg Museum of Natural History (SMNG)		Y

• [1] see BUA proposal [here](#)

Research goals, a look into:

- **Disambiguation** of organization names
- **Collaboration and internationalization**
- **Disciplinary** differences
- **Regional or continental** orientation
- **Sector** orientation
- **Cohesive subgroups**
- **BUA's effect as a strategic coalition**
- **Unibund's effect as a strategic coalition**
- **iDiv's effect as a new organizational form**
- **Intra Unibund and iDiv**

Data (Berlin, HJL/iDiv)

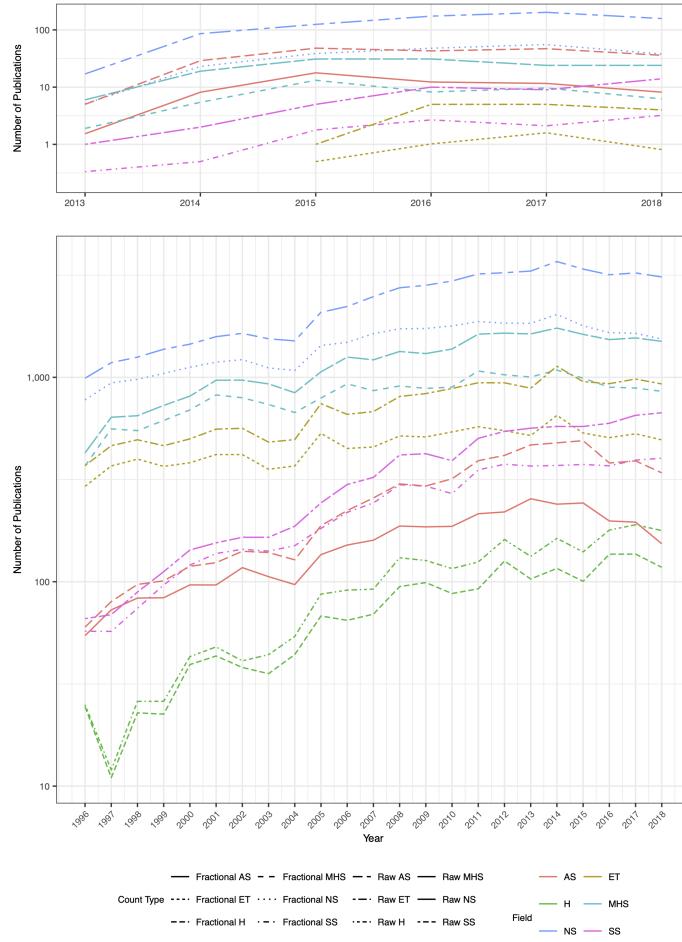
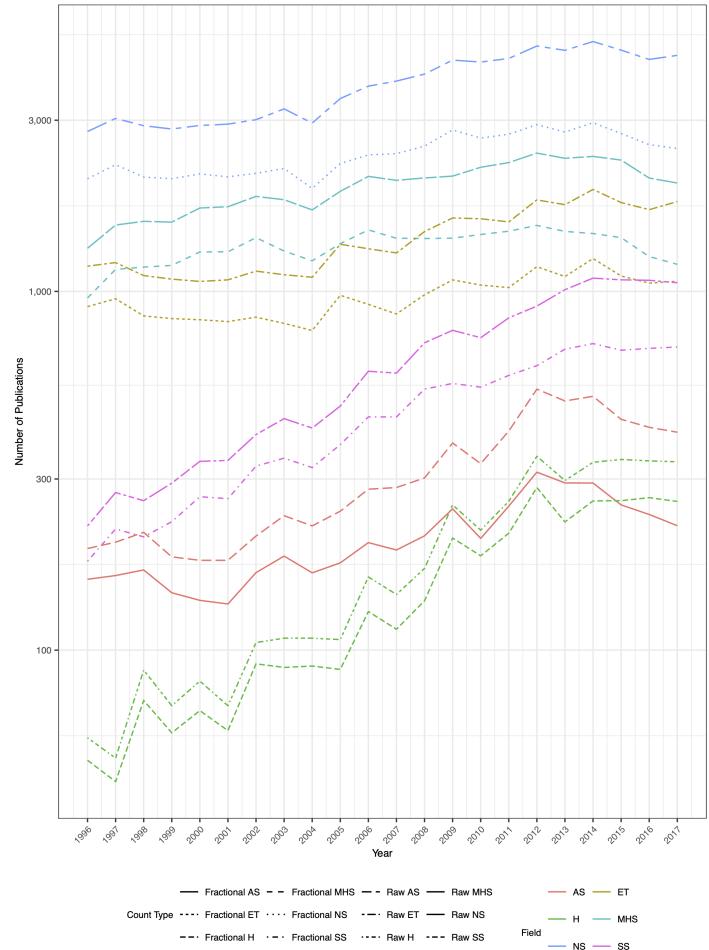
- Scopus **1990-2017** (b_2018 KB)
- *Article, Review and Conference proceeding*
- At least one institution of **Berlin, Germany**
- OECD fields (mapped to ASJC)
- **Wikidata** 27 March 2019, **GRID** (Global Research Identifier Database) 17 February 2019 (10 December 2019 for address complements)
- **Research Organization Registry (ROR)** [local] API (18 December 2019)
- Bipartite community detection, CPM, $\gamma = 6 \times 10^{-3}$
- Scopus **1990-2018** (b_2019 KB)
- *Article, Review and Conference proceeding*
- At least one institution of **HJL (Halle, Saale, Jena or Leipzig), Germany**
- iDiv website: **30 July 2020**; 2,371 unique DOIs, 1,749 on Scopus 2019, 74%

