Innovation, Inequality, and the Commercialization of Research

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University of Nevada, Las Vegas
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Outline

1. Innovation and inequality
2. BDR Effects
3. Self-replicating asymmetries
4. Implications
Innovation and jobs

QuickTime™ and a decompressor are needed to see this picture.

Source: David Rotman (June 12, 2013), How technology is destroying jobs. MIT Technology Review.
Innovation and inequality

Source: David Rotman (June 12, 2013), How technology is destroying jobs. *MIT Technology Review.*
Innovation-driven change

Long-term productivity gains
  • During the transition?
  • Distribution?

Skill-biased technical change
  • CTIs only?

Modes of innovation
  • Forms economic integration

Creative Destruction
  • Political and Economic
Outline

1. Innovation and inequality
2. BDR Effects
3. Inequalities
4. Implications
What is Bayh-Dole?

- Who owns patents from federally funded research?
  - Before: discretion of agency
  - After: research contractors
  - Universities
Patenting in the U.S.

US (domestic only) — left axis
University — right axis
Patenting: Forecast 1980-2005
(with 1963-1979 data)
Bayh-Dole Regime (BDR)

• Stevenson-Wydler 1980 (PL 96-480)
• FTTA 1986 (PL 99-502)
• CAFC 1982 (PL 98-462)
• NCRA 1984 (PL 98-462)
• Hatch-Waxman 1984 (PL 98-417)
• *Diamond v. Chakrabarty* 1980 (447 U.S. 303)
• *Diamond v. Diehr* 1981 (450 U.S. 175)
• Reforms in Financial Sector (ERISA, 74)
• Reforms in International Commerce (Special 301, 1994)
BDR Effects: Efficiency

- Quality of patents
- Crowding-out basic research
- Republic of science
  - Tragedy of anti-commons
  - Research tools
- Perverse incentives
  - Cultural change?
BDR Effects: Tradition

• Ideal type science: Mertonian norms.
• Ideal type university = traditional type
  – Public disclosure of research
  – Faculty defined research agenda
  – Impartiality of research (peer review)
• New values
  – Secrecy
  – Donor defined agenda
  – Conflicts of interest
The role of the university

Richard Levin (American Council of Education March 6, 2011)

• “Congress did not intend to give us the right to maximize profits”
• “…it gave us private-property rights for a public purpose: to ensure that the benefits of research are widely shared.”
BDR Effects: What is missing?

• How are the benefits of innovation distributed?
• Are there distributional outcomes in T2?
Outline

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Nexus: innovation-distribution

• Asymmetries of inputs tend to reproduce in outputs.

• Entrepreneurship
  – Creative destruction.
  – Small businesses

• Industrial Organization of high-tech sectors.
Modes of innovation

• Are there asymmetries in university tech transfer?

• Is tech transfer a catalyst of entrepreneurship?
  – inadvertently strengthening incumbents market power?

• Are high-tech industries concentrated or competitive?
OTTs: Org-isomorphism
Distribution of Licensing Income

Figure 2. Distribution of Licensing Income by University

- Last year (2011)
- Avg last 3 years
- Avg last decade
<table>
<thead>
<tr>
<th>University</th>
<th>Rank by Decade Avg</th>
<th>University</th>
<th>Rank by Decade Avg</th>
<th>University</th>
<th>Rank by Decade Avg</th>
</tr>
</thead>
<tbody>
<tr>
<td>New York Univ.</td>
<td>1</td>
<td>Mount Sinai Hospital</td>
<td>17</td>
<td>Univ. of Illinois at Chicago Urbana &amp; Champaign</td>
<td>33</td>
</tr>
<tr>
<td>Northwestern Univ.</td>
<td>2</td>
<td>CA Institute of Technology</td>
<td>18</td>
<td>Univ. of PA</td>
<td>34</td>
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<tr>
<td>Columbia Univ.</td>
<td>3</td>
<td>Univ. of Utah</td>
<td>19</td>
<td>Washington Univ. St. Louis</td>
<td>35</td>
</tr>
<tr>
<td>Univ. of CA System</td>
<td>4</td>
<td>Harvard Univ.</td>
<td>20</td>
<td>Baylor College of Medicine</td>
<td>36</td>
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<tr>
<td>Princeton University</td>
<td>5</td>
<td>Univ. of Iowa Research Fdn.</td>
<td>21</td>
<td>Iowa State Univ.</td>
<td>37</td>
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<tr>
<td>Emory Univ.</td>
<td>6</td>
<td>Univ. of Michigan</td>
<td>22</td>
<td>Texas A&amp;M Univ. System</td>
<td>38</td>
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<tr>
<td>Stanford Univ.</td>
<td>7</td>
<td>Mount Sinai School of Medicine of NYU</td>
<td>23</td>
<td>Vanderbilt Univ.</td>
<td>39</td>
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<tr>
<td>Wake Forest Univ.</td>
<td>8</td>
<td>Michigan State Univ.</td>
<td>24</td>
<td>Univ. of Chicago (UCTech)</td>
<td>40</td>
</tr>
<tr>
<td>Univ. of Minnesota</td>
<td>9</td>
<td>Research Foundation of State University of New York</td>
<td>25</td>
<td>Tulane Univ.</td>
<td>41</td>
</tr>
<tr>
<td>Massachusetts Inst. of Technology (MIT)</td>
<td>10</td>
<td>Univ. of Georgia</td>
<td>26</td>
<td>Indiana Univ. (ARTI)</td>
<td>42</td>
</tr>
<tr>
<td>Univ. of Washington/Wash. Res. Fdn.</td>
<td>11</td>
<td>Univ. of CO</td>
<td>27</td>
<td>Univ. of Texas at Austin</td>
<td>43</td>
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<tr>
<td>Univ. of Wisconsin at Madison</td>
<td>12</td>
<td>Johns Hopkins Univ.</td>
<td>28</td>
<td>Rutgers The State Univ. of NJ</td>
<td>44</td>
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<tr>
<td>University of Texas System</td>
<td>13</td>
<td>Duke Univ.</td>
<td>29</td>
<td>Wayne State Univ.</td>
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<tr>
<td>Univ. of Rochester</td>
<td>14</td>
<td>Case Western Reserve Univ.</td>
<td>30</td>
<td>Cornell Research Fdn. Inc.</td>
<td>46</td>
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<tr>
<td>Univ. of FL</td>
<td>15</td>
<td>Univ. of Texas Southwestern Med. Ctr.</td>
<td>31</td>
<td>The Curators of the Univ. of Missouri</td>
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<tr>
<td>Univ. of Massachusetts</td>
<td>16</td>
<td>FL State University</td>
<td>32</td>
<td>Univ. of Virginia Patent Fdn.</td>
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</tr>
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</table>
Research Funds & Licensing Income

