Heterogeneity in Knowledge Flows of Regions: Impact on Invention Quality

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Knowledge flows as outcome of search?

Region and firm boundaries

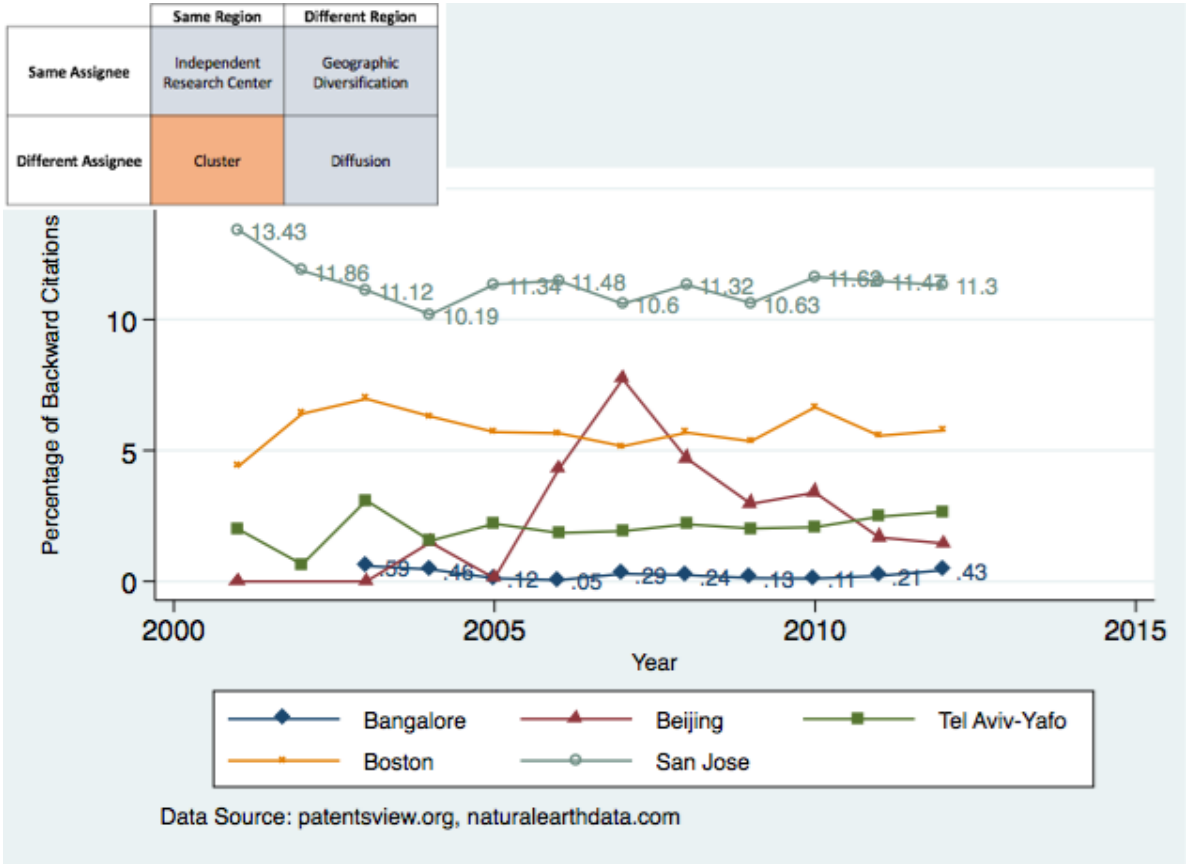
	Same Region	**Different Region**
Same Assignee	Independent Research Center	Geographic Diversification
Different Assignee	Cluster	Diffusion