Co-authorship networks: Berlin (top), HJL/iDiv (bottom)

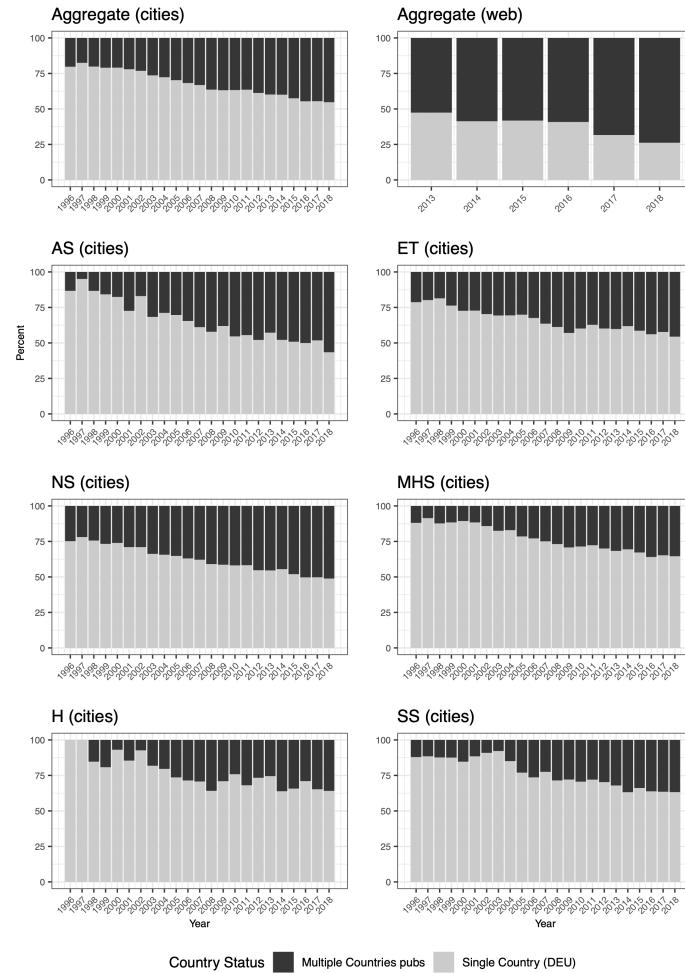
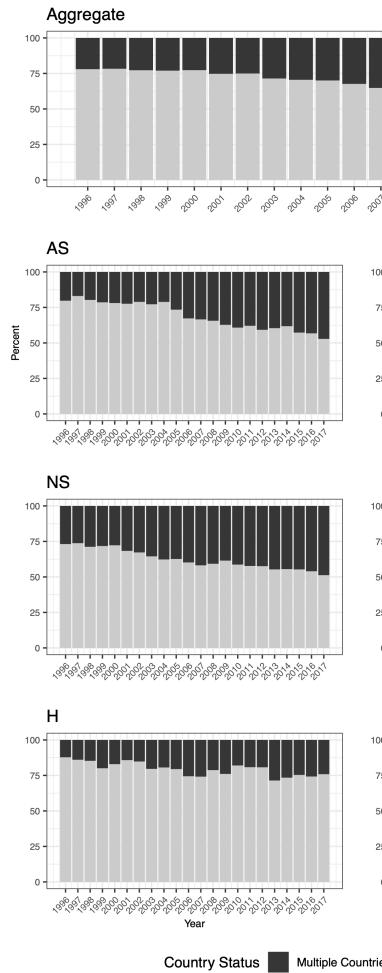
Metrics	Non disambiguated	PyString	Fuzzy	ROR
N. of connected components	10,269	66	159	100
N. of biparitite nodes	613,827	135,057	58,547	133,387
N. of biparitite edges	1,083,775	246,704	89,199	246,472
% of biparitite nodes in G	95	100	99	100
% of biparitite edges in G	98	100	100	100
N. of organizations	356,918	5,244	4,978	7,257
N. of organizations in G	337,755	5,176	4,809	7,153
N. of publications (%)	256,909	129,813 (51%)	53,569 (21%)	126,130 (49%)
N. of publications in G	245,203	129,657	53,248	125,949

