Heterogeneity in knowledge flows across regions: Investigating patterns and mechanisms

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February 10, 2017

Abstract

We analyze the pattern of knowledge flows by geographical region and by firm for seven prominent regions. We demonstrate that locations display significant heterogeneity with regard to the relative proportions of local and non-local knowledge flows, and within firm and across firm knowledge flows. Specific patterns idiosyncratic distribution of flows are identified by location and suggestions are made for furthering of theory on the causal contributors of knowledge flows.

1 Introduction

Long recognized that clusters and agglomeration economies play an important role in fostering innovation Agglomeration economies arise due to (Krugman, 1991) labour pooling advantages economies of specialization of local suppliers knowledge spillovers Research Question How do different types of knowledge flows in a region affect the quality of inventions originating in that region?

2 Effects of knowledge flows on quality of inventions

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

Figure 1: 2x2

Same Region, Same Assignee Competence building Local search on both dimensions (within firm and within region) Same Region, Different Assignee Knowledge spillovers Local search

on one dimension (within region) Different Region, Same Assignee Benefits of geographic diversification Local search on one dimension (within firm) Different Region, Same Assignee High exploration, global pipeline Excessive exploration? (Outside firm and outside region) Theoretically, it is not clear: what is the net effect of each type of knowledge flow? which type of flow will have the largest effect?

3 Data and Measures

Metropolitan Statistical Areas (MSA) from the US census Urban areas for world wide locations from Natural Earth Data Patent data from USPTO/ PatentsView Sample: All unique regions from MSA-Urban Areas (3013) Sample: Citations made by applicants Sample: Years 2001 - 2012 Unit of Analysis: Region-Year Dependent Variable: Total Citations Received (till 2015) by patents belonging to Region-Year Independent Variables: Share of Citations Made to Same Region, Same Assignee Same Region, Different Assignee Different Region, Same Assignee Different Region, Same Assignee Controls: Log (citations made total), Log (number of patents in Region-Year), Log (patent pool size in Region-Year), percentage of patents in Region-Year in each HJT technology subcategory (Hall, Jaffe & Trajtenberg 2001)

