COSC 6336 Statistical Methods in Data Analytics

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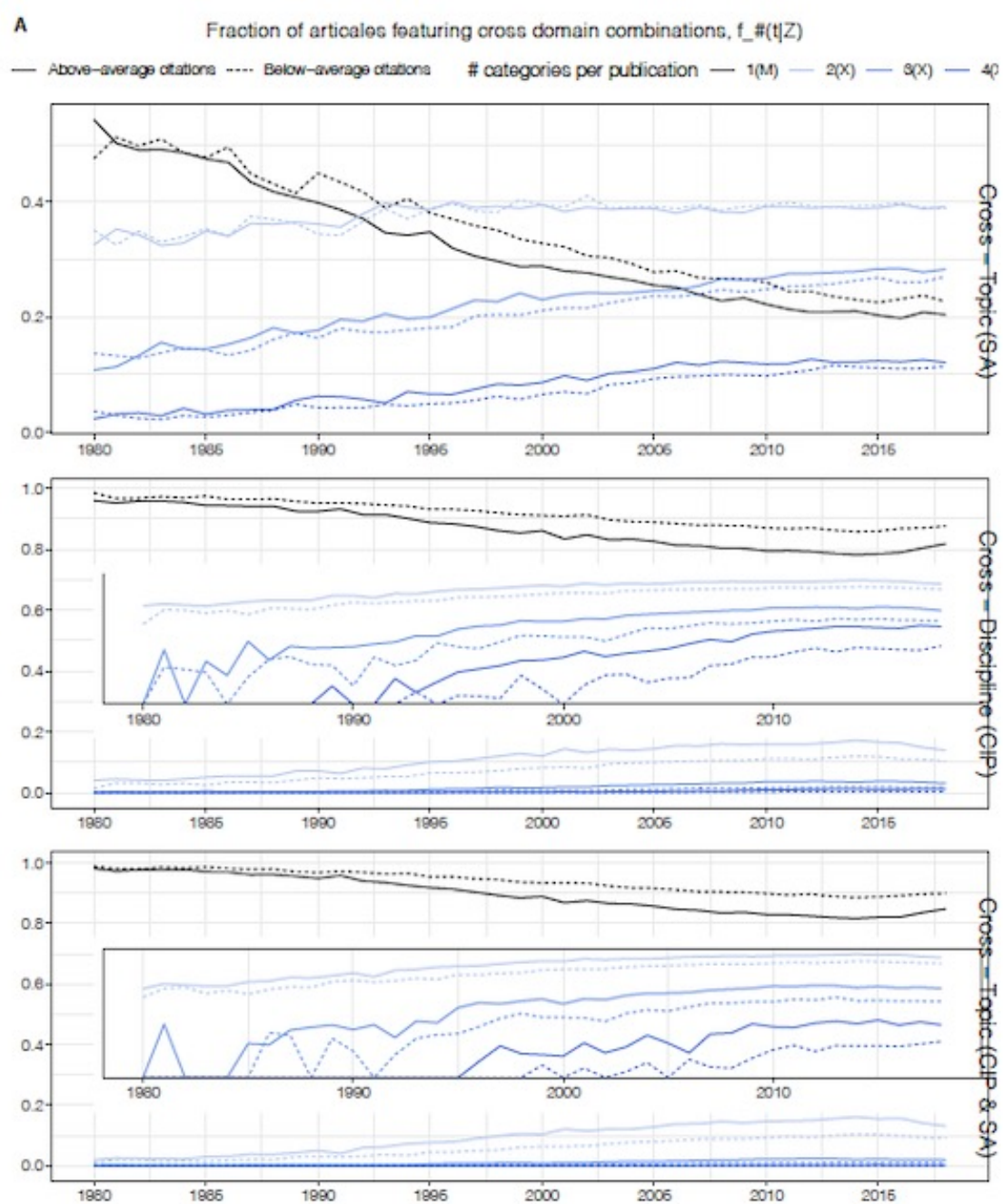

A
Fraction of articales featuring cross domain combinations, f_#(t|Z)
Above−average citations
Below−average citations
# categories per publication
1(M)
2(X)
3(X)
Cross − Topic (SA)
Cross − Discipline (CIP)
Cross − Topic (CIP & SA)

