Entry and Entrants in Innovative New Industries

Steven Klepper
Carnegie Mellon University
What Do We Know about Entry and Entrants in Innovative New Industries?

Steven Klepper
Carnegie Mellon University
Evolution of New U.S. Industries

- **What determines an industry’s market structure?**
  - 4 extreme cases of shakeouts & evolution of oligopoly
    - Autos, tires, penicillin, television
  - Exception that proves the rule--lasers

- **How do dynamic industry regional clusters emerge?**
  - 3 celebrated agglomerations
    - Semiconductors & Silicon Valley
    - Autos & Detroit (Michigan)
    - Tires & Akron (Ohio)

- **Where do great companies come from?**
  - Autos—Ford, General Motors, Chrysler
  - Tires—Goodyear, Firestone
  - Semiconductors—Intel, Texas Instruments

- **What drives a nation’s growth?**
  - Growth industries: autos, tires, antibiotics, televisions, semiconductors
  - Modern decline—autos, tires, televisions
Implications

- Management practice
- Competition policy
- Economic Theorizing
Nano-economics

- **Identify every entrant**
  - Year of entry, exit
  - Base location (branches)
  - Ownership, acquisitions
  - Initial capitalization, products (some cases)
  - Market shares (of leaders)

- **Origin of entrants**
  - Intellectual origin
    - Diversifiers & prior products
    - Spinoffs—primary & secondary parents
    - Other startups
  - Geographic origin—prior work/residence

- **Entry decision**
  - Identify potential diversifiers & characteristics
  - Impetus for spinoffs & founders

- **Innovators & nature of innovations**
  - Industry and firm innovation & patent history
Shakeouts: U.S. Auto Industry

1930: Ford, GM, Chrysler > 80% Market
Shakeouts: U.S. Auto Industry

1930: Ford, GM, Chrysler > 80% Market
Shakeouts: U.S. Tire Industry

1930: Goodyear, Uniroyal, Goodrich, Firestone > 70% Market
Entry

- How does entry evolve?
  - Opportunities change over time

- Which entrants succeed—role of entry timing
  - Ascending to ranks of leaders
U.S. Tire Entry

Total Entry
1901 -1911 = 105
1912 -1925 = 406
1926 -1980 ≈ 0

Minimal Entry
Entry of the Leaders
Entry of the Leaders

- Uniroyal
- Goodyear
- Firestone
- Kelly S
- Goodrich
- Penn
- Fisk

Timeline:
- 1895
- 1900
- 1905
- 1910
- 1915
- 1920
- 1925
- 1930
- 1935

Values:
- 0
- 20
- 40
- 60
- 80
- 100
- 120
Entry of the Leaders
Entry of the Leaders

- Uniroyal
- Kelly S
- Firestone
- Goodyear
- McGraw
- Ajax
- Mansfield
- Dayton
- Goodrich
- Penn
- Fisk
Entry of the Leaders

- 1895 1900 1905 1910 1915 1920 1925 1930 1935
- Goodrich
- Fisk
- Penn
- Uniroyal
- Kelly S
- Firestone
- McGraw
- Ajax
- Mansfield
- Dayton
- Republic
- Republic
Entry of the Leaders

Total Leaders/Entry
1901-11 = 11/105 = .10
1912-25 = 5/406 = .01
U.S. Television Entry

Total Entry
1946 - 1948 = 72
1949 - 1957 = 84
1958 - 1989 ≈ 0

Minimal Entry
Entry of the Leaders

RCA
GE
Philco
Motorola
Admiral

Entry of the Leaders

- RCA
- GE
- Philco
- Motorola
- Admiral
- Magnavox
- Zenith
Entry of the Leaders

1946-1948 = 7/72 = .10
1949-1957 = 1/84 = .01
24 Major U.S. Innovations—1946-1979
Who Innovates?
24 Major U.S. Innovations—1946-1979

- RCA
- GE
- Philco
- Motorola
- Admiral
- Zenith
- Magnavox
- Sylvania
- CBS—1 innovation
- Advent 1975—½ innovation
Theory of Early Mover Advantage

- Grow first & become larger
- Size conditions incentives to innovate
- Self reinforcing process
  - Bigger do more innovation
  - Better products, lower costs → grow bigger
- Eventually no entrant can compete
- Then later entrants forced to exit
Origin and Breeding of the Leaders

- Early leaders tend to be diversifiers
  - TVs—radio firms
  - Penicillin—drug & chemical producers
  - Tires—rubber producers
  - Semiconductors—electronics firms

The Best of the Best—Radio Firms Entering TV Industry
- 265 radio producers at start of tv industry
- Determinants of entry
  - Size—top radio producer (> $1 million in assets)
  - Years of experience
  - Producer of home radio
- Same factors conditioned longevity
### Changing of the Guard: Autos & Semiconductors