Metrics	Non disambiguated web	Disambiguated web	Non disambiguated cities	Disambiguated cities
N. of connected components	228	1	61,906	22
N. of biparitite nodes	14,577	1,604	617,248	86,233
N. of biparitite edges	16,485	4,312	631,291	168,078
% of biparitite nodes in G	87	100	55	100
% of biparitite edges in G	90	100	65	100
N. of organizations	12,828	686	462,426	6,289
N. of organizations in G	11,243	686	264,938	6,268
N. of publications	1,749	918	154,822	79,944
N. of publications in G	1,462	918	75,055	79,894

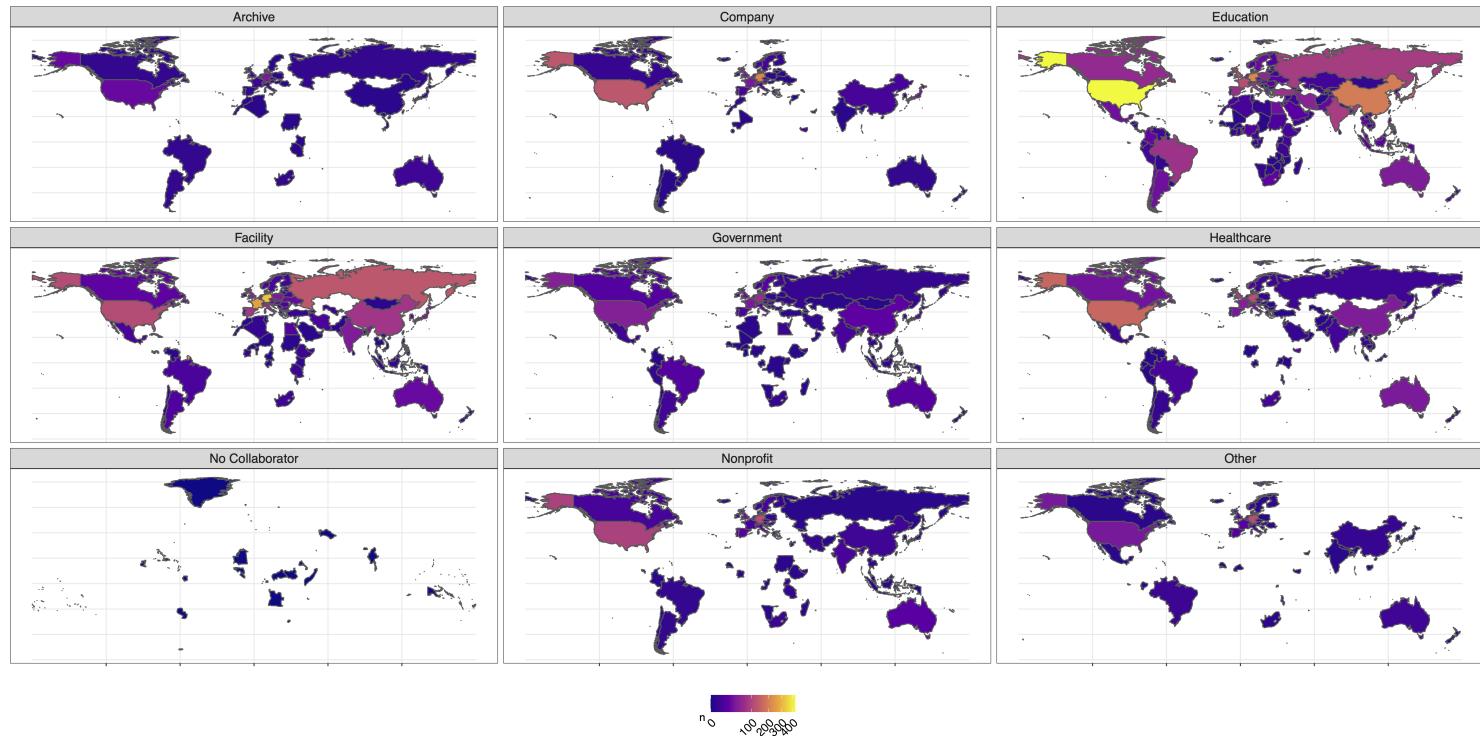
Publication trajectory: Berlin (left), iDiv (right top), HJL (right bottom)



