Learning from one another? US and European policies toward university-industry technology transfer

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Overview

- National innovation systems and the role of universities within them.
- How do knowledge and innovation flow between universities and industry?
- The US Bayh-Dole Act of 1980 and the “patent-centric model of university-industry interaction: Should it be emulated or avoided?
- Some (speculative) implications for Ireland.

National innovation systems

- Literature on “national innovation systems” focuses on institutions and policies influencing technology creation and adoption:
  - R&D funding & performance in public & private sectors.
  - Regulation of IP, product safety, competition.
  - Corporate finance.
  - Labor markets, including training.
- Important influence on policymaking in the “knowledge-based economy.”
- Universities are a key element of national innovation systems and a focus of policy for knowledge-based growth.

Interaction and emulation among national innovation systems

- "Systems of innovation" literature rarely considers interaction among national systems.
  - "evolutionary": cross-border flows of capital, technology => competitive pressure for adaptation, convergence.
  - "purposive": policymakers "emulate" one another's policies.
- Characteristics of policy emulation:
  - Learning is selective, and implementation often alters policy response from the original "model."
- Evolution of policy toward university-industry linkages within OECD governments exhibits many of these features.
  - US universities viewed as models, but many of the policy "lessons" from US may be unhelpful elsewhere.

Universities within national innovation systems

- Multiple roles:
  - Source of trained S&Es.
  - Combination of research & training => an important mechanism for knowledge & technology transfer through flow of graduates to industry.
  - Source of peer-reviewed knowledge placed in the global public domain.
  - Magnet for S&E immigrants from diaspora & elsewhere.
  - In *some* cases, universities support regional high-technology agglomerations.
    - Are they more important to catalyzing the formation of these clusters or to sustaining their growth?
    - Stanford vs. Fairchild in Silicon Valley.
- Multiplicity of roles => varied channels through which universities affect industrial innovation.

How do university and industrial innovation interact?

- Major channels of interaction (training; publishing; faculty consulting; new-firm formation; patents & licenses).
- The interaction is bidirectional: industrial research/innovation affects academic research, as well as the reverse.
  - Schockley Semiconductor and Stanford.
- Channels of interaction affect one another.
- Importance of different channels varies among fields of research.
  - Outside of pharmaceuticals, US industrial R&D managers in large firms indicate that patents are relatively unimportant channels of influence on industrial innovation.

How do different channels affect one another?

- Licensing & new-firm startups: Little work on role of licensing in “spinoff” formation, survival.
- Research & patenting: Most work concludes that patenters also are publishers.
- Gender and patenting: Senior female faculty publish comparably, patent far less than male faculty of similar rank and productivity in US universities.
- Cohort effects: Younger US faculty in biomedical research are more likely to pursue new-firm entrepreneurship at an early point in their career.
- We know little about relative importance of these, other channels of interaction in different national university, innovation systems.

For both gov’ts and universities, clear policy goals are essential

- Numerous competing goals for policies seeking to support university-industry links:
  - University revenues from technology licensing.
  - Industry financial support for academic research.
  - Regional or national economic development.
  - Retention, recruitment of “entrepreneurial” faculty.
  - Support for local SMEs, startup firms.
  - Attracting knowledge-intensive operations of MNCs, other established firms.

Goals => priorities for policy development & evaluation.

- Different goals => tradeoffs among channels of interaction.
  - Licensing income => tilt toward established-firm licensees.
  - “Regional development” may => liberal dissemination of academic research results.
  - Expanding supply of high-quality graduates may => less emphasis on commercialization of research results.
  - Attracting or retaining entrepreneurial faculty interested in startup formation may => lower license income.
- Different goals => different measures for policy evaluation.

The Bayh-Dole Act of 1980 and the "US model" for technology transfer

- Act sought to encourage commercial development of federally funded inventions in university and government labs.
- Rationalized and simplified federal policy toward assignment of patent rights, licensing.
  - Political statement as important as statutory provisions.
- Bayh-Dole did not legalize anything previously prohibited. It replaced a complex web of Institutional Patent Agreements (IPAs) between individual federal agencies and universities.
- Act delegated management to research performers and reduced agency oversight of licensing of federally funded research results.

International “emulation” of the Bayh-Dole Act.

- Discussions or policy changes affecting “technology transfer” activities of national universities in Japan; Italy; Germany; Denmark; France; Canada, and other nations.
- Many policy initiatives focus on patenting of university inventions.
  - Transfer ownership of patent rights from faculty to university (Denmark; Germany).
  - Transfer ownership of patent rights from university to individual faculty (Italy).
- Some initiatives (Sweden, Japan) include public financial support for “technology transfer offices.”
  - Others (France) liberalize leave-of-absence policies for gov’t and university researchers to start new firms.
- Bayh-Dole is cited as a model; but its influence on US universities’ knowledge transfer is overstated.

Structural characteristics of US higher education created incentives for technology transfer *long before 1980*

- Large scale of national “system” and (after 1945) public research funding.
- No centralized (e.g.,federal) control of administrative policies.
- Heterogeneous institutional structure (public; private; secular; religious; large; small) and quality.
- Importance for many institutions of “local” financial & political support motivated research with “local” benefits, search for links with “local” industry.
- Inter-institutional competition for resources, prestige, faculty.

