Location as a Factor in a For-Profit Firm's Decsion to Engage in Open Science

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INTRODUCTION

Although knowledge is often defined as a resource that can provide a substantial competitive advantage to a firm, it is often the case that many for-profit firms choose to engage in open science through the publication of their research findings for use by the larger community. Research suggests, however that such engagement is not done naïvely but with an intent to minimize the negative effects of spillover (Simeth & Raffo 2013) and is not simply a by-product of a firm's existing knowledge discovery activities, but rather reflects a deliberate organizational strategy (Ding, 2011; Simeth & Lhuillery, 2015) for purposes that, while nonpecuniary in nature, never the less serve a benefit to the firm (Hicks, 1995). Two purposes for such engagement highlighted in the literature include the increasing interdependence with academic scientists (McMillan, Narin, & Deeds, 2000; Simeth & Raffo, 2013) and the recruitment and retention of highly skilled internal researchers (Liu & Stuart, 2014; Sauermann & Roach, 2014).

Industries have always been geographically clustered for multiple reasons, however, Audretsch and Feldman (1996), years ago noted that in industries where innovation plays a greater role this clustering is often related to dependence on knowledge spillover either from universities or the movement of skilled labor. Today we often find high tech industries clustered on both the East and West coasts of the United States (Csomós & Tóth, 2016) near prominent universities and high quantities of skilled workers.

Given that both these features have been suggested as reasons for-profit firms engage in open science, **this study proposes that the closer a for-profit firm is located to a prominent university the more likely it will be to engage in open science through the publication of research findings.**

METHODS

This study analyzes the distance between 804 US high tech firms and US universities housing the top 25 computer science/mathematics departments as determined by the CWTS Lieden University Rankings (www.leidenranking.com). Firms were determined based on a set of optimal Standard Industrial Classification (SIC) codes (Kile & Phillips, 2009). The publication records of each firm were acquired from SCOPUS for the years 2011-2015. Distribution statistics were calcualted *(Table 1)* and binary logistic models were constructed to predict firm publication give location *(Table 2)*.

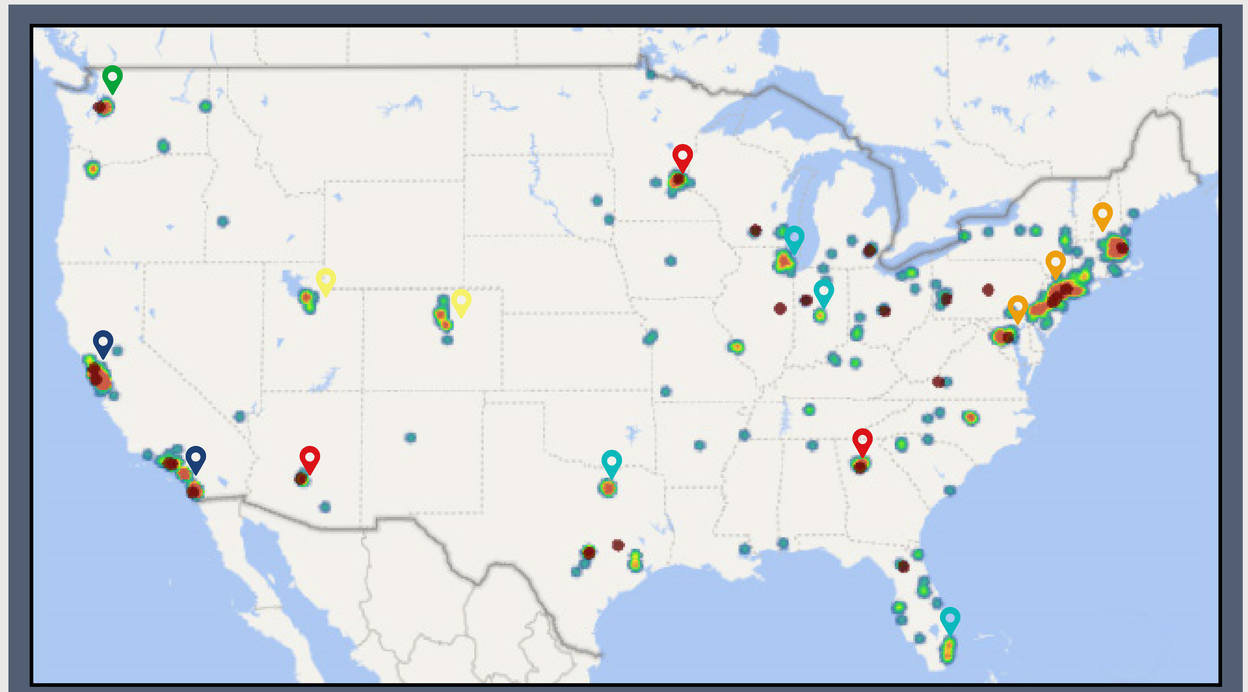
TABLE 1:
Distribution of Firms by Distance to Prominent University