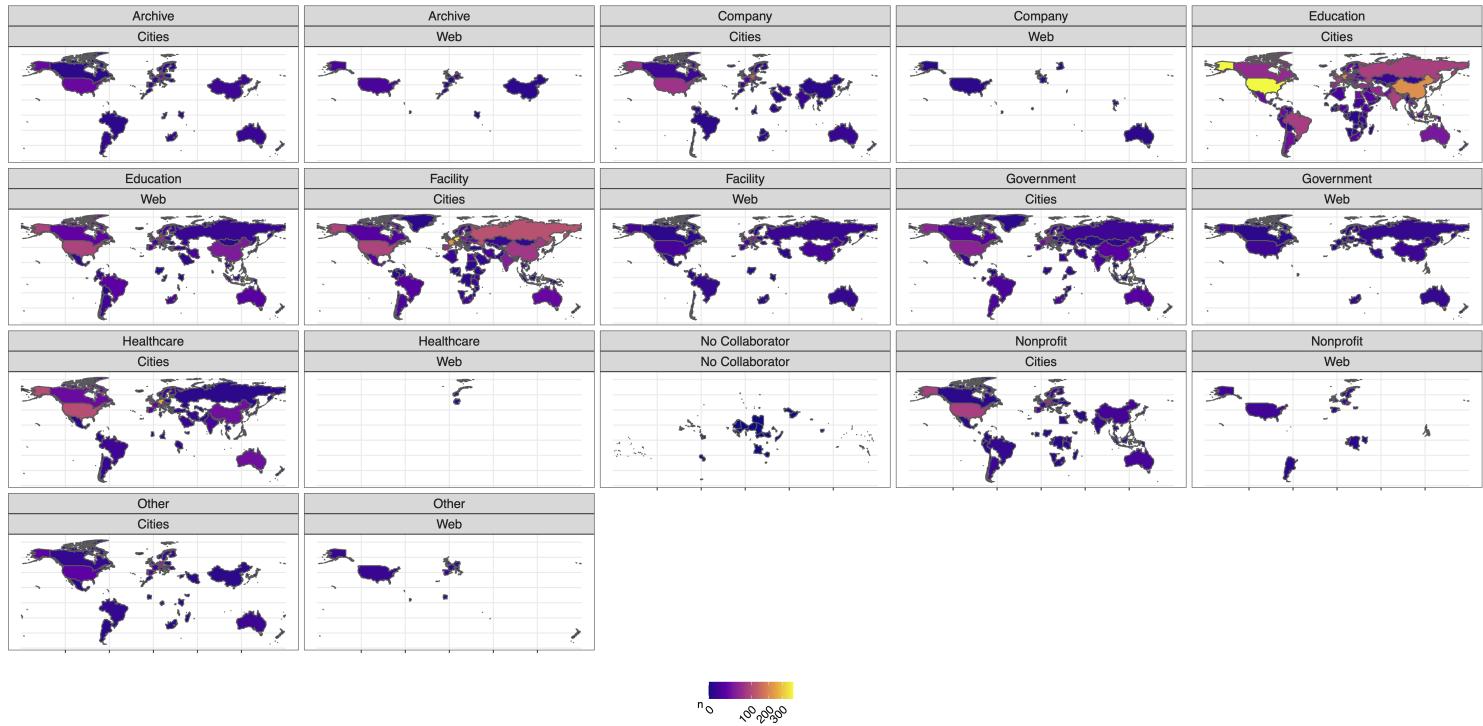
Internationalization: Berlin (left), iDiv (right, aggregate web), HJL (right, cities)