U.S. university patenting predates passage of Bayh-Dole in 1980

- Many universities avoided direct management role in patenting & licensing during the pre-1970 period.
- Significant change during the 1970s:
  - Overall university patenting accelerated.
  - Private universities expanded patenting.
  - Biomedical technologies' share of university patenting and licensing grew.
  - Universities entered direct management of patenting and licensing.
- In late 1970s, U.S. universities active in patenting & licensing clashed with federal agencies over licensing terms for federally funded research advances.
- Universities lobbied Congress for "flexibility" (e.g., exclusive licensing agreements) in federal policy, resulting in the Bayh-Dole Act.
- Act is an effect of growth in US university patenting during the 70s, as well as one of several causes of increased academic patenting during the 80s.

Post-Bayh-Dole trends

- University share of all US patents grew from 0.5% in 1980 to >4% by 2008.
- Universities with limited pre-1980 patenting experience expanded patenting, but received "lower-quality" patents initially.
  - "Quality gap" with experienced institutional patenters narrows by early 1990s.
  - Underscores complexity, difficulty of "learning to patent" in university OTTs.
  - Highlights dangers in using patent counts to measure performance.
- In spite of rhetorical emphasis on "university spinoffs," new firms consistently account for less than 20% of US university licensees.
- Industry-funded share of total university research in U.S. grew from roughly 3.9% in 1980 to 7.4% in 1999, dropping to 5.1% in 2008 (below 1957).

Other “lessons” from Bayh-Dole: US university management of IP

- For many US universities, *net* licensing revenues are modest (or negative).
  - U of California systemwide gross revenues averaged **US$99M**/year for FY 2001 – 2006; net licensing revenue averaged **US$28M**/year.
  - Industry-funded research exceeded **$200M** during FY 2006.
  - Licensing revenues dominated by small # of patents, typically in biomedical field.
- University administrators often are unclear about priorities, unrealistic about potential licensing revenues.
  - Net revenues can’t offset cuts in public funding.
- Fixed costs, operating expenses of TTOs are high.
  - Little experimentation by US universities with multi-campus collaboration.

Gov't., industry criticism of US universities

- Emphasis on patenting => frictions with some non-biomedical firms.
  - 2002: Hewlett-Packard cited "less restrictive" IPR regime in non-U.S. universities in expanding foreign research collaboration.
- National Institutes of Health efforts to encourage sharing among scientists of research tools have encountered resistance from universities.
  - "…universities take inconsistent positions on fair terms of access to research tools depending on whether they are importing tools or exporting them." (NIH Working Group on Research Tools, 1998).
- Late-2010 National Academy of Sciences report criticizes university efforts to maximize licensing revenues:
  - "Patenting and licensing practices should not be predicated on the goal of raising significant revenue for the institution. The likelihood of success is small, the probability of disappointed expectations high, and the risk of distorting and narrowing dissemination efforts is great."

Some US universities have developed less "patent-centric" policies

- Gradual shift to recognize that:
  - Licensing revenues may not be either large or worth the expense and conflict with industry.
  - Much academic research does not resemble the biomedical field.
    - Patents are less valuable, lucrative sources of licensing revenues.
- Both Stanford, UCB now emulate MIT in combining management of IP with industrial liaison activities supporting industry-sponsored research.
- New policies have reduced universities' emphasis on ownership of tangible IP from IT industry collaborations.
  - December 2005 "Open Collaboration Principles" agreement between 7 research universities and 4 IT firms.

Implications for Ireland?

- Build on past success for a world of footloose talent & investment.
  - Irish universities made substantial economic contributions to the “Celtic Tiger” growth boom through training and research.
  - Excellence in fundamental research a critical attraction for industry collaboration, recruitment of best & brightest talent.
- Maintain institutional excellence without blurring missions.
  - Avoid inclusion of faculty patenting or entrepreneurial activities in professional assessments.
  - Faculty conflict-of-interest policies are important.

Implications for Ireland? (2)

- Manage IP as part of a portfolio of policies to encourage industry funding of university research, collaboration.
  - Licensing revenues should be of 2ndary importance.
  - Experiment with different structures for TTOs.
  - # of patents, gross license revenues are poor evaluation measures.
  - Industry funding % of universities research budgets, measures of 2-way flow of researchers & students may be better.
- Policies & institutions external to the university are critical to success of new-firm formation, survival.

Conclusion

- Bayh-Dole is arguably of 2ndary importance in US university patenting, licensing, industry collaboration.
  - Long history of such collaboration reflects structural characteristics of US higher education "system."
  - US universities' BD-era patent policies may have impeded some forms of industry-university collaboration.
- More than a "Bayh-Dole policy" is needed to stimulate interaction between universities and industry.
  - Structure of university system and research funding.
  - US post-1945 public research funding is crucial.
  - Institutions external to the university (labor mobility; venture capital).
  - Importance of patents for university-industry technology transfer varies across and within industries.

THANK YOU!