Categories of knowledge flows

Research Question

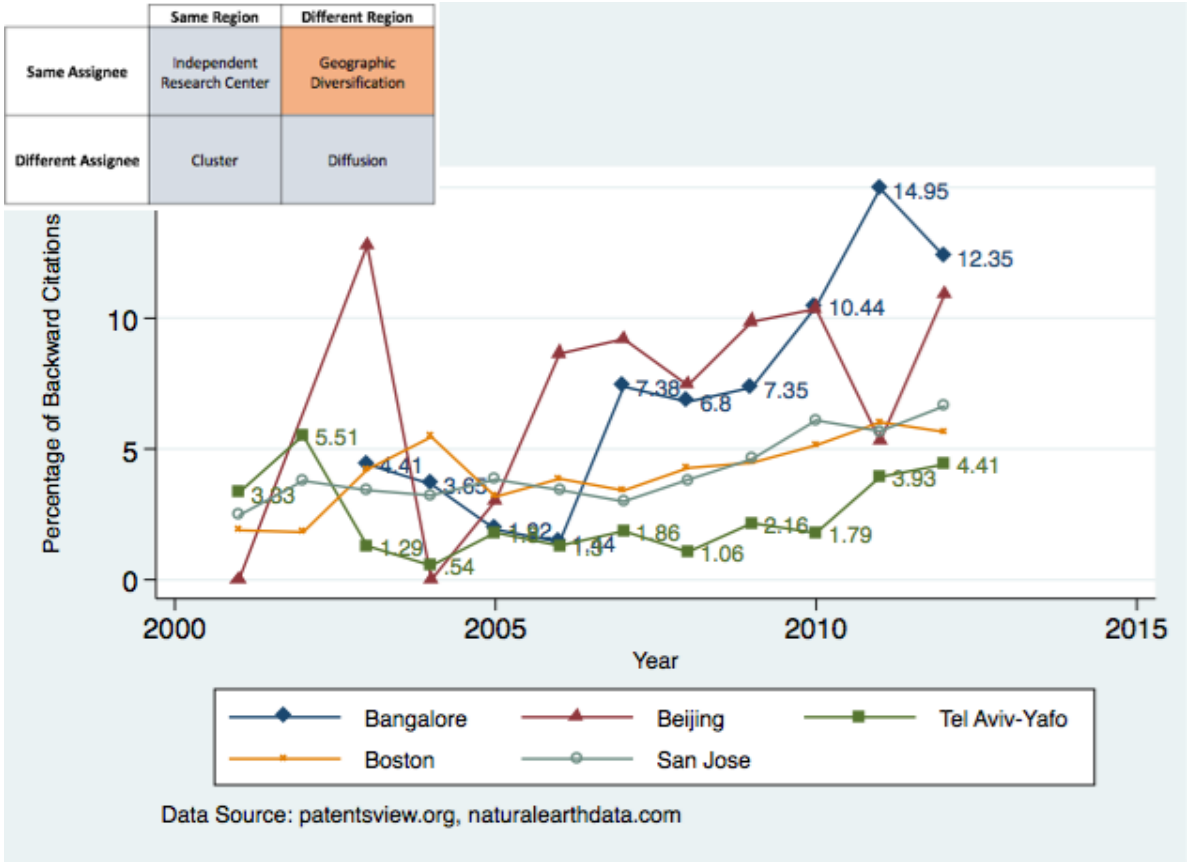
How do the **nature** *of knowledge flows in a region affect the* **quality** *of inventions generated in the region?*