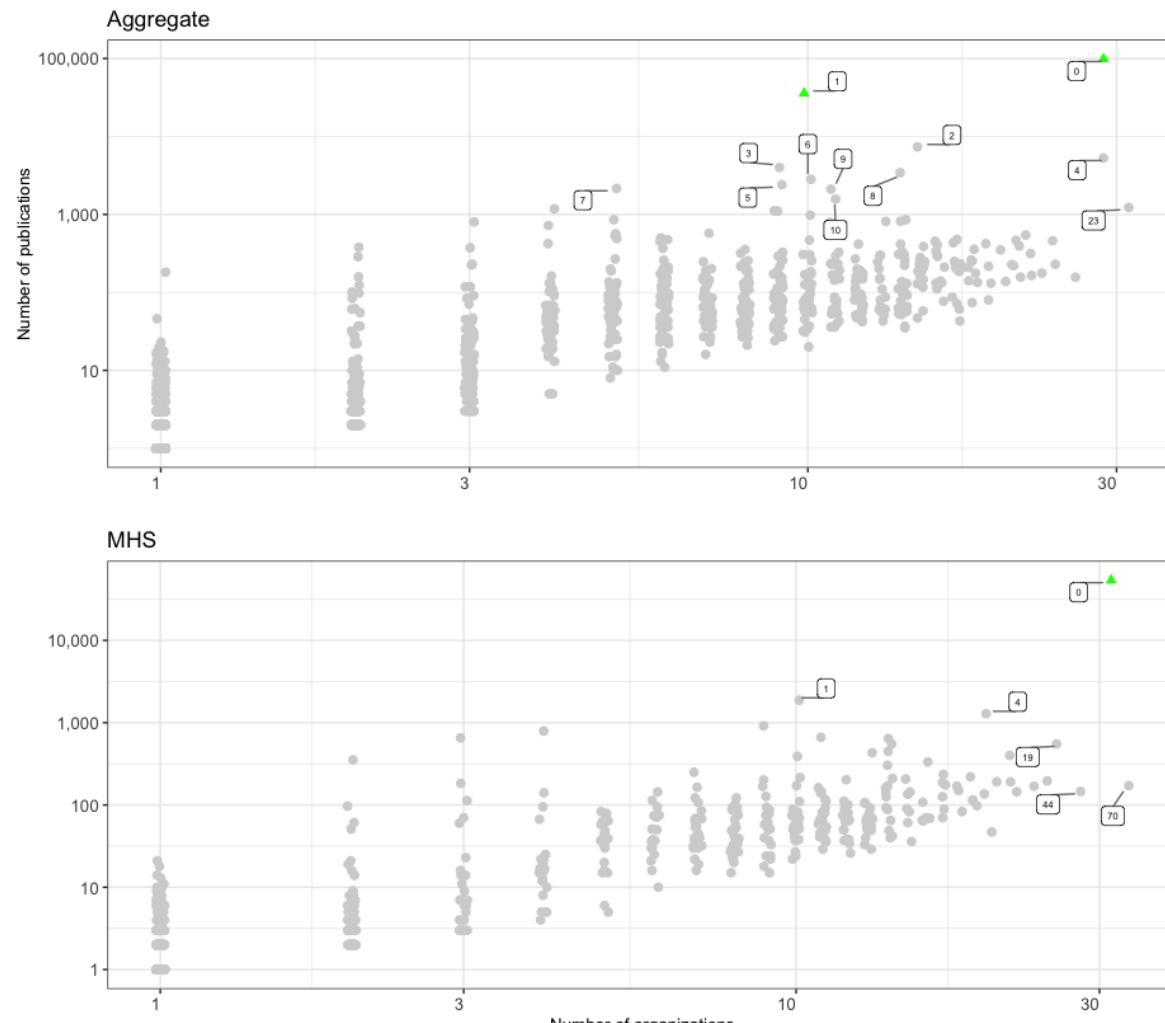
Sectors (1/2): Berlin



Sectors (2/2): iDiv (web), HJL (cities)



Cohesive communities: Berlin

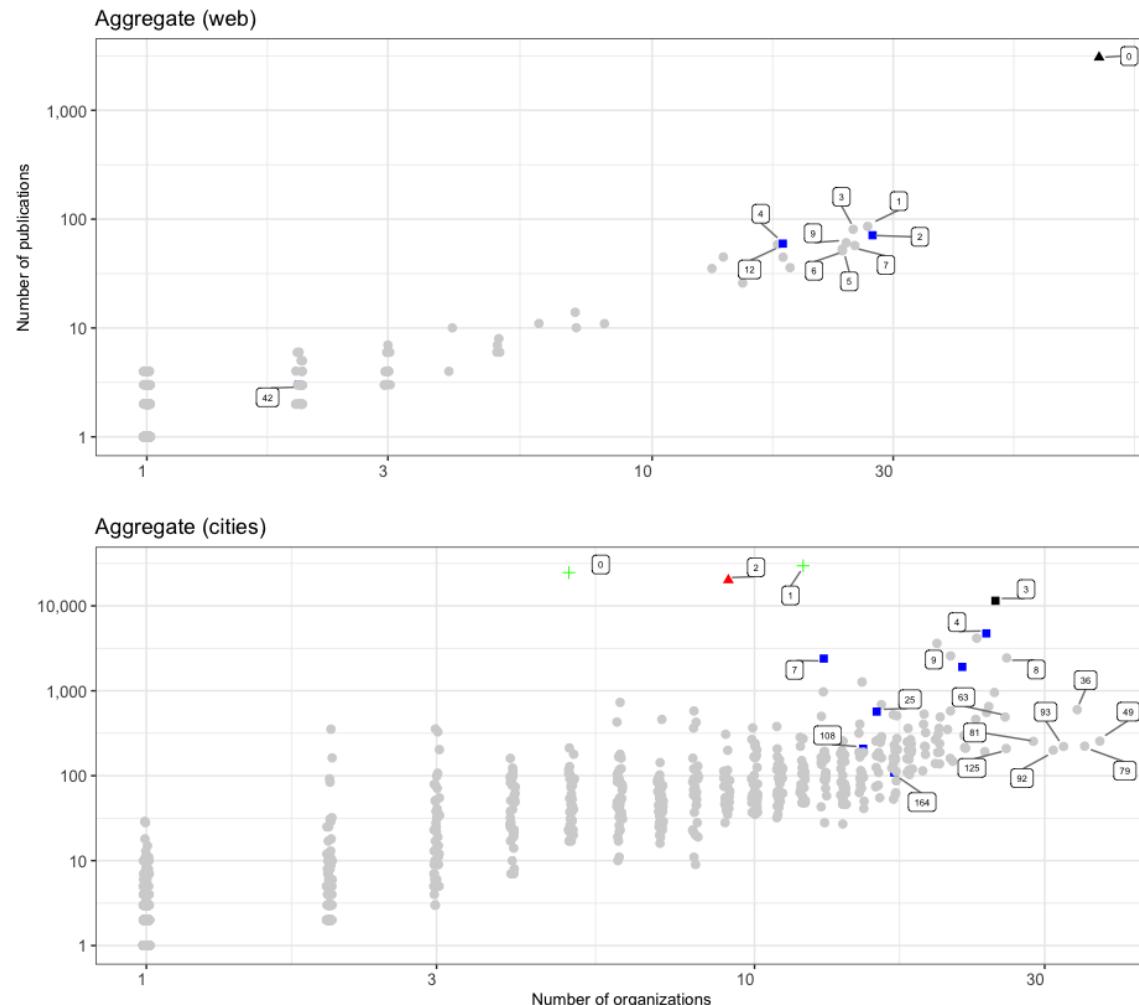


Community composition (Berlin)