Figure 2A

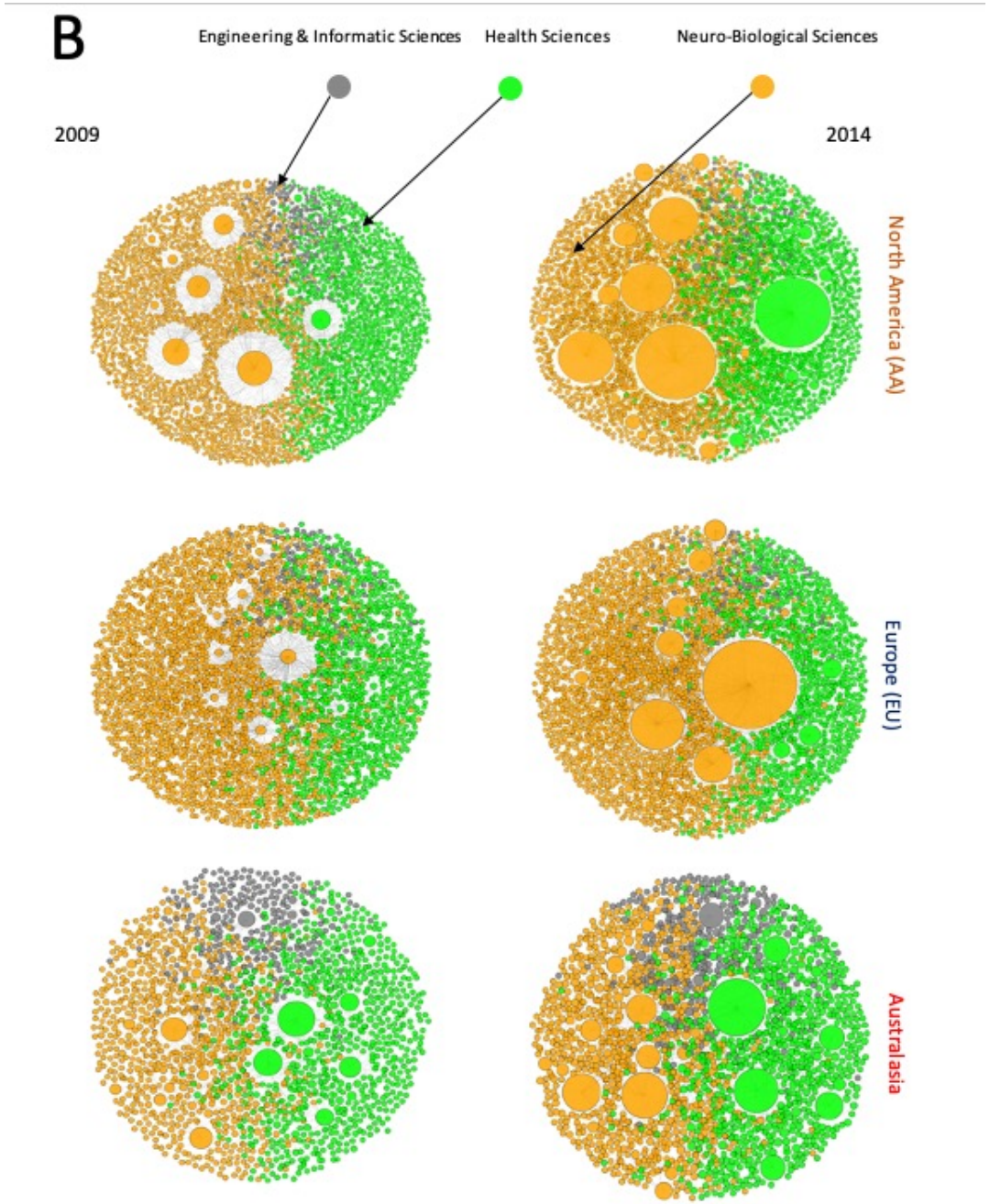

B
Engineering & Informatic Sciences
Health Sciences
Neuro-Biological Sciences
2009
2014
North America (AA)
Europe (EU)
Australasia