Heterogeneity in knowledge flows of clusters



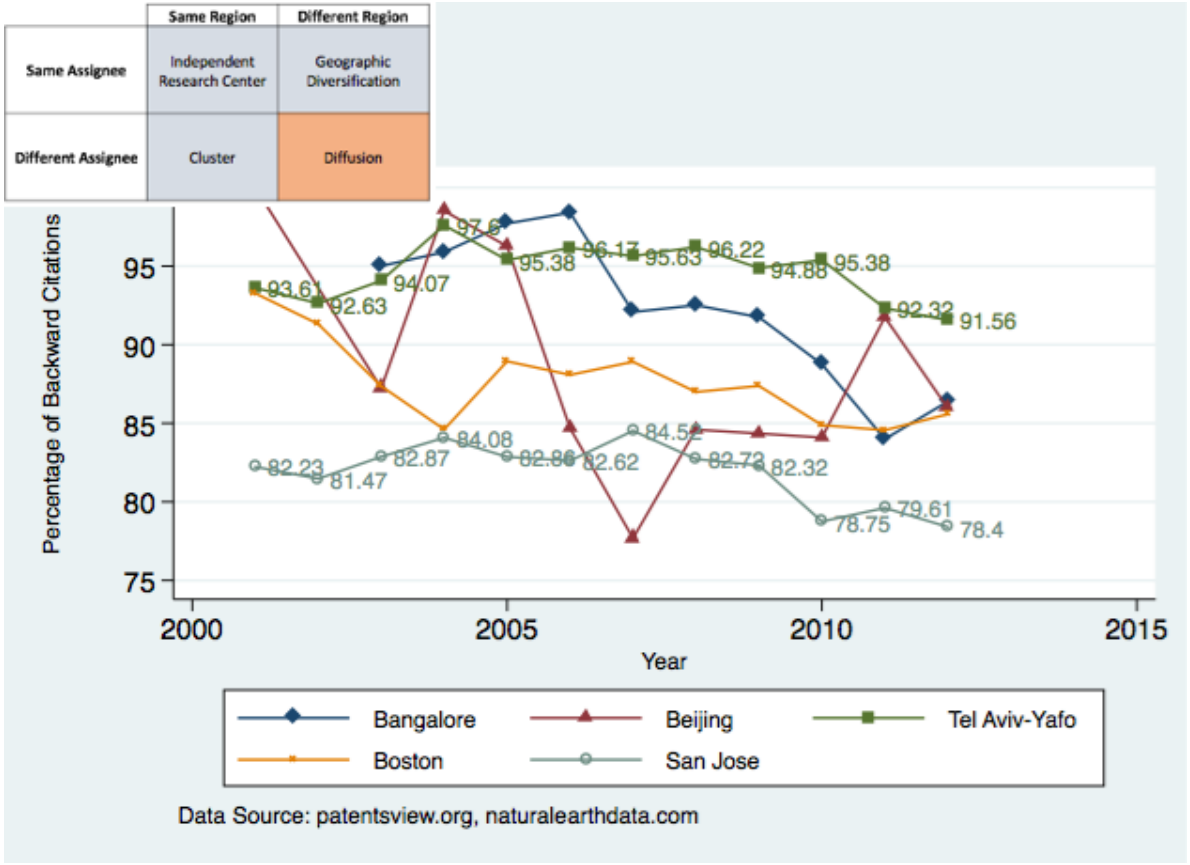
Clusters

Heterogeneity in knowledge flows in geographic diversification



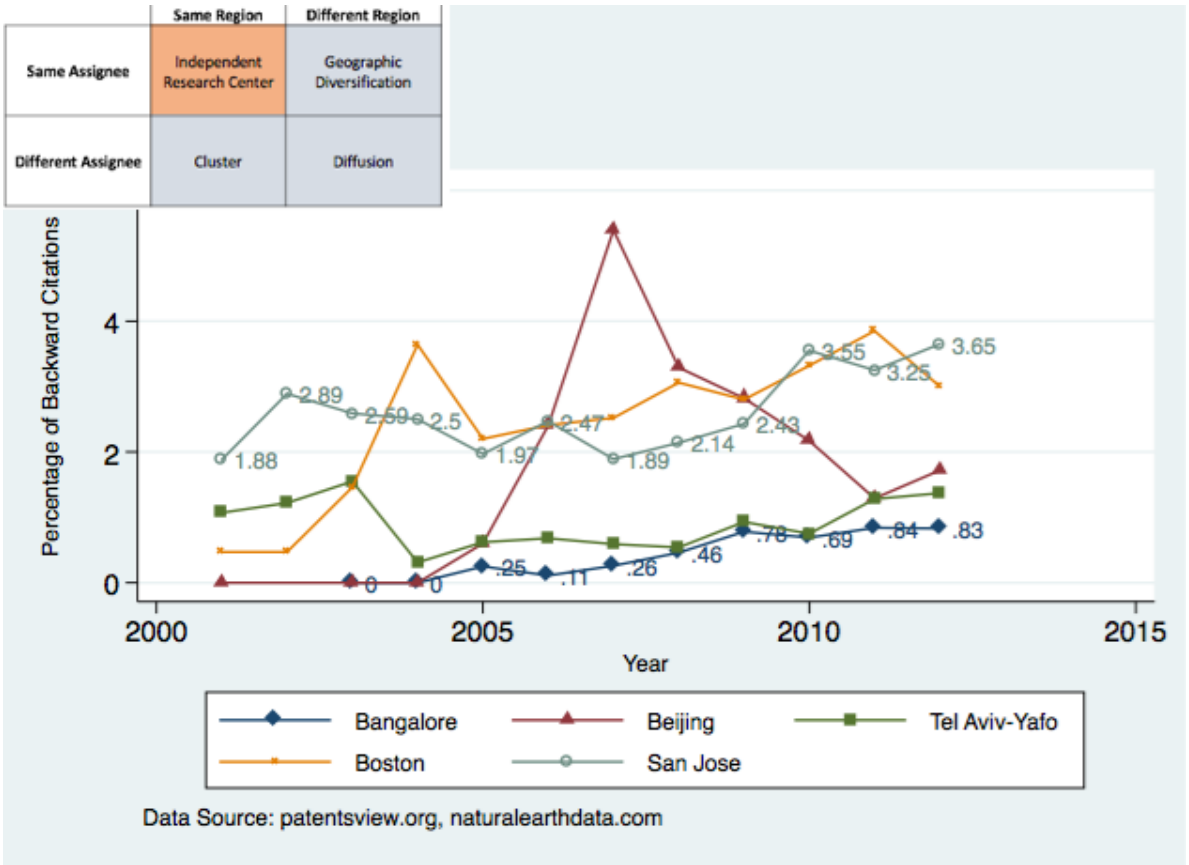
Geographic Diversification

Heterogeneity in knowledge flows under diffusion



Diffusion

Heterogeneity in knowledge flows of independent research centers



Independent Research Centers

Prior art on knowledge flows

Patent citation analysis

Economic Geography Literature

- Knowledge spillovers are localized (Jaffe, Trajtenberg, & Henderson, 1993)
- Innovation is more spatially concentrated than is production (Feldman, 1994)

International Business Literature

- Firms profit from offshoring R&D by leveraging better organizational linkages (Zhao, 2006)
- Subsidiary - MNC parent flows are as strong as MNC parent - Subsidiary knowledge flows (Singh, 2007)

Research Question

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Categories of knowledge flows

Underlying effects across region and firm boundaries

	Same Region	Different Region
Same Assignee	(+) Specialization (-) Lack of Related Variety	(+) Agglomeration Benefits (+) Complementary Assets
Different Assignee	(+/-) Marshallian Externalities (+/-) Jacobs Externalities (-) Incremental Innovation (Schumpeter 1942)	(+/-) Social proximity (+/-) Complexity of search