4 Classification of Citations Made

4.1 Knowledge Flows to Same Region, Same Assignee

4.2 Knowledge Flows to Same Region, Different Assignee

4.3 Knowledge Flows to Different Region, Same Assignee

4.4 Knowledge Flows to Different Region, Different Assignee

5 Results

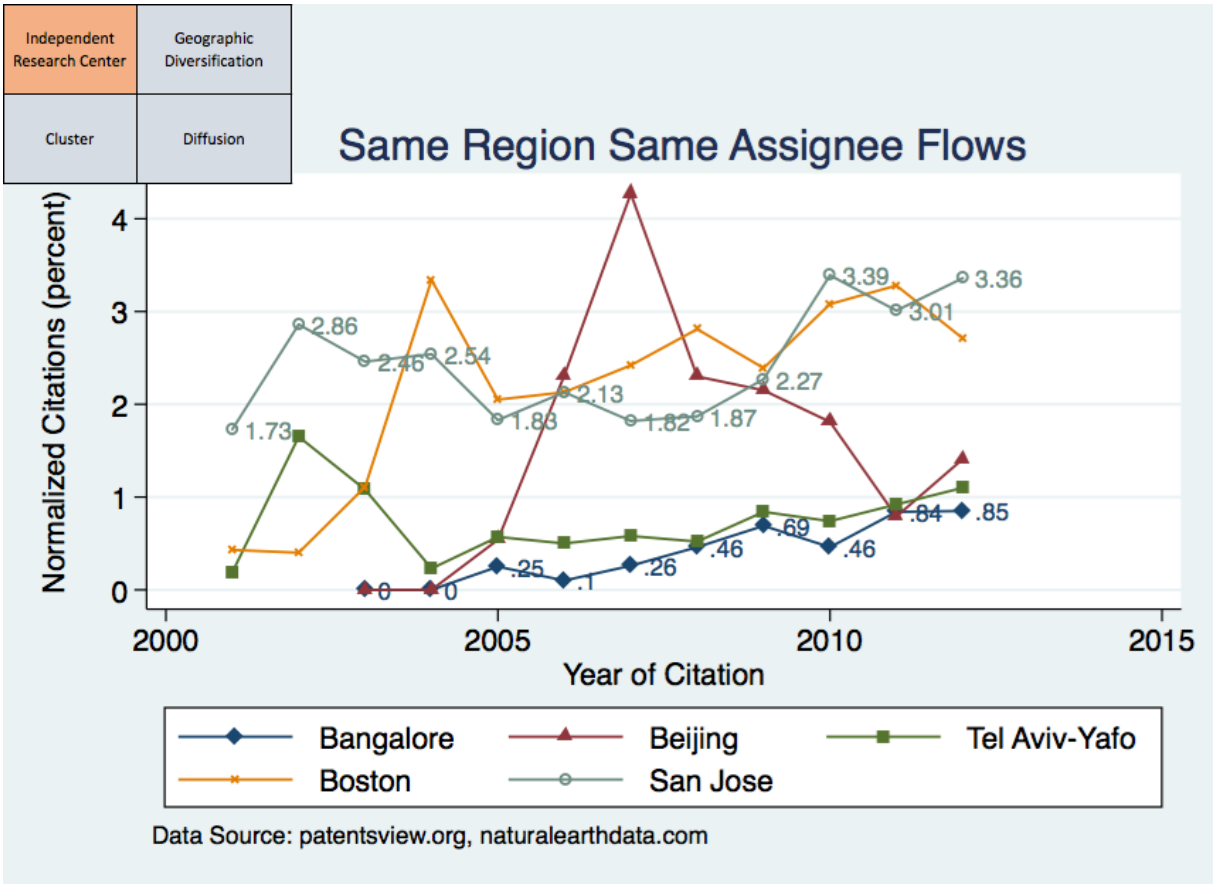

Figure 2: Flows within regions and within assignees

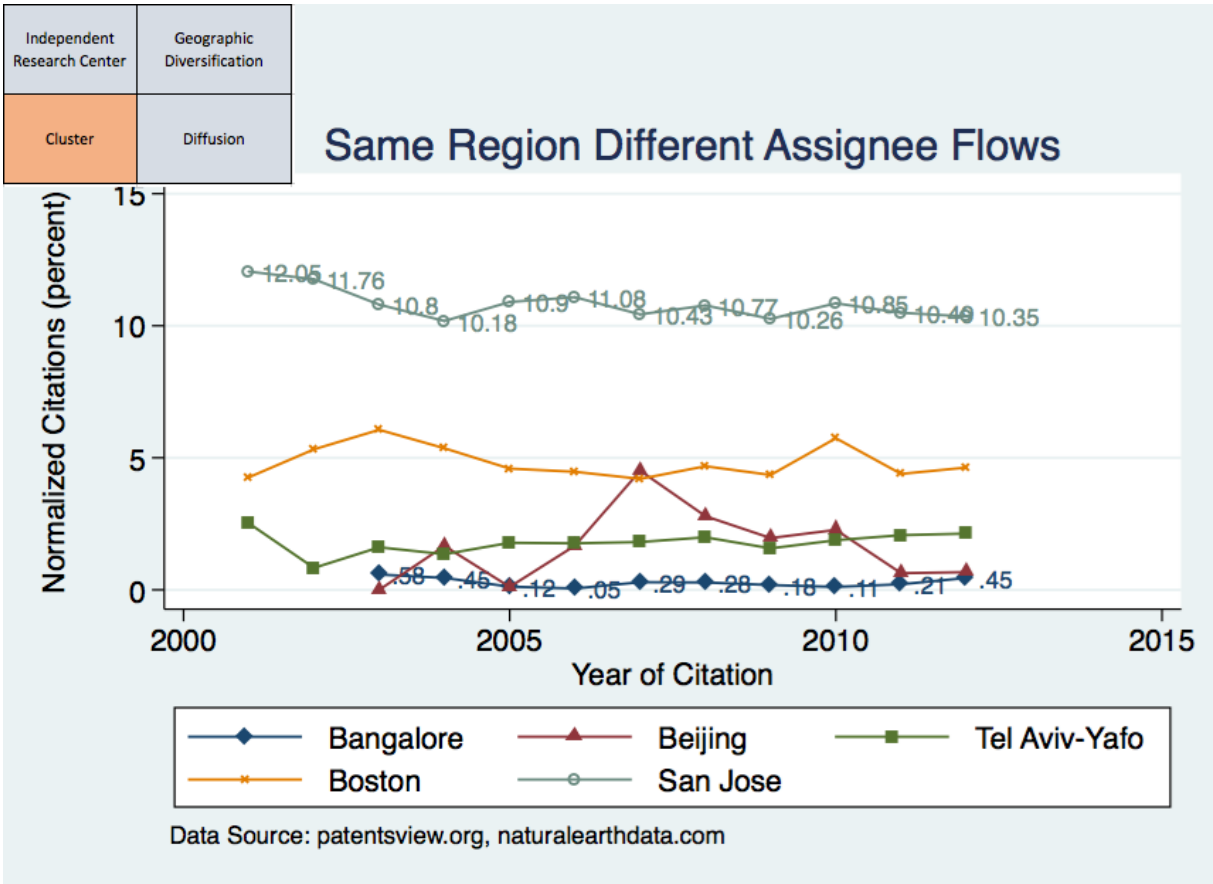

Figure 3: Flows within regions and across assignees

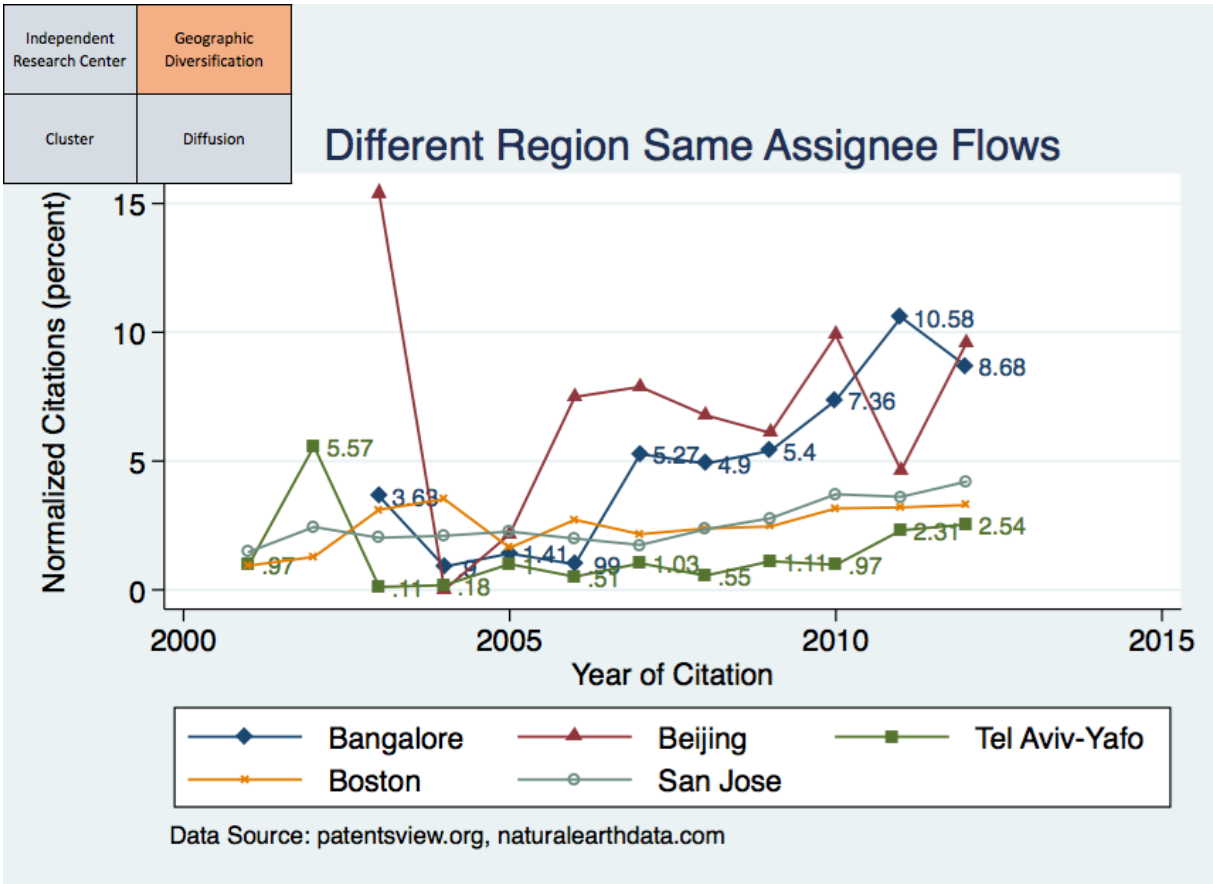

Figure 4: Flows across regions and within assignees

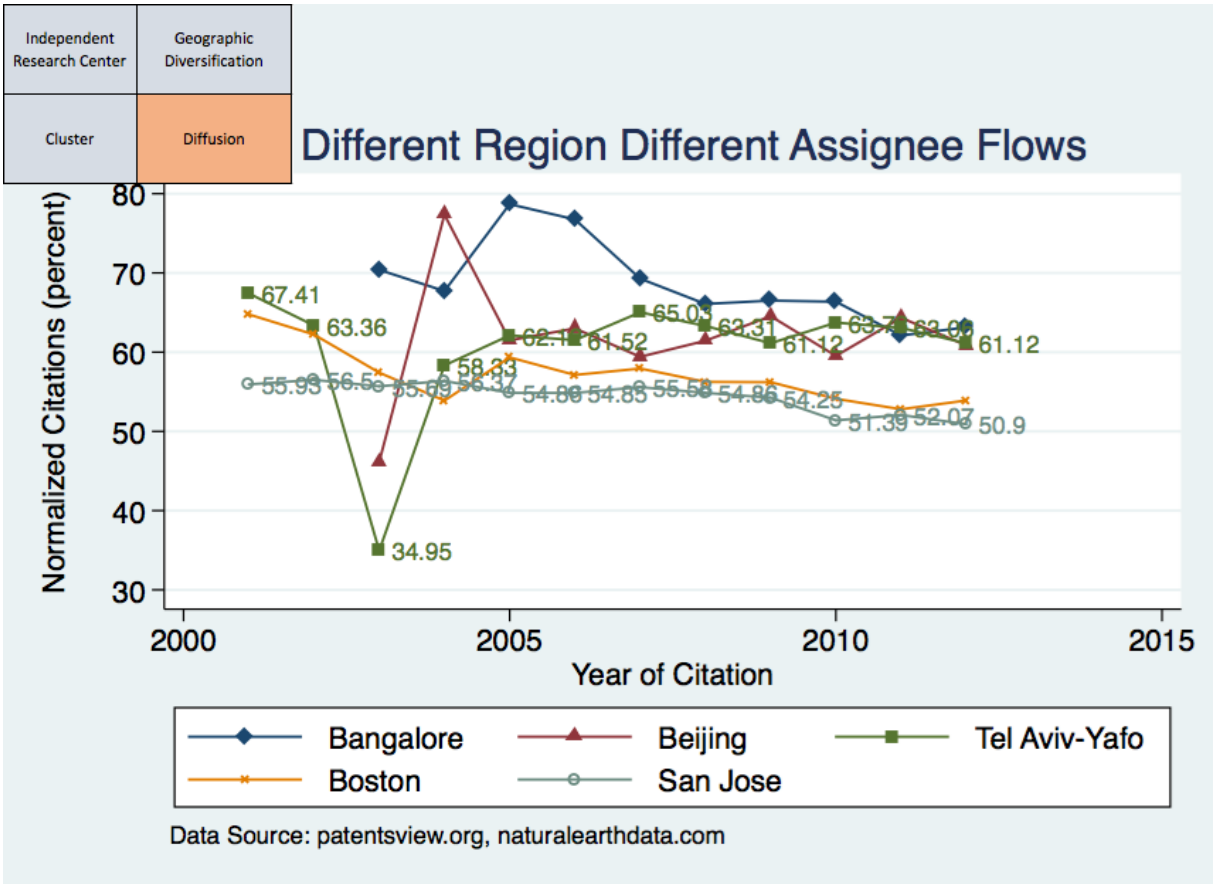

Figure 5: Flows across regions and across assignees

Table 1: Effect of Nature of Citations Made on Self Citations Received*

	(1) Self Citations Received	(2) Self Citations Received	(3) Self Citations Received
Self Citations Received			