Figure 2B

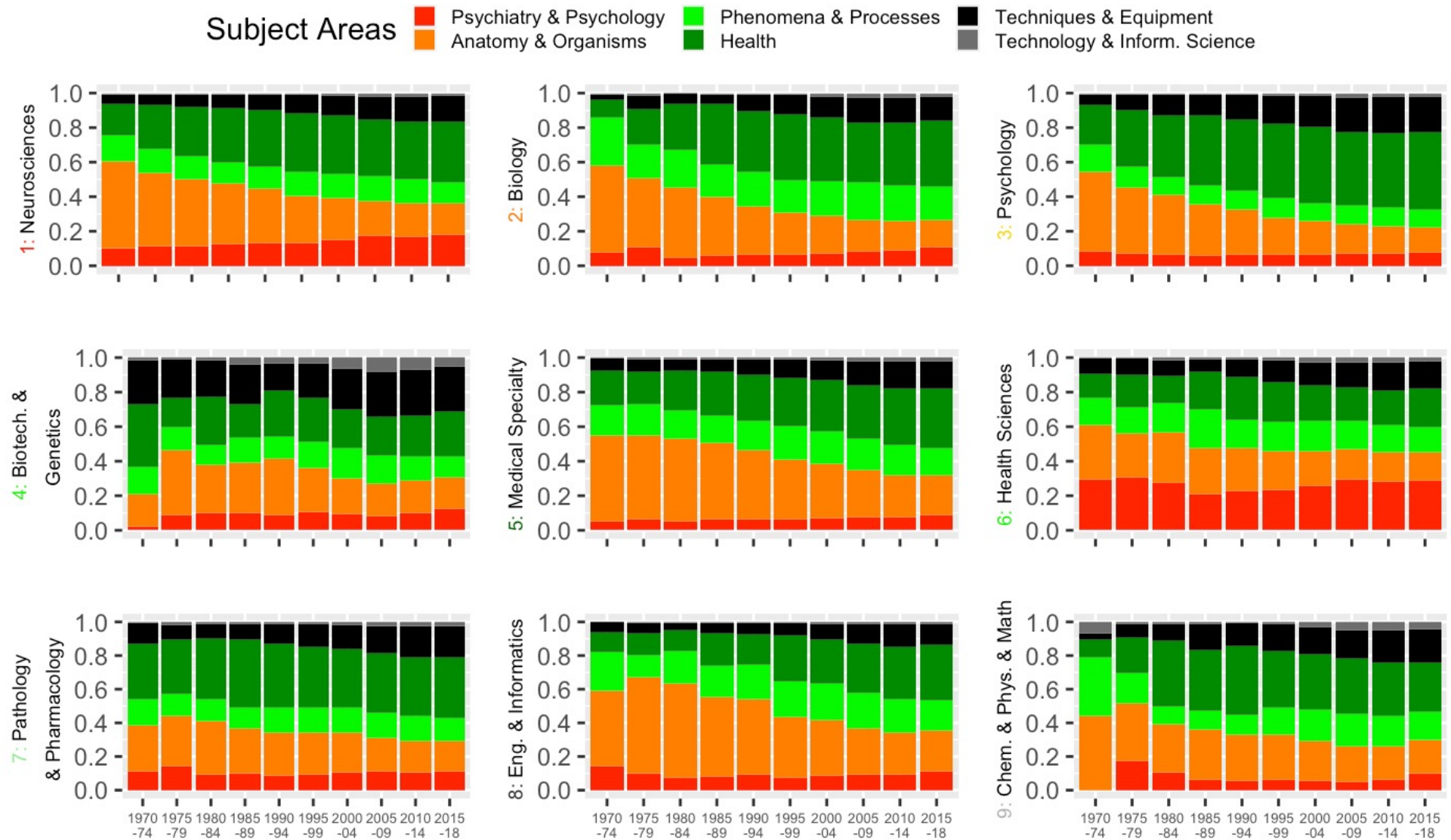
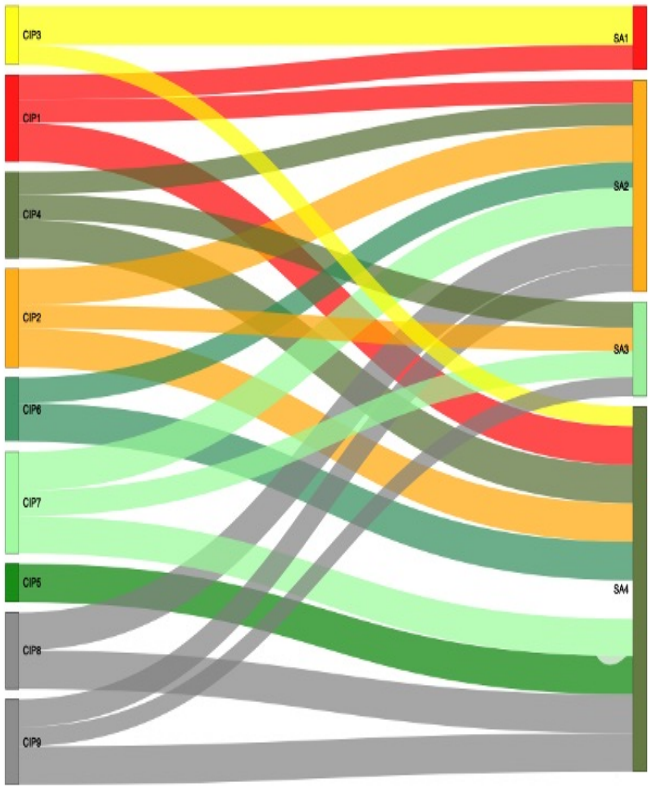