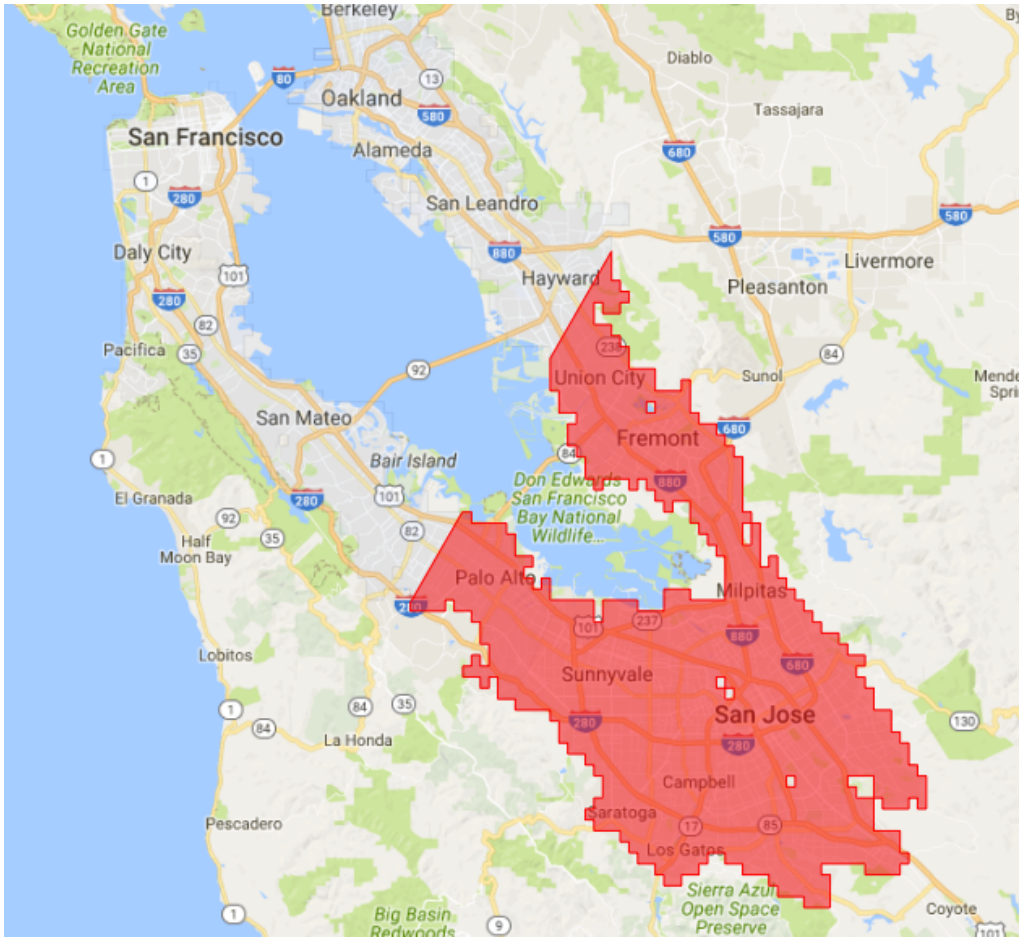
Underlying effects affecting of knowledge flows

On the Localization of Knowledge Spillovers

- Proximity is beneficial due to lower costs of collaboration, opportunities for serendipitous encounters
- Tacit knowledge is not easily transferred across long distances
- Institutions and Regional innovation systems contribute to localization of knowledge flows
- Related variety (Boschma & Iammarino, 2009; Frenken, Oort, & Verburg, 2007; Jacobs, 1969) in urban clusters promotes generation of new ideas