<table>
<thead>
<tr>
<th>Early Auto Leaders</th>
<th>Early Semiconductor Leaders</th>
</tr>
</thead>
<tbody>
<tr>
<td>Locomobile</td>
<td>GE, RCA, Raytheon, Sylvania, West., Philco</td>
</tr>
<tr>
<td>Olds Motor Works/GM</td>
<td>Motorola</td>
</tr>
<tr>
<td>Cadillac/GM</td>
<td>Texas Instruments</td>
</tr>
<tr>
<td>Jeffery/Nash</td>
<td>Fairchild</td>
</tr>
<tr>
<td><strong>Later Top 10</strong></td>
<td><strong>Later Top 10</strong></td>
</tr>
<tr>
<td>Ford</td>
<td>Signetics</td>
</tr>
<tr>
<td>Reo</td>
<td>Analog Devices</td>
</tr>
<tr>
<td>Buick/GM</td>
<td>AMI</td>
</tr>
<tr>
<td>Maxwell-Briscoe/Chrysler</td>
<td>National</td>
</tr>
<tr>
<td>Willys</td>
<td>Harris</td>
</tr>
<tr>
<td>Studebaker</td>
<td>Intel</td>
</tr>
<tr>
<td>Brush</td>
<td>AMD</td>
</tr>
<tr>
<td>E.R. Thomas-Detroit/Chr.</td>
<td>Mostek</td>
</tr>
<tr>
<td>Hupp</td>
<td>Micron Technology</td>
</tr>
<tr>
<td>Hudson</td>
<td>VLSI Technology</td>
</tr>
<tr>
<td>Dodge/Chrysler</td>
<td>LSI Logic</td>
</tr>
<tr>
<td>Chevrolet/GM</td>
<td></td>
</tr>
<tr>
<td>Durant Motors</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Changing of the Guard: Autos & Semiconductors

### Early Auto Leaders
- Locomobile
- Olds Motor Works/GM
- Cadillac/GM
- Jeffery/Nash

### Later Top 10
- Ford
- Reo
- Buick/GM
- Maxwell-Briscoe/Chrysler
- Willys
- Studebaker
- Brush
- E.R. Thomas-Detroit/Chr.
- Hupp
- Hudson
- Dodge/Chrysler
- Chevrolet/GM
- Durant Motors

### Early Semiconductor Leaders
- GE, RCA, Raytheon, Sylvania, West.,Philco
- Motorola
- Texas Instruments
- Fairchild

### Later Top 10
- Signetics
- Analog Devices
- AMI
- National
- Harris
- Intel
- AMD
- Mostek
- Micron Technology
- VLSI Technology
- LSI Logic

**Spinoffs Reign!**
Origin & Performance of Spinoffs

Firm fertility: Main Determinants

- Top firm/market share +
- Detroit/Silicon Valley +
- Non-spinoff entry rate +
- Acquired by outside firm +
- Acquired by competitor +
- Age +
- $Age^2$ - } Max at middle age

Performance of Spinoffs

- Superior to other startups
- Better firms have better spinoffs
Disagreement Theory of Spinoffs

- **Spinoffs result from unrecognized good ideas**
  - Better firms--better employees w/better ideas
  - So better firms have more & better spinoffs
  - Spinoffs distinctive performers

- **Firms are formed of like-minded people**
  - No chance of spinoffs initially
  - Information accumulation eventually eliminates disagreements
  - So spinoffs more likely at middle age

- **Acquisitions ↓ influence of decision makers**
  - Larger disagreements after acquisitions

- **Spinoffs provide outlets for dissidents w/ good ideas**
  - Financed by better judges of ideas/talent
Dynamic Industry Clusters

Silicon Valley Semiconductor Share

Detroit Auto Share

Ohio Rubber & Tire Share

Santa Clara Pop. 1950 = .3 million 1980 = 1.3 million

Wayne County Pop. 1900 = .3 million 1930 = 1.9 million

Summit County Pop. 1900 = 70,000 1930 = 350,000

40 years
Common Patterns

- **Great early firm**
  - Autos—Olds Motor Works in Detroit
  - Tires—Goodrich in Akron
  - Semiconductors—Fairchild in Silicon Valley

- **Spinoff driven growth**
### Region Make the Firms or Firms Make the Region?