Subject Areas
Psychiatry & Psychology
Anatomy & Organisms
Phenomena & Processes
Health
Techniques & Equipment
Technology & Inform. Science
1: Neurosciences
2: Biology
3: Psychology
4: Biotech. & Genetics
5: Medical Specialty
6: Health Sciences
7: Pathology & Pharmacology
8: Eng. & Informatics
9: Chem. & Phys. & Math
0.0
0.2
0.4
0.6
0.8
1.0
1970 -74
1975 -79
1980 -84
1985 -89
1990 -94
1995 -99
2000 -04
2005 -09
2010 -14
2015 -18

Figure 3A

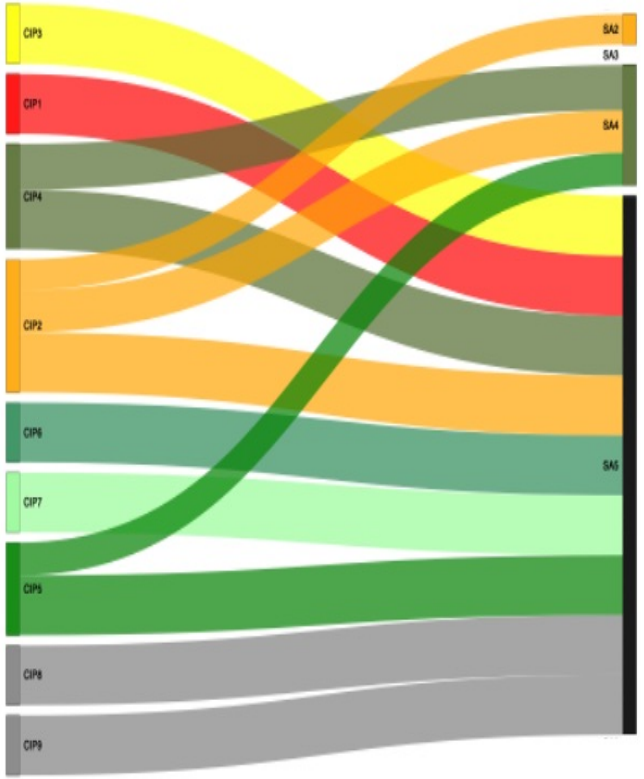
Convergence Nexus
CIP-SA coupling
2009- 2018