Data	cluster	N	Region (%)										Sector (%)						
			P	B	Africa	Americas	Asia	Berlin	DEU	Europe	Oceania	Company	Education	Facility	Government	Healthcare	Nonprofit	Other	
ROR	0	29	98,408	3				21	76	3		3	62	10	3	21			
	1	10	35,734	1				60	30	10		30	60	10					
	2	15	7,356			20	7	7	20	47			33	40	20			7	
	3	9	4,002			11	11	22	56				33	56				11	
	4	29	5,285			10	21	3	10	55		7	62	21	3			3	
	5	9	2,414					11		89			67	33					
	6	10	2,822			20	30	10		40		10	80	10					
	7	5	2,157					20	40	40			40	40		20			
	8	14	3,441			14		7	14	64			79	14				7	
	9	11	2,110			9	18		18	55			18	45	18			18	
	10	11	1,571					18	45	36			18		55	9	9	9	
	23	31	1,230		3	3	61	3	16	10	3	3	68	10	3	3	10	3	

- N: size of community
- P: total publications
- B: number of BUA members

Cohesive communities: Unibund/iDiv/HJL



- Green plus: includes Unibund member(s), blue square: includes iDiv member(s), black: includes iDiv center, triangle/red: includes Unibund/iDiv member(s)

Community composition (HJL cities (top), iDiv web (bottom))

Data	cluster	N	P	iDiv	I	U	Region (%)									Sector (%)								
							Africa	Americas	Asia	Berlin	DEU	Europe	HJL cities	Oceania	No region	Archive	Company	Education	Facility	Government	Healthcare	Nonprofit	Other	
ROR web	0	77	3,061	Y	5	3	3	5	9	4	38	29	10	3	1	70	22	3	3	3	1			
	1	27	86				30	33		15	11	7	4		4	81	7	4			4			
	2	27	71		1	4		4	15		22	59			7		63	7	22					
	3	25	81				4	28				64	4		12		64	16	4				4	
	4	18	60		1	33	17			11	33	6			6	6	50	11	6			11	11	
	5	24	51				67	21		4	8				12	4	71	12						
	6	24	53				21	21	17		29		12		4		71	8	4			8	4	
	7	25	57				32	4			52		12		8		64	16	8				4	
	9	24	61				50		4	4	38		4			4	83	4	4				4	
	12	18	59				61	6		6	17		11		6		78	6					6	6
ROR cities	42	2	3		1					100								100						
	0	5	24,616				1			20	20	60				60	20		20					
	1	12	29,608		1					25	17	50	8			42	42		17					
	2	9	20,127		1	1				67		33				67	33							
	3	25	11,481	Y	1					48	36	12	4			72	20	4				4		
	4	24	4,741		1			42		8	46	4				79	17	4						
	7	13	2,398		1			31	15		46	8				62	31	8						
	8	26	2,437				19	12		19	46	4				38	46	12				4		
	9	22	1,912		1	5	14			27	50	5				27	45	14				9	5	
	25	16	569		1	6	6	12		44	31				6	56	19	6	12					
	36	34	599			12	6	6		9	59		6	3	3	3	29	44	9	3	6	3		
	49	37	255			5	24	51		16		3			3	68	16	3	8	3		3		
	63	26	491			4	8	19	4	27	35		4			35	23	8	27	4	4			
	79	35	223				11	49		40				6		60	14		20					
	81	29	254			3	3	90			3				3	69	14	7						
	92	31	200				16	3		6	74				6	3	29	45	3	3	6	3		
	93	32	221				75	3	6	6		9				38	22	19	9	9	3			
	108	15	208		1	7		27		27	40					47	33	7			7	7		
	125	26	209				15	8	4	73					4	46	35	8	4	4				
	164	17	109		1		6	6		12	76				18	6	29	35	6			6		

N: size of community, P: total publications, iDiv: includes iDiv center, I: number of iDiv members, U: number of Unibund members

Conclusions

- **Disambiguation** has high impact
- **Collaboration** trajectory is stable
- **Internationalization** is increasing, not prevalent yet
- Geographical proximity is not enough but, **Integrated European Research Area** seems to have formed
- Sectoral ruling class: Education and facility
- Low integration of business sector (companies)
- Education *still* dominates the research activity in many countries
- Can **BUA** copy Charité's success case?
- **Unibund**, more a top-down initiative
- **iDiv**, a highly internationalized case
- **Unibund and iDiv** show high cohesion *only* in NS

Discussion

- Impersonal trust¹
- Role of bureaucracy¹ in inter-mediating cooperation among ex-competitors
- Keeping it limited to administrative level and providing further freedom in the researcher level?