Share Citations Made[Same Region, Same Assignee]	-0.0999	-0.324	0.175
	(0.733)	(0.475)	(0.651)
Share Citations Made[Same Region, Different Assignee]	-1.120	-1.718	-0.657
	(0.000)	(0.001)	(0.073)
Share Citations Made[Different Region, Same Assignee]	0.592	0.255	0.834
	(0.000)	(0.328)	(0.000)
Share Citations Made[Different Region, Different Assignee]	0.0226	-0.00949	0.0546
	(0.737)	(0.916)	(0.578)
Log(Total Citations Made)	0.0402	-0.00108	0.0537
	(0.000)	(0.926)	(0.000)
Log (Num Patents)	0.692	0.881	0.696
	(0.000)	(0.000)	(0.000)
Log (Patent Pool Size)	-0.0113	-0.187	-0.0109
	(0.719)	(0.001)	(0.796)
Constant	-2.745	-2.557	-2.637
	(0.000)	(0.000)	(0.000)
Observations	7979	3557	4422
Groups	1003	441	562
Sample	All Locations (UC)	US Locations (UC)	Non-US Locations (UC)

p-values in parentheses

* Results reported are from a priliminary analysis

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

UC - Urban Centers definition obtained from naturalearthdata.com

6 Discussion

Preliminary findings No evidence that local knowledge spillovers lead to higher quality inventions Building on knowledge from outside the firm and outside the region improves invention quality Limitations Using patent data to measure knowledge flows Definition of regions (any systematic biases in identifying regions can create biases in measures of within and outside region knowledge flows) Future work Analysis at level of firm-year rather than region-year Look at the additional dimension of technology (within and outside technological domain) Other measures of invention outcomes (e.g., breakthrough inventions) Why don?t local knowledge spillovers have any effect on invention quality?