$M_{CIP} \rightleftharpoons M_{SA}$



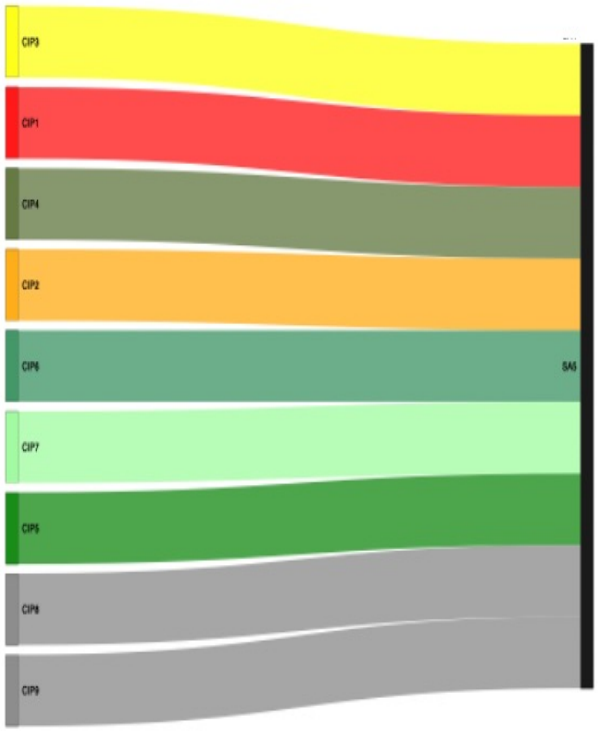
Mono-domain articles

$X_{CIP} \rightleftharpoons X_{SA}$



Cross-domain articles

$\Delta_{XM} = (X \rightleftharpoons X) - (M \rightleftharpoons M)$



Difference

Figure 3-B

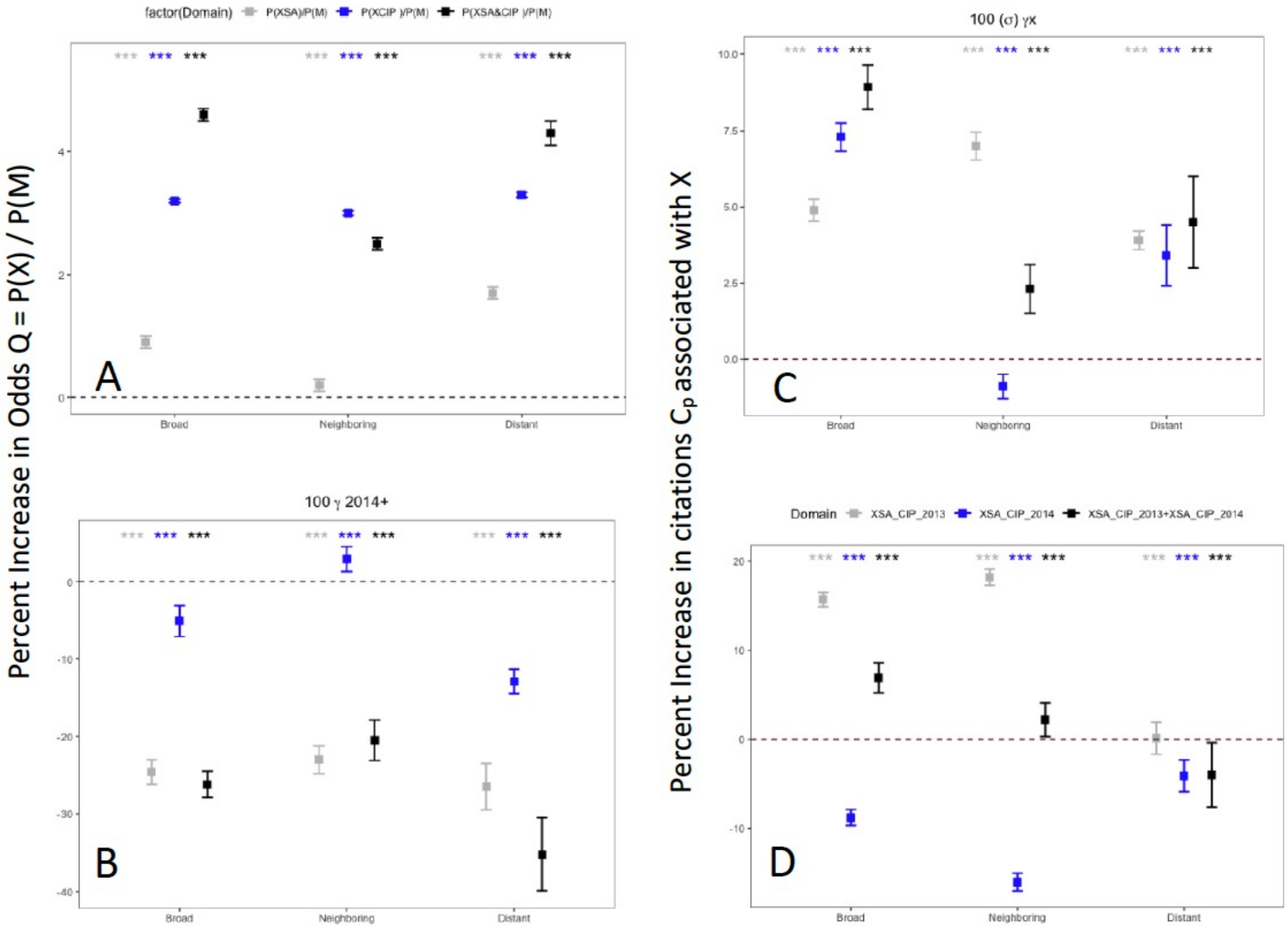

factor(Domain) P(XSA)/P(M) P(XCIP)/P(M) P(XSA&CIP)/P(M)
Percent Increase in Odds Q = P(X) / P(M)
A
Broad
Neighboring
Distant
100 γ 2014+
B
100 (σ) γx
Percent Increase in citations C_p associated with X
C
Domain XSA_CIP_2013 XSA_CIP_2014 XSA_CIP_2013+XSA_CIP_2014
D

Figure 5

S1

	Dependent variable:					
	X_{SA}	X_{CIP}	$X_{SA\&CIP}$	X_{SA}	X_{CIP}	$X_{SA\&CIP}$
	(1)	(2)	(3)	(4)	(5)	(6)
y	1.032***	1.009***	1.046***	1.033***	1.021***	1.031***
	(0.0003)	(0.001)	(0.001)	(0.0004)	(0.001)	(0.001)
$\bar{z_j}$	0.997***	1.282***	1.415***	0.978***	1.223***	1.257***
	(0.006)	(0.008)	(0.012)	(0.006)	(0.009)	(0.009)
ln k	0.885***	1.753***	1.562***	0.897***	1.821***	1.618***
