“From Lab to Market”: Policy Reforms for More Effective University Technology Transfer

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University research/innovation have “real” effects

- 50% of basic research in the United States; in Japan, 52% in 2011
- University research stimulates R&D and patenting by private firms through knowledge spillovers, and produces early-stage technologies
- Dramatic increase in university technology transfer in the U.S. in patenting, licenses and revenues ($186 m. in 1991, $1.54 b. in 2012)
- **U.S. Bayh-Dole Act, 1980:** Universities/public research organizations got ownership of inventions from federally-funded R&D, with mandate to transfer technology and share revenues with inventors. Universities had required approval from each funding agency. Licensing occurred before Bayh-Dole, but higher transactions cost and uncertainty.
- **Japan:** Similar reforms began in 1998, culminating in corporatization of national universities and public research organizations.

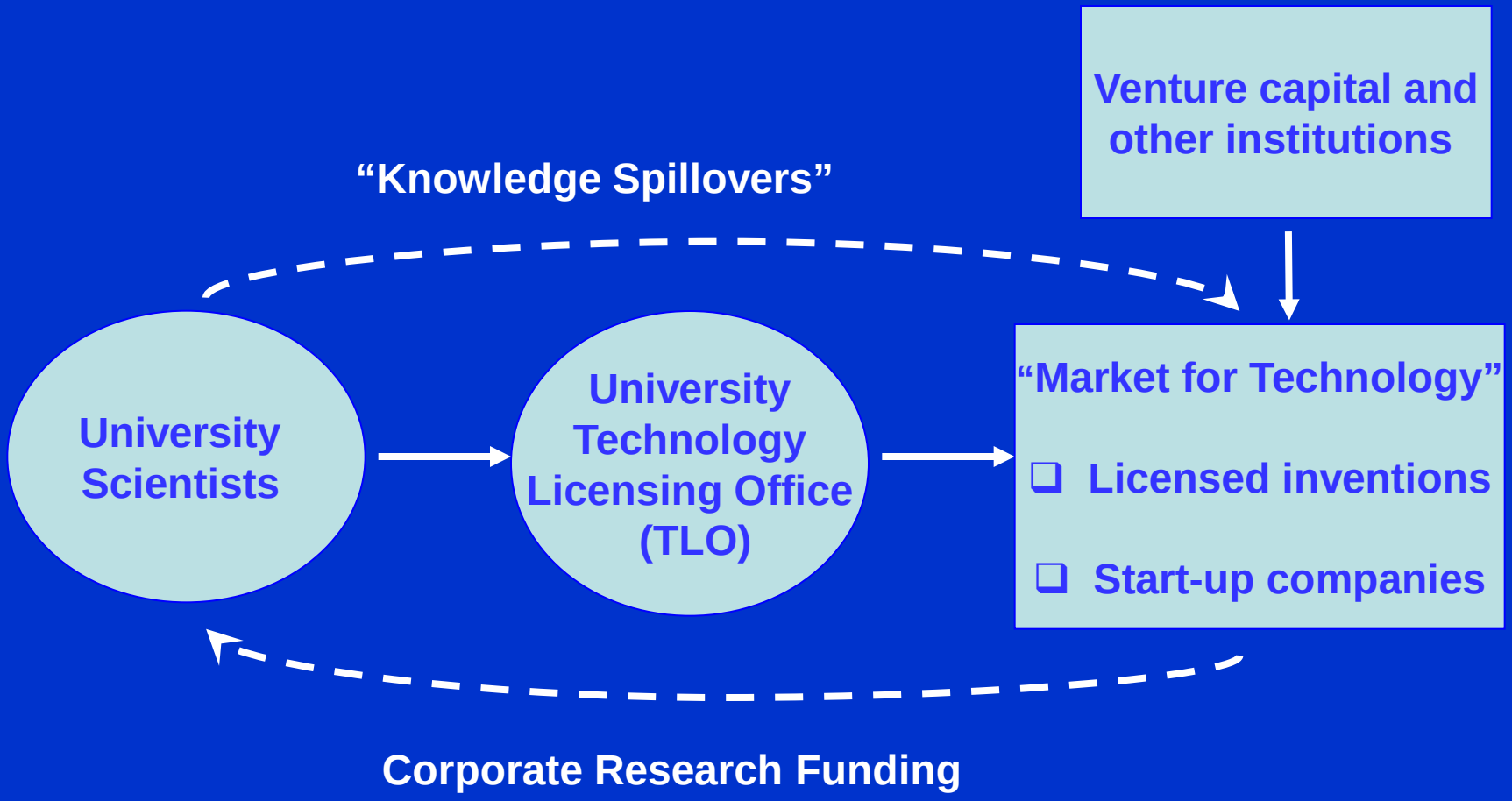
Topics for Today:

1. **What are key benefits (and costs) of university technology transfer?**

2. **What policy reforms are needed to make the process more effective?**

- Monetary incentives
- Efficient structure for the “market for technology transfer”
  - Role for Consolidation
  - Role for Competition
- Other features of the “innovation ecosystem”

University-Private Sector S&T Links



Key Benefit: Economic gains from *"efficient delegation"* in developing and commercializing university inventions

- Finding licensees who can extract maximum value from the invention, who may not be local (not making money for its own sake)

- Need monetary incentives so universities exert effort to find licensees, and clear property rights so licensees are willing to contract and make required downstream investments

Other Benefits:

- Stronger incentives for university scientists to focus on commercially relevant technologies (but may be a potential cost)