Geographic Mapping

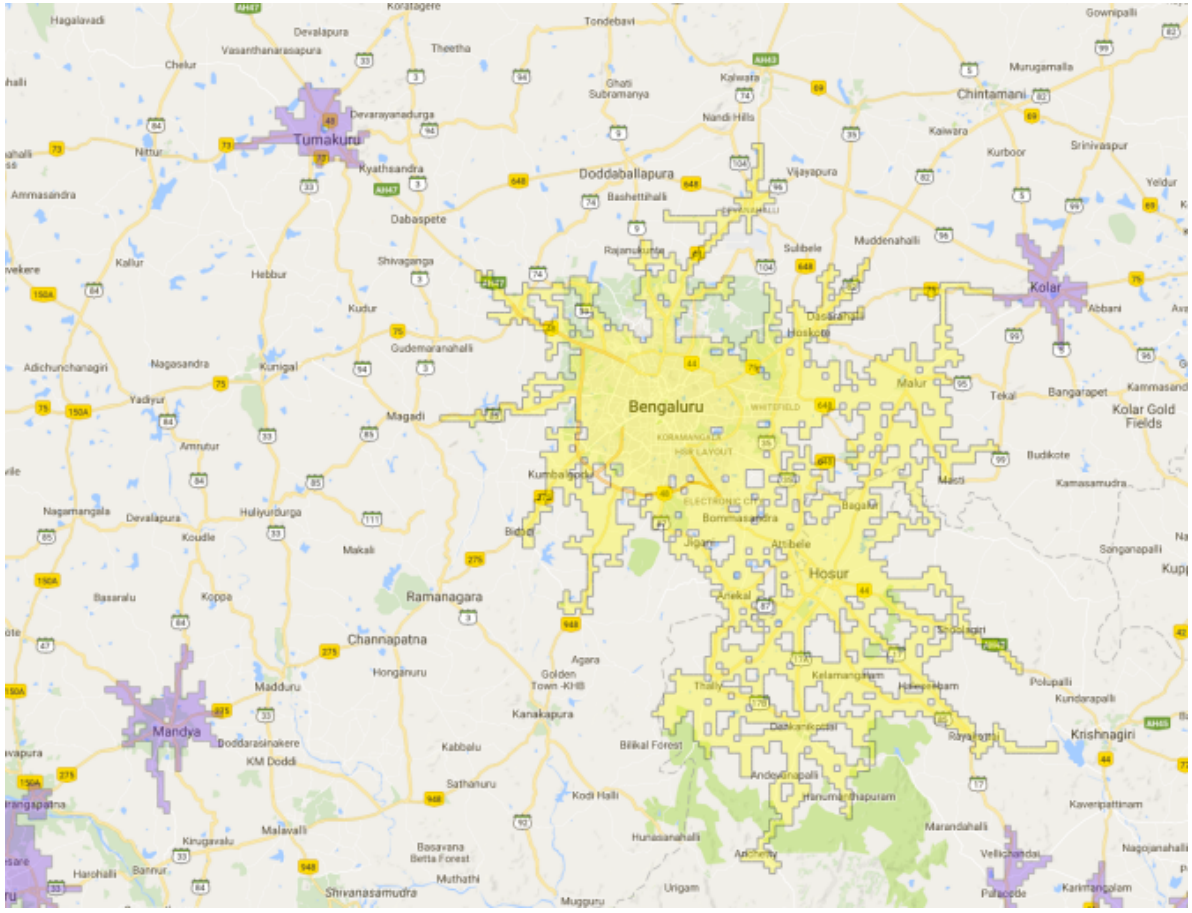
San Jose



Geographic Definition of San Jose, CA

Geographic Mapping

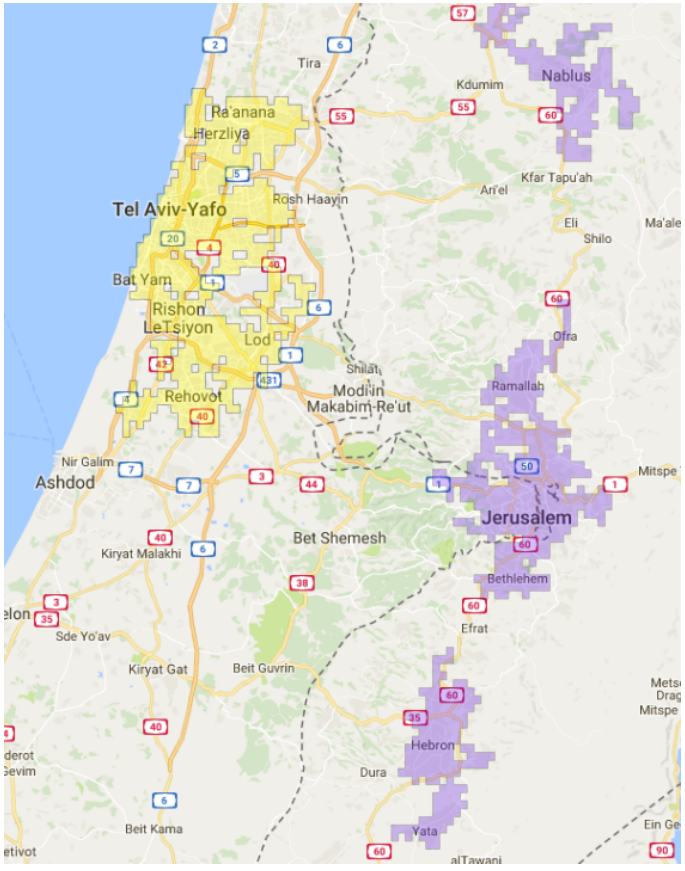
Bangalore



Geographic Definition of Bangalore

Geographic Mapping

Tel Aviv-Yafo



Geographic Definition of Tel Aviv-Yafo

Data sources and estimation

- Data Source: Patents from USPTO, source: patentsview.org
- Data Source: Regions using Remote Sensing Data, source: naturalearthdata.com
- Unit of Analysis: Region-Year
- Dependent Variables: Total Citations Received, Non-Self Citations Received
- Independent Variables: Share of citations made within/outside region, within/outside assignee
- Control Variables: Technology subcategories (Hall, Jaffe, & Trajtenberg, 2001), Region fixed effects, Year effects
- Estimation Method: Negative Binomial

Results

Applicant citations

	(1) Total Citations Received	(2) Total Citations Received	(3) Total Citations Received	(4) Non-Self Citations Received	(5) Non-Self Citations Received	(6) Non-Self Citations Received
Share Citations Made[Same Region, Same Assignee]	-0.125	-0.156	-0.0437	-0.0698	-0.0575	-0.113
	(0.372)	(0.468)	(0.809)	(0.613)	(0.782)	(0.560)
Share Citations Made[Same Region, Different Assignee]	-0.0501	-0.250	0.0494	0.214	0.0341	0.267
	(0.677)	(0.305)	(0.704)	(0.052)	(0.889)	(0.035)
Share Citations Made[Different Region, Same Assignee]	0.260	0.316	0.326	0.215	0.209	0.247