	(0.006)	(0.008)	(0.011)	(0.006)	(0.008)	(0.008)
ln w	4.655***	0.933***	4.858***	4.678***	0.929***	1.620***
	(0.009)	(0.012)	(0.016)	(0.009)	(0.012)	(0.012)
N_R	1.324***	7.810***	12.004***	1.211***	3.028***	2.782***
	(0.009)	(0.008)	(0.013)	(0.021)	(0.019)	(0.019)
N_{CIP}	1.307***			1.294***		
	(0.009)			(0.009)		
N_{SA}		1.216***			1.206***	
		(0.004)			(0.005)	
I_{2014+}				0.949***	0.754***	0.738***
				(0.020)	(0.016)	(0.017)
$I_{R_{NA}}$				0.913***	0.380***	0.383***
				(0.024)	(0.022)	(0.023)
$I_{R_{EU}}$				0.942***	0.313***	0.325***
				(0.024)	(0.023)	(0.024)
$I_{R_{AA}}$				0.746***	0.229***	0.213***
				(0.025)	(0.026)	(0.028)
I_R						
$I_{R_{NA}} \times I_{2014+}$				1.074***	1.007***	1.010***
				(0.024)	(0.023)	(0.024)
$I_{R_{EU}} \times I_{2014+}$				0.955***	1.038***	1.025***
				(0.024)	(0.024)	(0.026)
$I_{R_{AA}} \times I_{2014+}$				1.111***	0.898***	0.936***
				(0.026)	(0.034)	(0.038)
N	602,599	602,599	207,281	602,599	602,599	602,599

