Spinoffs and Clustering

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If You Look for Industry Clusters, You Find Spinoffs

Geographic clustering of industries is often attributed to agglomeration economies:

- pooling of labor;
- co-location of suppliers and producers;
- localized spillovers of technological knowledge.

But these accounts do not explain why industry clusters typically grow through the entry of spinoff firms, many of which can trace their heritage back to a single successful early entrant.

Unanswered Questions

- Why do firms agglomerate especially in innovative industries?
- Why is so much of the entry driving the growth of agglomerative clusters coming in the form of spinoffs?
- And why are these spinoffs typically more successful, often becoming the industry leaders?

Our Explanation

Firms grow and spinoffs form through the discovery of new submarkets based on innovation.

- Spinoffs locate close to their parents – this generates clustering.

Innovation leads to more innovation, a positive feedback cycle.

- Rapid innovation opens the door for spinoffs to enter, driving the entire region's growth.

Innovations build on what came before.

- Spinoffs initially produce in submarkets similar to their parents'.
- Spinoff performance correlates with parent's performance.
- Spinoffs from a particularly successful early entrant are especially well-positioned to become industry leaders themselves.

Look at Famously Clustered Industries

- Automobiles (Detroit)
- Tires (Akron)
- Semiconductors (Silicon Valley)
- Disk drives (Silicon Valley)
- Biotherapeutics (San Diego, San Francisco, Boston)

Patterns in Clustered Industries

1. More innovative industries have more often become highly clustered.
2. Clusters typically were characterized by an early successful firm and then grew subsequently through entry.
3. A greater percentage of entrants in the clusters than elsewhere were spinoffs.
4. Spinoffs accounted for a disproportionate share of the leaders in the clusters relative to their share of entrants overall.
5. Clusters prospered after spinoffs entered, even while in some cases the flagship firm that seeded the region subsequently declined.

Patterns in Clustered Industries

6. Spinoffs performed better than other entrants.
7. Larger firms spawned spinoffs at a higher rate.
8. Spinoffs from larger firms were superior performers.
9. Spinoffs that entered at a larger size tended to perform better.
10. Spinoffs in clusters outperformed spinoffs elsewhere.
11. Spinoffs initially produced similar types of products as their parents.

Assumptions about Innovation

- An industry is composed of submarkets discovered through innovation
- Each submarket x is characterized by a set of attributes $\{s : s \in x\}$
- A firm may innovate on any of its submarkets by incorporating a single new attribute – if already producing in submarket x, it might discover $x' = x \cup \{s\}$
- These innovations occur randomly (as a continuous-time Poisson branching process with mean intensity λ)

Intuition about Innovation

- Firms build off of what they know – diversified firms generally develop products in related submarkets
- A firm's capabilities evolve as it gains more experience and diversifies
- More diversified firms have more opportunities and tend to discover innovations more rapidly

Assumptions about Market Conditions

- A firm monopolizes any submarket it discovers
- Output and profit in a submarket both depend on demand, which is random and conditioned by the attributes that characterize the submarket
- Each attribute s has a quality z_s (some innovations are better than others)
- Output has a *mixed geometric distribution* with parameters z_s for each $s \in x$
- Most innovations fail to generate any profit at all ($z_s < \frac{1}{2}$)

Assumptions about Spinoff Formation / Firm Entry

- Firms sometimes fail to pursue their innovations, and employees who worked towards discovery sometimes start out on their own to pursue them – we'll say this happens with probability α
- If the discovered submarket turns out to be profitable, a spinoff is able to enter
- Outside startups occasionally try to enter single-attribute submarkets (appearing as random arrivals)
- Outside startups enter in geographic region r at a rate proportional to the share of overall economic activity in the region, f_r
- Spinoffs always locate in the same region as their parents

Intuition about Spinoff Formation

- Spinoffs originate within incumbent firms from new ideas
- We have built in that spinoffs initially produce in submarkets that are similar to their parents' (Fact #11)
- Spinoff's and parent's product lines will always share a common thread, but may gradually diverge

Clustering

Ellison and Glaeser (1997) propose an index of clustering γ_t that controls for the size distribution of firms so that if all firms choose their locations randomly (i.e., in our model, if there were no spinoffs), then $E(\gamma_t) = 0$ (no clustering)

