Spin-off Formation and Cluster Dynamics

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Industry evolution, entry, and cluster formation

- Observation:
  - Spin-off formation appears to play a crucial role in many clusters
  - Big examples: Silicon Valley (“Fairchildren”), Detroit (automobiles), Akron (tires)

- Basic dynamics of spin-off-based cluster formation:
  1. Historical accident: successful early firm enters in a region (possibly based on prior presence of related industry)
  2. Superior firms have more / better spin-offs → enhance regional birth potential
  3. Like other entrants, spin-offs tend to enter locally → clustering based on entry of indigenous firms, not attraction of entrants from elsewhere
  4. Cluster performance explained by superiority of its firms

→ In principle, cluster performance explicable without reference to agglomeration economies
A Model (1)

- **Klepper (unpublished working paper, 2007)**
- **Variant of Klepper’s model of industry evolution (AER, 1996)**
  - Basic idea: R&D reduces average cost of production \(\rightarrow\) larger firms conduct more R&D \(\rightarrow\) larger firm more profitable \(\rightarrow\) grow further
  - Through growth process, advantages to early entrants
  - Over time, new entry dries up as \(p\) ↓ and increasing advantages of incumbents
  - Further \(p\) ↓ induces exit from the industry \(\rightarrow\) shakeout
- **Simplification: no product innovation (cf. Klepper, RAND 2002)**
- **Two levels of R&D productivity:**
  - H (high) vs. L (low)
- **Pre-entry experience affects R&D productivity**

A Model (2)

- **Assumptions on the effects of pre-entry experience:**
  1. **Related diversification:**
     - Firms in related industries may be H- or L-types
     - All have same probability to diversify as L-types in the new industry
     - H-types also have positive probability to diversify as H-types in new industry
  2. **Spin-offs from industry incumbents:**
     - All firms in industry have same probability of spawning L-type spin-offs
     - H-type incumbents also have positive probability to spawn H-type spin-offs
  3. **Other de novo entrants (“startups”)** are always L-types
- **Also assume geographic inertia: all diversifiers and spin-offs enter at the location of their origination**
A Model (3)

- **Implied phases of industry evolution:**
  1. Both H and L-types enter
  2. Only H-types able to enter (experience no longer discernible in performance)
  3. No more entry
  4. Disproportional exit of L-types and late entrants

- Model predicts that industry eventually dominated by early H-types → can only be diversifiers and spin-offs from successful incumbents
- Due to geographical inertia: industry clusters at locations of early H-entrants

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The Akron Tire Cluster


Part II: Firm Performance
Model Implications for Firm Performance

- **Hazard of firm exit determined by entry time and firm type**
  - Only spin-offs and diversifiers can be on average have lower hazard
- **Akron: many early entrants; diversifiers and spin-offs**
  -> On average expect lower hazard in Akron
- **When distinguishing by entry types**
  -> Expect lower hazard only for Akron spin-offs and diversifiers
- **When competence of entrants is fully controlled**
  -> Expect same average hazard in Akron and elsewhere

Empirical approach

- **Perform analysis on national level, some background info available only for Ohio firms**
- **Use Gompertz specification for firm’s exit hazard:**
  \[ h(\tau) = \exp[\beta_0 + \beta x] \cdot \exp[(\gamma_0 + \gamma x)\tau] \]
  - Allows hazard to vary with firm’s age
  - Age-dependent hazard terms included for entry cohorts and diversifier dummy (Klepper, RAND 2002)
  - Acquired firms treated as censored exits
- **Perform series of model specifications to distinguish agglomeration effects from effects of firm background**
Firm performance: effects of agglomeration

- Model 1 suggests agglomeration (localization) effect on performance
- Model 2: Adding Akron control wipes out general agglomeration effect
- No agglomeration effect in counties close to Akron
- No effect of proximity to Detroit
- Model 3: Akron effect not confined to set of key early entrants