Exponentiated coefficients
Standard errors in parentheses
*p<0.1; **p<0.05; ***p<0.01

S2

	Dependent variable:					
	X_{SA}	X_{CIP}	$X_{SA\&CIP}$	X_{SA}	X_{CIP}	$X_{SA\&CIP}$
	(1)	(2)	(3)	(4)	(5)	(6)
y	1.030***	1.002***	1.025***	1.028***	1.012***	1.036***
	(0.0004)	(0.001)	(0.001)	(0.0005)	(0.001)	(0.001)
$\bar{z_j}$	1.488***	1.344***	1.765***	1.428***	1.266***	1.646***
	(0.006)	(0.010)	(0.015)	(0.006)	(0.010)	(0.015)
ln k	0.530***	1.755***	1.132***	0.543***	1.832***	1.188***
	(0.006)	(0.009)	(0.013)	(0.006)	(0.009)	(0.013)
ln w	1.756***	0.889***	1.816***	1.788***	0.889***	1.799***
	(0.008)	(0.015)	(0.021)	(0.008)	(0.015)	(0.021)
N_R	1.763***	6.297***	8.424***	1.853***	2.617***	4.071***
	(0.008)	(0.009)	(0.013)	(0.017)	(0.020)	(0.028)
N_{CIP}	1.429***			1.415***		
	(0.007)			(0.007)		
N_{SA}		1.230***			1.215***	
		(0.005)			(0.005)	
I_{2014+}				1.029***	0.770***	0.795***
				(0.016)	(0.018)	(0.026)
$I_{R_{NA}}$				1.122***	0.405***	0.511***
				(0.020)	(0.025)	(0.035)
$I_{R_{EU}}$				1.192***	0.327***	0.404***
				(0.020)	(0.026)	(0.037)
$I_{R_{AA}}$				0.626***	0.172***	0.156***
				(0.022)	(0.033)	(0.051)
I_R						
$I_{R_{NA}} \times I_{2014+}$				1.053***	1.040***	1.009***
				(0.019)	(0.027)	(0.039)
$I_{R_{EU}} \times I_{2014+}$				1.044***	1.114***	1.035***
				(0.019)	(0.029)	(0.044)
$I_{R_{AA}} \times I_{2014+}$				1.274***	1.081***	1.210***
				(0.024)	(0.048)	(0.075)
N	602,599	602,599	430,801	602,599	602,599	430,801

Exponentiated coefficients
Standard errors in parentheses
*p<0.1; **p<0.05; ***p<0.01

S3

	Dependent variable:					
	X_{SA}	X_{CIP}	$X_{SA\&CIP}$	X_{SA}	X_{CIP}	$X_{SA\&CIP}$
	(1)	(2)	(3)	(4)	(5)	(6)
y	1.033***	1.017***	1.043***	1.036***	1.035***	1.071***
	(0.0004)	(0.001)	(0.002)	(0.0005)	(0.002)	(0.003)
$\bar{z_j}$	0.635***	1.210***	0.838***	0.624***	1.127***	0.750***
	(0.006)	(0.019)	(0.030)	(0.006)	(0.019)	(0.031)
ln k	0.867***	1.740***	1.289***	0.879***	1.861***	1.403***
	(0.005)	(0.016)	(0.026)	(0.005)	(0.016)	(0.026)
ln w	2.258***	0.918***	2.584***	2.261***	0.894***	2.496***
	(0.008)	(0.028)	(0.041)	(0.008)	(0.028)	(0.041)
N_R	1.107***	4.594***	5.094***	0.986***	1.652***	1.924***
	(0.008)	(0.015)	(0.023)	(0.017)	(0.034)	(0.053)
N_{CIP}	1.181***			1.169***		
	(0.007)			(0.007)		
N_{SA}		1.183***			1.171***	
		(0.010)			(0.010)	
I_{2014+}				0.871***	0.735***	0.648***
				(0.016)	(0.030)	(0.047)
$I_{R_{NA}}$				0.872***	0.378***	0.450***
				(0.020)	(0.044)	(0.067)
$I_{R_{EU}}$				0.894***	0.123**	0.132
				(0.020)	(0.055)	(0.085)
$I_{R_{AA}}$				0.725***	0.188***	0.130
				(0.021)	(0.057)	(0.096)
I_R						
$I_{R_{NA}} \times I_{2014+}$				1.063***	0.860***	0.842***
				(0.018)	(0.048)	(0.072)
$I_{R_{EU}} \times I_{2014+}$				1.031***	1.228***	1.039***
				(0.019)	(0.069)	(0.113)
$I_{R_{AA}} \times I_{2014+}$				1.118***	0.646***	0.711***
				(0.021)	(0.092)	(0.160)
N	602,599	602,599	396,471	602,599	602,599	396,471