Limitations

- Success stories
- Database coverage

• [1] Shrum, W., Genuth, J., Carlson, W. B., Chompalov, I., & Bijker, W. E. (2007). *Structures of Scientific Collaboration*. MIT Press.

Thank you for your attention

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Berlin preprint is here: <https://arxiv.org/abs/2008.08355>

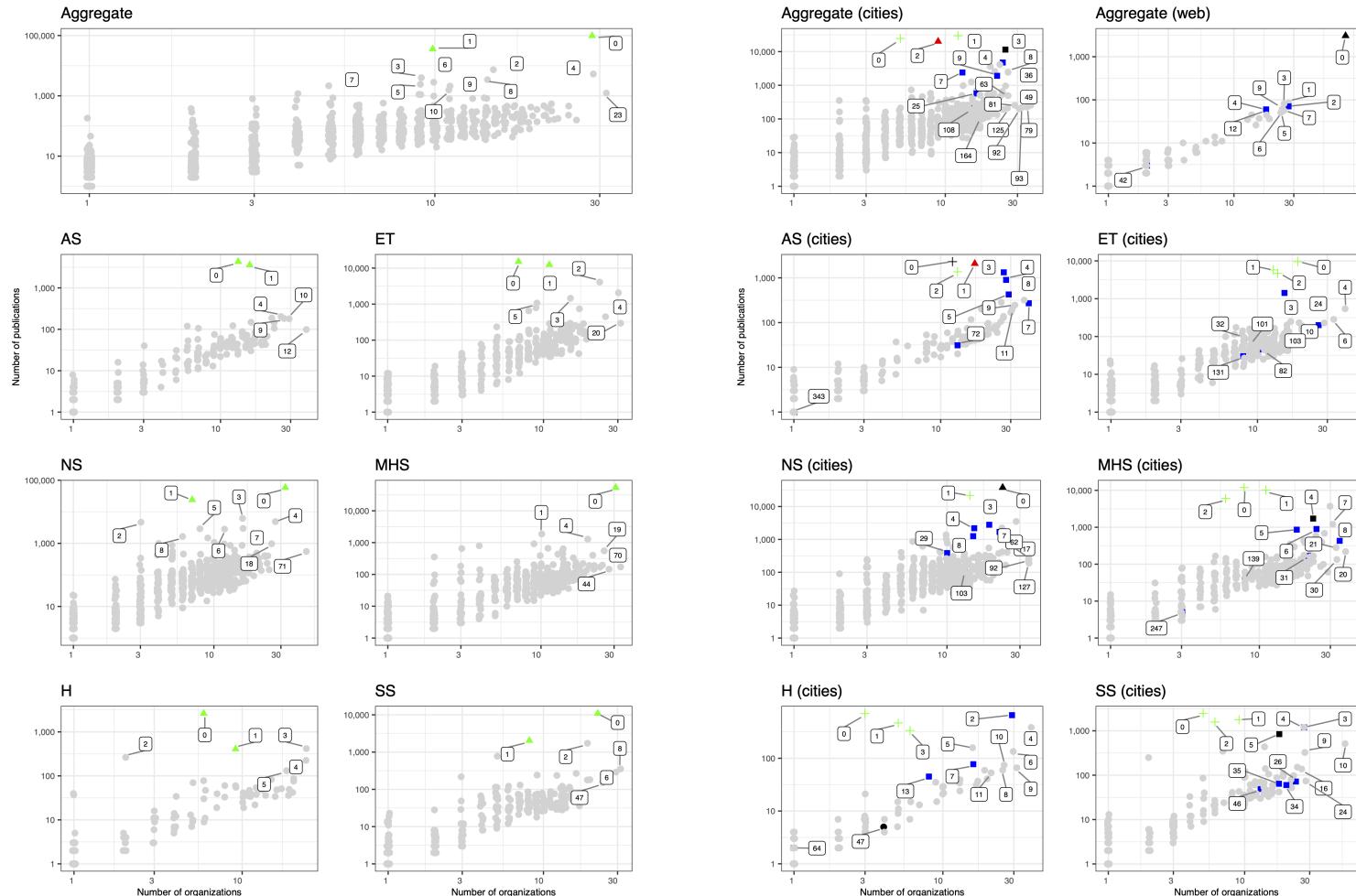
HJL/iDiv preprint: *coming soon*

Fields' networks: Berlin (top), HJL/iDiv (bottom)

Metrics	AS	ET	H	MHS	NS	SS
N. of connected components	13	56	34	48	55	68
N. of biparitite nodes	8,528	33,930	4,835	46,842	89,032	16,045
N. of biparitite edges	13,822	57,671	6,195	84,945	170,334	25,336
% of biparitite nodes in G	100	100	98	100	100	99
% of biparitite edges in G	100	100	99	100	100	100
N. of organizations	1,687	2,991	798	3,843	5,970	2,091
N. of organizations in G	1,668	2,933	763	3,792	5,910	2,012
N. of publications	6,841	30,939	4,037	42,999	83,062	13,954
N. of publications in G	6,828	30,851	3,988	42,913	82,989	13,849