<table>
<thead>
<tr>
<th></th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Other tire firms (cnty)</td>
<td>-0.025** (.010)</td>
<td>0.006 (.012)</td>
<td></td>
</tr>
<tr>
<td>Akron</td>
<td>-0.667*** (.299)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Neighboring Counties</td>
<td>0.232 (.206)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;200 miles to Detroit</td>
<td>-0.092 (.173)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Akron_ini</td>
<td></td>
<td>-0.620*** (.190)</td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>-1.759*** (.054)</td>
<td>-1.807*** (.067)</td>
<td>-1.795*** (.049)</td>
</tr>
<tr>
<td>Age</td>
<td>-0.046*** (.005)</td>
<td>-0.042*** (.005)</td>
<td>-0.046*** (.005)</td>
</tr>
<tr>
<td>Obs.</td>
<td>4786 (532 firms)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Log-likelihood</td>
<td>-802.519***</td>
<td>-793.258***</td>
<td>-800.609***</td>
</tr>
</tbody>
</table>

Note: standard errors in parentheses; ***p ≤ 0.01; **p ≤ 0.05; *p ≤ 0.10

Performance: effects of pre-entry experience

- Model 4: Akron effect robust to entry time, background controls
- Model 5: Akron effect limited to Akron spin-offs
- Model 6: Entry size as proxy of spin-off capabilities → Akron spin-off effect no longer significant

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<thead>
<tr>
<th></th>
<th>Model 4</th>
<th>Model 5</th>
<th>Model 6</th>
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</thead>
<tbody>
<tr>
<td>Akron_ini</td>
<td>-0.455*** (.195)</td>
<td>-0.097 (.194)</td>
<td>-0.095 (.194)</td>
</tr>
<tr>
<td>Akron spin-off</td>
<td>-1.062** (.416)</td>
<td></td>
<td>-0.522 (.406)</td>
</tr>
<tr>
<td>Diversifying firm</td>
<td>-0.592*** (.205)</td>
<td>-0.607*** (.208)</td>
<td>-0.605*** (.208)</td>
</tr>
<tr>
<td>Spin-off</td>
<td>-0.355* (.190)</td>
<td>-0.128 (.202)</td>
<td></td>
</tr>
<tr>
<td>Large TopSpin-off</td>
<td></td>
<td></td>
<td>-1.702* (.1020)</td>
</tr>
<tr>
<td>Medium TopSpin-off</td>
<td></td>
<td></td>
<td>-0.601** (.286)</td>
</tr>
</tbody>
</table>

(see paper for cohort effects and age-dependent coefficient estimates)

Log-likelihood | -718.523 | -715.952 | -713.885
Discussion

The Akron Tire Cluster Revisited

- **Evolution of Akron tire cluster**
  - Initial set of high-performance tire firms (Goodrich et al.)
  - Better firms have more, and more successful, spin-offs
  - All firms (including spin-offs) tend to locate close to their origin
  - Self-reinforcing concentration based on historical accident

- **Why did Akron firms perform better?**
  - Performance explained by entrants’ background (spin-offs from leading firms; diversifiers)

- **Why so little entry in Detroit?**
  - U.S. Rubber plant moves to Detroit only in 1905
  - U.S. Rubber was not an ideal source of spin-offs
Akron and Detroit

- Clusters emerge at roughly the same time in closely related industries
- Striking parallels between both clusters (Klepper, MS 2007)
  - Initial successful entrant (B.F. Goodrich / Olds Motor Works) (note, however, that Detroit “missed” the auto industry’s first years)
  - Four additional early successful Detroit entrants had links to Olds; were prolific breeders of spin-offs
  - 50 out of 61 Detroit spin-offs located also there
  - Detroit effect on performance was limited to spin-offs
  - Controlling for spin-off background, Detroit spin-offs performed similar to spin-offs located elsewhere
- Similar role of spin-off entry also in more contemporary clusters, most notably Silicon Valley (Klepper in Audretsch and Strom (eds.) forthc.)

Intershop and the Emerging E-Commerce Software Industry in Jena

(Buenstorf and Fornahl, JEE 2008)
Motivation

- **Observations**
  - For investors, dot.com shares mostly were a disastrous investment
  - Regional perspective: Single firms can trigger clusters and regional development

- **Research Question**
  - How does a temporarily successful dot.com affect regional conditions and spin-off activities?