Our Theorem 1: Conditional on the existence of spinoffs, $E(\gamma_t) > 0$ (there is clustering)

Intuition: spinoffs "attracted" to regions by the presence of their parents

Insight: spinoffs locating near their parents can generate clustering, even in the absence of traditional agglomerative forces

More Innovative Industries Tend to Become More Clustered

Theorem 2: At any time t, $E(\gamma_t)$ is increasing in λ

Intuition: more innovative industries provide more opportunities for spinoffs to form, and spinoffs give rise to clustering

Implication: Fact #1

More Spinoffs in the Leading Regions

Theorem 3: There is a positive correlation between a region's share of the profits in the industry at a given time and the number of spinoffs subsequently spawned there

Intuition: leading regions generate more innovations and hence more spinoffs

Implication: a greater percentage of the entrants in clusters than elsewhere are spinoffs (Fact #3)

Spinoffs Lead to Growth

Theorem 4: (Assuming homogeneous attribute quality and) controlling for the current size of a region, the number of spinoffs in the region correlates with the region's subsequent growth

Intuition: comparing two regions with the same total profits, the one with more past spinoffs can be expected to have discovered more new submarkets and hence to continue to be more innovative

Implication: spinoffs stimulate the growth of highly clustered regions (Fact #5)
(Silicon Valley vs. Dallas)

A Virtuous Cycle of Spinoffs and Cluster Growth

Theorem 5: The profit upon entry of the initial firm in a region is predictive of the number of spinoffs subsequently spawned there

Intuition: the initial entrant's profit is a signal of the quality of the first attribute discovered in the region, which will influence the success of potential spinoffs pursuing submarkets that retain this attribute (in order to form)

Implication: Regions with flagship firms are expected to have more spinoff entrants (and more subsequent growth) (Fact #2)

Spinoffs Perform Better

Theorem 6: The expected profit of a spinoff exceeds the expected profit of an outside startup at the same age

Intuition: the spinoff necessarily enters the industry in a submarket similar to some other submarket that has already proven to be successful for its parent

Implication: Fact #6

Larger Firms Spawn More Spinoffs

Theorem 7: There is a positive correlation between firm profits at a given time and the number of spinoffs that the firm subsequently spawns

Intuition: two common causes

- Expanding into more submarkets generates profits and also more opportunities for discovering innovations that occasionally lead to spinoffs
- Finding high quality submarkets both increases profits and also increases the likelihood that future innovations pursued by potential spinoffs will be successful

Implication: Fact #7

Spinoff Performance

Theorem 8: A spinoff's profit upon entry correlates with its parent's profit, and both are predictive of the spinoff's subsequent growth

Intuition: the submarkets they enter are similar

Implication: Facts #8 and #9

Better Performers in the Leading Regions

Theorem 9: Total profit in a spinoff's home region when it enters correlates with the spinoff's future profits (even after controlling for the parent's profit)

Intuition: other firms in the region may share a heritage and thus tend to pursue similar submarkets

Implication: spinoffs inside a cluster are more successful (Fact #10)

Implication (alongside Theorem 6): spinoffs disproportionately became industry leaders in the largest clusters (Fact #4)

The Absence of Agglomeration Economies

We have shown that spinoffs lead to clustering, even in the absence of agglomeration economies

Still, there is much evidence that firms in clusters perform better, that entry is concentrated in these regions, and that firms in related industries tend to locate near each other as well

Each of these patterns could be driven exclusively by spinoffs

In many industries (autos, tires, book publishing, fashion design), the superior performance of firms in clusters does not extend beyond spinoffs

Big Picture

Traditional economic theory might explain more entry in clusters because of the advantages of clustering and remains pretty silent on why the entrants are spinoffs

Typical perspective: observed patterns of clustering are due to firms' incentives

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New perspective: opportunity matters as much as incentives

Innovation creates the opportunity for spinoff firms to form and for an industry cluster to grow

Mixed Geometric Distribution

$$\text{Prob}\left(\underline{\eta}(x) = \eta\right) = \frac{1}{|x|}\sum_{s \in x} z_s^{\eta}(1 - z_s) \quad \text{for } \eta \in \{0, 1, 2, \ldots\}.$$

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