Exponentiated coefficients
Standard errors in parentheses
*p<0.1; **p<0.05; ***p<0.01

S4

	Dependent variable:					
	Z_p (1)	Z_p (2)	Z_p (3)	Z_p (4)	Z_p (5)	Z_p (6)
ln k	0.413*** (0.002)	0.413*** (0.002)	0.419*** (0.002)	0.434*** (0.003)	0.423*** (0.002)	0.404*** (0.002)
ln w	0.036*** (0.003)	0.041*** (0.003)	0.042*** (0.003)	0.028*** (0.005)	0.056*** (0.004)	0.042*** (0.004)
τ	−0.011*** (0.0001)	−0.011*** (0.0001)	−0.011*** (0.0001)	−0.013*** (0.0002)	−0.010*** (0.0002)	−0.010*** (0.0002)
$I_{X_{SA}}$	0.049*** (0.003)					
$I_{X_{CIP}}$	0.073*** (0.003)					
$I_{X_{Neighboring,SA}}$		0.089*** (0.003)				
$I_{X_{Neighboring,CIP}}$		0.070*** (0.003)				
$I_{X_{Distant,SA}}$			−0.009*** (0.003)			
$I_{X_{Distant,CIP}}$			0.023*** (0.006)			
$I_{X_{SA\&CIP}}$				0.139*** (0.005)		
$I_{X_{Neighboring,SA\&CIP}}$					0.134*** (0.006)	
$I_{X_{Distant,SA\&CIP}}$						0.045*** (0.011)
N	824,306	824,306	824,306	357,859	551,771	526,904
R^2	0.101	0.102	0.100	0.130	0.090	0.092
Adjusted R^2	0.092	0.092	0.091	0.109	0.076	0.077
Standard errors in parentheses:						*p<0.1; **p<0.05; ***p<0.01

S5

	Dependent variable:					
	Z_p	Z_p	Z_p	Z_p	Z_p	Z_p
	(1)	(2)	(3)	(4)	(5)	(6)
ln k	0.413***	0.413***	0.419***	0.434***	0.423***	0.404***
	(0.002)	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)
ln w	0.036***	0.041***	0.042***	0.028***	0.056***	0.042***
	(0.003)	(0.003)	(0.003)	(0.005)	(0.004)	(0.004)
τ	−0.011***	−0.011***	−0.011***	−0.013***	−0.010***	−0.010***
	(0.0001)	(0.0001)	(0.0001)	(0.0002)	(0.0002)	(0.0002)
$I_{X_{SA}}$	0.049***					
	(0.003)					
$I_{X_{CIP}}$	0.073***					
	(0.003)					
$I_{X_{Neighboring,SA}}$		0.089***				
		(0.003)				
$I_{X_{Neighboring,CIP}}$		0.070***				
		(0.003)				
$I_{X_{Distant,SA}}$			−0.009***			
			(0.003)			
$I_{X_{Distant,CIP}}$			0.023***			
			(0.006)			
$I_{X_{SA\&CIP}}$				0.139***		
				(0.005)		
$I_{X_{Neighboring,SA\&CIP}}$					0.134***	
					(0.006)	
$I_{X_{Distant,SA\&CIP}}$						0.045***
						(0.011)
N	824,306	824,306	824,306	357,859	551,771	526,904
R^2	0.101	0.102	0.100	0.130	0.090	0.092
Adjusted R^2	0.092	0.092	0.091	0.109	0.076	0.077
Standard errors in parentheses:						*p<0.1; **p<0.05; ***p<0.01