	(0.002)	(0.015)	(0.003)	(0.013)	(0.105)	(0.040)
Share Citations Made[Different Region, Different Assignee]	0.00251	0.0382	0.0123	0.0426	0.0336	0.0615
	(0.933)	(0.383)	(0.760)	(0.160)	(0.447)	(0.143)
Log (Total Citations Made)	0.0194	0.0126	0.0220	0.0131	0.00662	0.0152
	(0.000)	(0.031)	(0.000)	(0.002)	(0.258)	(0.012)
Log (Num Patents)	0.788	0.860	0.830	0.799	0.826	0.849
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Log (Patent Pool Size)	-0.124	-0.303	-0.110	-0.0871	-0.157	-0.108
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Constant	-0.911	0.510	-1.368	-1.296	-0.557	-1.677
	(0.000)	(0.002)	(0.000)	(0.000)	(0.002)	(0.000)
Observations	9358	3974	5384	9037	3868	5169
Groups	1359	539	820	1255	503	752
Sample	All Locations	U.S. Locations	Non-U.S. Locations	All Locations	U.S. Locations	Non-U.S. Locations

p-values in parentheses

All models include region fixed effects, year dummies and technology subcategory controls

Contributions

- Examine the effects of search on technology domain (Rosenkopf & Nerkar, 2001)
- Investigate the effect on alternate outcomes, e.g., breakthrough inventions
- Identify the mechanisms underlying the impact of knowledge flows on invention quality

Boschma, R., & Iammarino, S. 2009. Related variety, trade linkages, and regional growth in italy. **Economic Geography**, 85(3): 289–311.

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