Figure 4. Total research budget and Licensing NOR.
Research Funds & Licensing Income

Figure 3. Federal Research Funds and Licensing NOR

- Total Fed Res Funds
- NOR
Asymmetries

Distribution of licensing income
- Of 218 OTTs, 132 at a loss
- Stable top 40 earners
- Input-output asymmetries
Why stay in T2 business?

– Not current but expected revenues
– Internal: Manage existing IP portfolio. Train faculty.
– External: Partner in economic development
– **Public mission**: profit motive in check with other values
## PROBIT model of Blockbuster patent as a function of Research Funds

<table>
<thead>
<tr>
<th>Rank According to Research Funds</th>
<th>Probability of NOR&gt;10m</th>
<th>Function of total research funds (TRF)</th>
<th>Function of federal research funds (FRF)</th>
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</thead>
<tbody>
<tr>
<td>4</td>
<td>58.6%</td>
<td>72.9%</td>
<td></td>
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<tr>
<td>10</td>
<td>30.4%</td>
<td>24.8%</td>
<td></td>
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<tr>
<td>20</td>
<td>23.8%</td>
<td>22.6%</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>15.3%</td>
<td>14.9%</td>
<td></td>
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<tr>
<td>40</td>
<td>11.7%</td>
<td>11.8%</td>
<td></td>
</tr>
<tr>
<td>50</td>
<td>9.8%</td>
<td>11.0%</td>
<td></td>
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<tr>
<td>100</td>
<td>5.3%</td>
<td>5.8%</td>
<td></td>
</tr>
<tr>
<td>149</td>
<td>4.0%</td>
<td>4.2%</td>
<td></td>
</tr>
</tbody>
</table>

Estimated using PROBIT mode: Regression of success/failure of blockbuster patent (NOR>$10m) over TRF (intercept -1.766565, slope 0.0013321) and over FRF (intercept -1.744929, slope 0.00185); all estimated coefficients are statistically significant at p<.05. Data Source AUTM 2012
Research is not a lottery

• Re-balance research portfolio
• Cultivate entrepreneurial spirit in campus
• Organizational incentives

Also…

• New T2 business model
New T2 models

• Socially responsible licensing
• “Nurturing” start-ups
  – Legal: IP portfolio
  – Incubator services
  – Experience in negotiation
  – Networking (investors, suppliers)
A new OTT model

Pros
• Easier than selling licenses
• Higher deferred income
• Prestige: fostering entrepreneurship

Cons
• Hard to sell lackluster start-ups
• Early large negative cash-flow
• Univ. going out of traditional roles
Lessons from history

• Venture Capital: evidence from survey data (Gans, Hsu, Stern, 2000)
• Biotechnology
• Creative destruction
  – Baumol: “Why Computers Get Cheaper and Health Care Doesn't”
1. Innovation and inequality
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Three levels

- University
- Federal Agency
- Congress: changes to the statute
Universities

- Explain role of university beyond “economic rationalization”
  - Education:
    - Labor force but also consumers.
    - Civic education.
  - Public mission not-for-profit character
  - Equal opportunity (social mobility)
Universities

- Emphasis on best practices (9 points)
- Socially responsible licensing programs
- Preference for non-exclusive licenses
  - Research tools, humanitarian, environmental.
  - Multi-site research and commercialization
  - Patent Pools
- Nurturing start-ups: Longer horizon for investments
Policy: Federal Agencies

- Declare preference for non-exclusive licenses from their research grants
- Invite grantees to voluntarily opt-out from aggressive licensing practices
  - E.g. Reach-through fees
- More multi-site research grants
- Sponsor patent-pools
Policy: Congress

- Reaffirm the role of the university as broker-agent
- Create incentives for university cooperation
  - For agencies to limit or cancel rights to inventions
- Expand powers for “marching-rights” (35 U.S.C. § 203)
  - To control of monopolistic prices