**New Automobile Firms—”Initial” Capital**

<table>
<thead>
<tr>
<th>Initial Capital &gt;</th>
<th>Detroit Spinoffs</th>
<th>Non-Detroit Spinoffs</th>
<th>Detroit Startups</th>
<th>Non-Detroit Startups</th>
</tr>
</thead>
<tbody>
<tr>
<td>$1 million</td>
<td>7.7%</td>
<td>1.1%</td>
<td>0.0%</td>
<td>1.3%</td>
</tr>
<tr>
<td>$300K</td>
<td>17.3</td>
<td>4.4</td>
<td>5.4</td>
<td>3.6</td>
</tr>
<tr>
<td>$50K</td>
<td>53.9</td>
<td>38.9</td>
<td>37.8</td>
<td>19.3</td>
</tr>
</tbody>
</table>

**New Ohio Tire Firms—”Initial” Capital**

<table>
<thead>
<tr>
<th>Initial Capital &gt;</th>
<th>Akron Spinoffs</th>
<th>Non- Akron Spinoffs</th>
<th>Akron Startups</th>
<th>Non- Akron Startups</th>
</tr>
</thead>
<tbody>
<tr>
<td>$1 million</td>
<td>7.1%</td>
<td>0.0%</td>
<td>7.1%</td>
<td>0.0%</td>
</tr>
<tr>
<td>$300K</td>
<td>42.8</td>
<td>10.0</td>
<td>14.2</td>
<td>11.8</td>
</tr>
<tr>
<td>$50K</td>
<td>71.3</td>
<td>46.6</td>
<td>49.9</td>
<td>39.3</td>
</tr>
</tbody>
</table>
## Region Make the Firms or Firms Make the Region?

### New Automobile Firms—"Initial” Capital

<table>
<thead>
<tr>
<th>Initial Capital &gt;</th>
<th>Detroit Spinoffs</th>
<th>Non-Detroit Spinoffs</th>
<th>Detroit Startups</th>
<th>Non-Detroit Startups</th>
</tr>
</thead>
<tbody>
<tr>
<td>$1 million</td>
<td>7.7%</td>
<td>1.1%</td>
<td>0.0%</td>
<td>1.3%</td>
</tr>
<tr>
<td>$300K</td>
<td>17.3</td>
<td>4.4</td>
<td>5.4</td>
<td>3.6</td>
</tr>
<tr>
<td>$50K</td>
<td>53.9</td>
<td>38.9</td>
<td>37.8</td>
<td>19.3</td>
</tr>
</tbody>
</table>

### New Ohio Tire Firms—"Initial” Capital

<table>
<thead>
<tr>
<th>Initial Capital &gt;</th>
<th>Akron Spinoffs</th>
<th>Non- Akron Spinoffs</th>
<th>Akron Startups</th>
<th>Non- Akron Startups</th>
</tr>
</thead>
<tbody>
<tr>
<td>$1 million</td>
<td>7.1%</td>
<td>0.0%</td>
<td>7.1%</td>
<td>0.0%</td>
</tr>
<tr>
<td>$300K</td>
<td>42.8</td>
<td>10.0</td>
<td>14.2</td>
<td>11.8</td>
</tr>
<tr>
<td>$50K</td>
<td>71.3</td>
<td>46.6</td>
<td>49.9</td>
<td>39.3</td>
</tr>
</tbody>
</table>
Survival of Spinoffs & Startups in Akron & Elsewhere in Ohio
Survival of Spinoffs & Startups in Detroit & Elsewhere

DETROIT SPINOFFS

NONDETROIT SPINOFFS

DETROIT INEXPERIENCED FIRMS

NONDETROIT INEXPERIENCED FIRMS
Management Practices in Young Innovative Industries

- **Early commitment to innovation**
  - Exploit size advantage if arises
  - Commit early to process as well as product innovation
    - Process most exploits the advantage of size
  - Make your product a “dominant design”
    - Don’t wait for product innovation to slow down

- **Greatest threat is from within**
  - Internal division for dissident employee ideas
  - Corporate spinoffs
    - Recruit outsider investors & managers
Competition Policy for Young Innovative Industries

- Resisting the inevitable may be wasteful
  - Social as well as private advantage to size
    - Greater % socially beneficial innovations undertaken
- What’s good for incumbents may not be good for society
  - Limited vision of incumbents
    - Decline of autos, tires, tvs in U.S. after entry foreclosed
    - Small number of gatekeepers, no outlets for dissidents
  - Spinoffs a key outlet for dissidents
    - Narrow interpretation of trade secrets
Broad Policy Implications

- **Mobility, mobility, mobility**
  - Employee non-compete covenants
  - Trade secret law
  - Free movement of employees
    - Promote founding teams
  - Limited responsibility of founders if fail

- **Clusters not worth promoting**
  - Except perhaps as stimulus to spinoffs

- **Planting seeds?**
  - Basic research support—universities & beyond
  - Universities as source of firms?
Implications for Theorizing About Competition in Innovative Industries

- **Entry exerts limited discipline**
  - Unlimited queue of able potential entrants a myth
    - Heterogeneity in backgrounds, time of entry

- **Entry a vehicle for innovation**
  - Modeling conditions bearing on entry
    - Entrants specialized—e.g., spinoffs
    - Availability of complementary producers important