- **Approach**
  - Qualitative case study of former German dot.com star: **Intershop Communication**

The Rise and Fall of Intershop (1)

- **Before March 10, 2000**
  - Poster child of Germany’s New Economy
  - Founded in 1992 in Jena by three founders
  - Early producer of e-commerce software
  - First East German firm with substantial VC funding
  - Dot.com boom supported rapid growth
  - Peak stock market value € 11.1 billion with 1,218 employees, € 123 million revenue

- **After March 10, 2000**
  - 70% of stock market value lost on a single day
  - All three founders resigned
  - Expert consensus: Intershop had high quality products, but weak marketing and strategy
  - Downsizing: at present, 222 employees, € 15 million revenue
The Rise and Fall of Intershop (2)

- Development of number of employees (10 year period)
- Development of stock price in Euro (3 year period)

Software Spin-offs from Intershop (1)

- **Serial Entrepreneurship**
  - All three Intershop founders started new (one or several) firms
  - One of them located in U.S., other ventures even stayed in Intershop Tower
  - Hired key managers and employees from Intershop
  - Business models:
    - Demandware: VC-based attempt to develop and market on-demand e-commerce software
    - ePages: further development of first-generation Intershop software
    - Pixaco (Snapfish): online photo development; 2005 acquired by HP
    - AdiCash: online payback system
    - Argiv: venture capital for web-related businesses
Software Spin-offs from Intershop (2)

- At least 40 spin-offs in total; 25 located in Jena or its environs
- Employee spin-offs reflect Intershop experiences
- Examples:

<table>
<thead>
<tr>
<th>Spin-off</th>
<th>Intershop position</th>
<th>Business model / field of activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clienthouse</td>
<td>Customer and partner services</td>
<td>Customer relation management consulting</td>
</tr>
<tr>
<td>Cresco Services</td>
<td>CFO</td>
<td>Financial consulting services</td>
</tr>
<tr>
<td>J-media</td>
<td>Press relations</td>
<td>Standard software for marketing / PR</td>
</tr>
<tr>
<td>Moccafish</td>
<td>User interface design</td>
<td>Interface design, e-learning</td>
</tr>
<tr>
<td>Towerconsult</td>
<td>VP Human resources</td>
<td>Human resource consulting (recruiting); software development</td>
</tr>
<tr>
<td>Xceptance</td>
<td>Quality control</td>
<td>Quality management for software development</td>
</tr>
</tbody>
</table>

Software Spin-offs from Intershop (3)

- Evidence for employee learning
  - Business models related to e-business (but no employee spin-off entered in Intershop’s core market)
  - Interviews: Founders report exploitation of Intershop knowledge and experiences
- Intershop supported spin-off emergence
- Social network based on common Intershop experience
- TowerByte eG as a privately organized technology park
  - Cooperative of currently 28 software firms
  - Joint infrastructure services in Intershop Tower
  - Labor pooling and knowledge spillovers
  - Reputation and size effects; lobbying efforts
  - Cooperative has attracted non-spin-off member firms from Jena and elsewhere
Software Spin-offs from Intershop (4)

- **Overall assessment**
  - Substantial number of spin-offs emerged
  - Evidence for inheritance of Intershop knowledge
  - Spin-offs formed by top employees closer to Intershop strategy / core market
  - Intershop’s peculiar situation: Failure breeds success?
    - Intershop spin-offs as necessity spin-offs → expected to be less successful
    - Intershop problems in part due to industry crisis
    - Downsizing → Existence of high quality capabilities and opportunities that Intershop itself could not exploit

Discussion

- **Spin-off-based cluster formation**
  - Intershop created new technological trajectory in Jena
  - Intershop crisis triggered spin-off process (“necessity spin-offs”)
  - Spin-offs’ business models reflect Intershop experience → on-the-job learning
  - Majority of spin-off entrepreneurs stayed in the region
  - Spin-off activities helped to keep IT-related human capital in the region

→ **Albeit at smaller scale, basic dynamics are similar to Akron, Detroit, Silicon Valley etc.**
→ **Subtle difference: extreme modularity → entry in submarkets**
→ **From regional perspective, Intershop seems to have lasting positive effects**
Spin-offs and Cluster Policy

- If our results describe general patterns of cluster formation:
  - What policies would seem promising?
  - What policies would seem less promising?

Some Considerations on Policy

1. The spin-off process
   - Spin-offs are substantial fraction of high-tech firm formation (30-40 % and more)
   - Do spin-offs have adverse effects on training / openness in parent firms?
   - Can/should public policy encourage spin-off formation (e.g., non-compete clauses; trade secrets)?

2. Spin-off-based cluster formation
   - Hayekian knowledge issues and openness for local developments
   - Can/should spin-off-based clustering be supported by policy makers?
   - Industry (lifecycle)-specific cluster policies?
   - What role for academic institutions?