Distance [a]	n Firms	n Firm published	% Firms published
<5 km	65	51	78.5%
5-25 km	310	217	70.0%
26-75 km	184	113	61.4%
76-150 km	61	37	60.7%
>150 km	184	93	50.5%
Total	804	511	63.6%

[a] Distance from closest university with a top 25 Computer Science/Mathematics Department.

RESULTS

- Distribution statistics for the dataset show that 79% of the firms located less than five kilometers from a prominent university published research findings.
- The percentages of firms publishing drops significantly, as distance increases. Between five and twenty-five kilometers, the percentage of firm's publishing is 70% and at greater than 150 kilometers only 50% of firms had published research findings.
- Modeling using binary logistic regression predicts that firms located within five kilometers of a prominent university are1.6 times more likely to publish than firms beyond that distance and that firms located more than 150 kilometers from a prominent university are 0.4 times less likely publish than those within the five kilometer radius.
- When firms were plotted on a map, hot spots appear, as expected, on both the East and West coasts. Athough there are also some other interesting areas.
  - Many firms that publish are located in California around San Francisco and in and between Los Angeles and San Diego. Most of these firms are in close proximity to one of the three University of California campuses (Los Angeles, San Diego, and Berkley) on the CWTS list or Stanford University.
  - Seattle Washington is also a hot spot for firms who publish, which is in the same place as the University of Washington, also among CWTS' top 25.
  - On the East coast, there a number of firms who publish around Boston and down the coast to New York, Philadelphia, and Washington DC. Universities in the area on the list include MIT, Columbia, Rutgers, Princeton, and the University of Maryland.
  - Smaller hot spot areas which engulf university areas include Minneapolis, Phoenix, and Atlanta.
  - Hot spots for which there are few close universities include Chicago, which is more than 225 kilometers from both the University of Wisconsin and the University of Illinois; Indianapolis, which is 100 kilometers from Purdue University, Dallas, which is more than 300 kilometers from both the University of Texas at Austin and Texas A&M; and Miami, which is 540 kilometers from the University of Florida.
  - Several spots stand out with high firm publication activity far from prominent universities, these include, Denver, where the closest prominent university is more than 900 kilometers away, in Minnesota and Salt Lake City where the closest prominent University is more than 800 kilometers away, in Arizona. Both of these places, however, are near major universities not on the CWTS list.



For-Profit Firm Poximity to Universities:
Hot spots resprent for-profit firms who published reserachers findings between 2011-2015. Red dots respresent universities housing the top 25 Computer/Mathematics Departments as compiled by the CWTS Lieden University Rankings (www.leidenranking.com).

TABLE 2:
Binary Logistic Regression Models based on Firm Publication

	Model 1	Model 2 [c]
Independent Variables [b]		
< 5 km	.875 *(.3174)***	
5-25 km		-.575 *(.3317)*
26-75 km		-.895 *(.3446)***
76-150 km		-.940 *(.4105)**
>150 km		-1.335 *(.3435)****
Control Variables		
firmSize	.495 *(.0861)****	.473 *(.0871)****
firmAge	-.012 *(.0040)***	.009 *(.0042)**
Intercept	-.414 *(.2042)**	.461 *(.3446)*
X^2 [d]	802.833***	803.263***

[a] Standard errors are in parentheses (significance levels: *** p < 0.001, ** p < 0.01, * p < 0.05). [b] Distance from closest university with a top 25 Computer Science/ Mathematics Department. [c] The <5km variable is the reference variable in this model. [d] The X^2 statistics used here is the Pearson Chi-Square.

CONCLUSIONS

Although geography is known to correlate with a firm's innovation potential (Audretsch & Feldman, 1996; Csomós & Tóth, 2016), the present study presents strong evidence for a geographical factor influencing a for-profit firm's decision to engage in open science through the publication of their research findings. Additionally, it sets the stage for further research identifying the relationship between recruitment of internal researchers and university collaboration in both firm's publishing and location decisions.

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