Metrics	AS_w	AS_c	ET_w	ET_c	H_w	H_c	MHS_w	MHS_c	NS_w	NS_c	SS_w	SS_c
N. of connected components	4	8	1	18	1	18	4	17	1	17	1	19
N. of biparitite nodes	505	7,881	68	19,511	6	2,993	316	31,317	1,511	60,682	144	9,842
N. of biparitite edges	1,026	14,279	87	34,578	5	4,080	578	55,259	3,966	122,102	216	15,880
% of biparitite nodes in G	98	100	100	100	100	98	98	100	100	100	100	99
% of biparitite edges in G	99	100	100	100	100	99	99	100	100	100	100	100
N. of organizations	279	1,816	51	2,469	5	687	167	3,357	655	5,316	95	1,646
N. of organizations in G	270	1,809	51	2,449	5	669	163	3,341	655	5,300	95	1,623
N. of publications	226	6,065	17	17,042	1	2,306	149	27,960	856	55,366	49	8,196
N. of publications in G	223	6,055	17	17,008	1	2,279	146	27,935	856	55,337	49	8,158

Cohesive communities: Berlin (left), iDiv (right, aggregate web), HJL (right, cities)



Community composition (Berlin, all fields)

Data	cluster	N	P	B	Region (%)							Sector (%)							
					Africa	Americas	Asia	Berlin	DEU	Europe	Oceania	No region	Archive	Company	Education	Facility	Government	Healthcare	Nonprofit
ROR	0	29	98,408	3	1				21	76	3		3	62	10	3	21		
	1	10	35,734						60	30	10			30	60	10			
	2	15	7,356				20	7	7	20	47			33	40	20		7	
	3	9	4,002				11	11	22	56				33	56			11	
	4	29	5,285				10	21	3	10	55		7	62	21	3		3	3
	5	9	2,414						11		89			67	33				
	6	10	2,822				20	30	10		40		10	80	10				
	7	5	2,157						20	40	40			40	40		20		
	8	14	3,441				14		7	14	64			79	14		7		18
	9	11	2,110				9	18		18	55			18	45	18	9	9	9
AS	10	11	1,571		3				18	45	36			18	55	9			
	23	31	1,230				3	61	3	16	10		3	68	10	3	10	3	
	0	13	4,308	2					31	62	8			69		15			
ET	1	16	3,582	2	8		6	12	12	56	6	6	6	56	19		19		
	4	26	204				8	15	4	54	12		4	4	50	31	8		
	9	27	182				15	4	4	7	67	4	3	4	59	22	7		4
	10	29	180				3	17	34	7	10	28		3	55	28	7	3	3
	12	38	99				13	8			79		8	37	16	13	13	8	3
NS	0	7	15,116	1	3				71	29				29	71				
	1	11	12,457						36	55	9			45	18	9	27		
	2	23	4,092				9	26	4	22	39			39	39	13	4	4	
	3	15	1,460				20	40	13		27		7	60	33				
	4	30	2,059				3	23	3	7	63		3	60	20	7		3	7
	5	9	1,072				11			33	56		11	22	44	11		11	
	20	31	294				6	6	10	74	3		6	42	23	3	6	13	6
	0	32	58,586	3					19	78	3		3	62	12	3	19		
	1	7	24,045	1					57	29	14			29	57		14		
	2	3	4,676						33	67				67	33				
MHS	3	16	6,186		2		6	12	6	19	56			31	44	19		6	4
	4	27	4,869				7	22	4	7	59		7	63	22	4			
	5	8	2,897				12		25	38	25			12	62		25		
	6	12	2,816				33	25	8		33		8	75	17				
	7	16	2,976				6	6	6		69	12		75	19	6		17	
	8	6	1,643						17	17	67			67	17				
	18	26	968				8	62	12	4	12	4	4	77	4	4		8	8
	71	45	553				7	4		84	2		20	42	7	13	9	9	
	0	31	53,817	4					19	81			3	61	10	3	23		
	1	10	1,875				20	20	20	30	10			40	40		20		
H	4	20	1,286		4		45		5	5	45			90	10				
	19	26	552				23		4		73			46	12	15	27		
	44	28	146				7	11		4	79		4	36	36	4	18	4	
	70	33	172				64	12	6		18		3	33	12	6	21	9	9
	0	6	2,628	3					50	50			17	67		17			
SS	1	9	411	1	4		33		11	22	33			100				50	
	2	2	264				50		50					50					
	3	24	416				17	4	4	17	46	12		88	8				
	4	24	225				42		4	8	42			83	17				
	5	18	131				22	28	6	11	33			61	28	11			
	0	22	10,895	3					14	77	9		5	64	9		23		
	1	8	2,046	1					50	38	12			38	50			12	
SS	2	19	1,733		3		32		5	21	37		5		89	11			
	6	29	291				14	14	3	3	62			3	55	31	3		
	8	31	353				58		6		35			6	77	6		6	3
	47	24	150				4	12	8		67			4	67	8	17	4	