- Supplementary income source for universities [careful, revenues are highly skewed and hard to predict]

Potential Costs

- Redirecting basic to applied research/patenting activity
  - Evidence does not indicate that patenting replaces publications. They typically go together (complements not substitutes)
  - Need to ensure rigorous publication standards for tenure to protect academic quality
- Restricting ‘open science’
  - Evidence does not indicate substantial increase in delays in publishing research findings or delays/ refusals to engage in material transfer agreements (information sharing)

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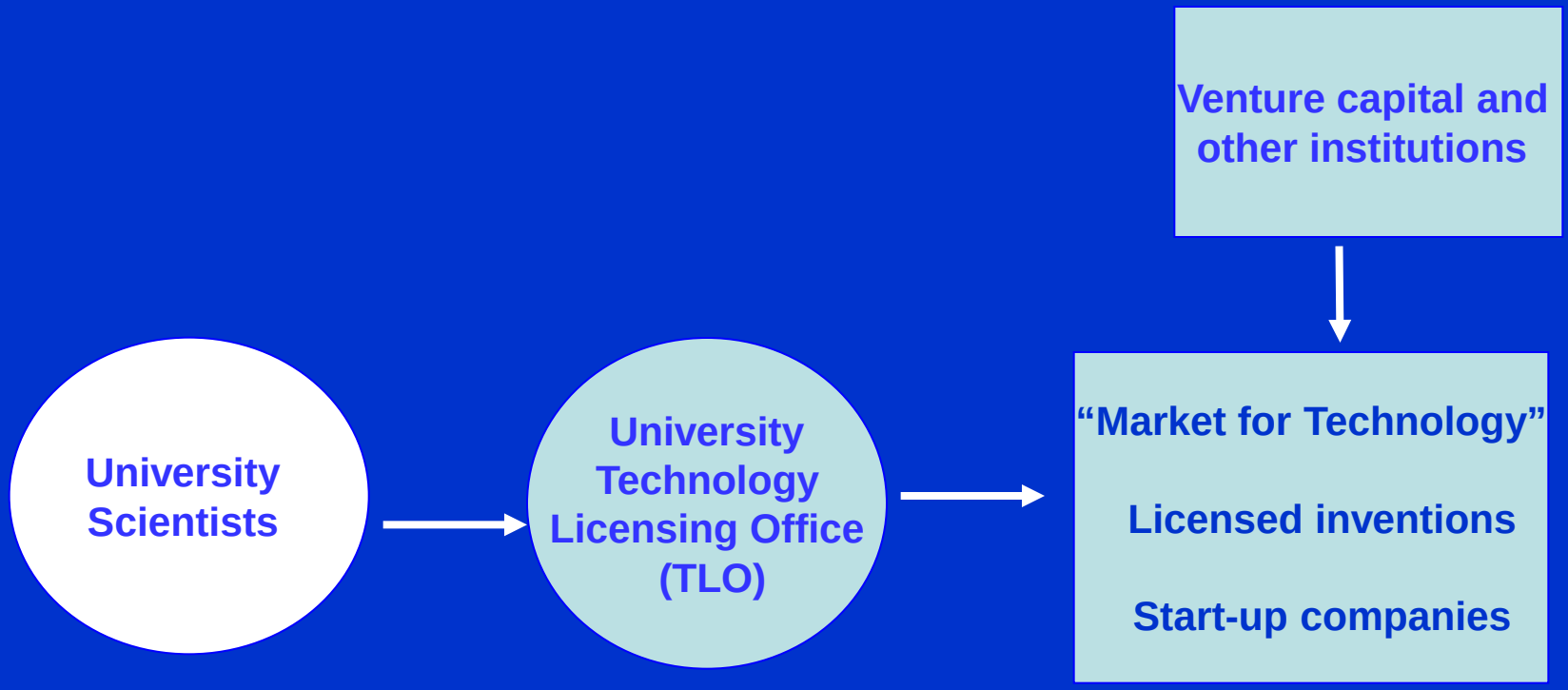

Reform 1: Introduce performance-based incentives to faculty scientists. They strongly affect university innovation and technology transfer performance

- U.S. universities formally share royalties (and cashed in equity) with faculty scientists. This gives them “high-powered” incentives.

- Universities publish royalty schedules. They are part of the faculty employment contract. Royalties received by the university are divided between the inventor, lab, department, university

- **‘Inventor royalty share’:** cash directly to inventor or to her lab

- **Three key characteristics of inventor royalty shares**:
  1. Very large variation across universities
  2. Observe both constant rate and variable rate sharing schedules
  3. Variable rate sharing is always regressive (i.e., the inventor keeps a smaller share at higher levels of license income)

Inventor Royalty Shares in U.S. Universities

	Average	Minimum	Maximum
Constant sharing	41	21	65
Variable sharing	51	20	97
< 10,000 ($)	53	20	100
10 -50,000	45	20	93
50-100,000	42	20	85
100-300,000	35	20	85
300-500,000	33	20	85
500,000- 1 million	32	20	85
> 1 million	30	15	85

Finding 1:Inventor royalty shares strongly affect license income. A 10 percentage point increase in inventor share raises license income by an average of 19%. In private universities the impact is 50%.

Gatekeeper Effect: The impact of royalty incentives depends on the effectiveness of TLO

- If a TLO is ineffective (many scientists complain about them) and has monopoly power over commercialization, as in the U.S., changing incentives will not have much effect.

- Thus reforming royalty incentives needs to go together with policies to make the TLO's more effective. These are **complementary policy instruments**.

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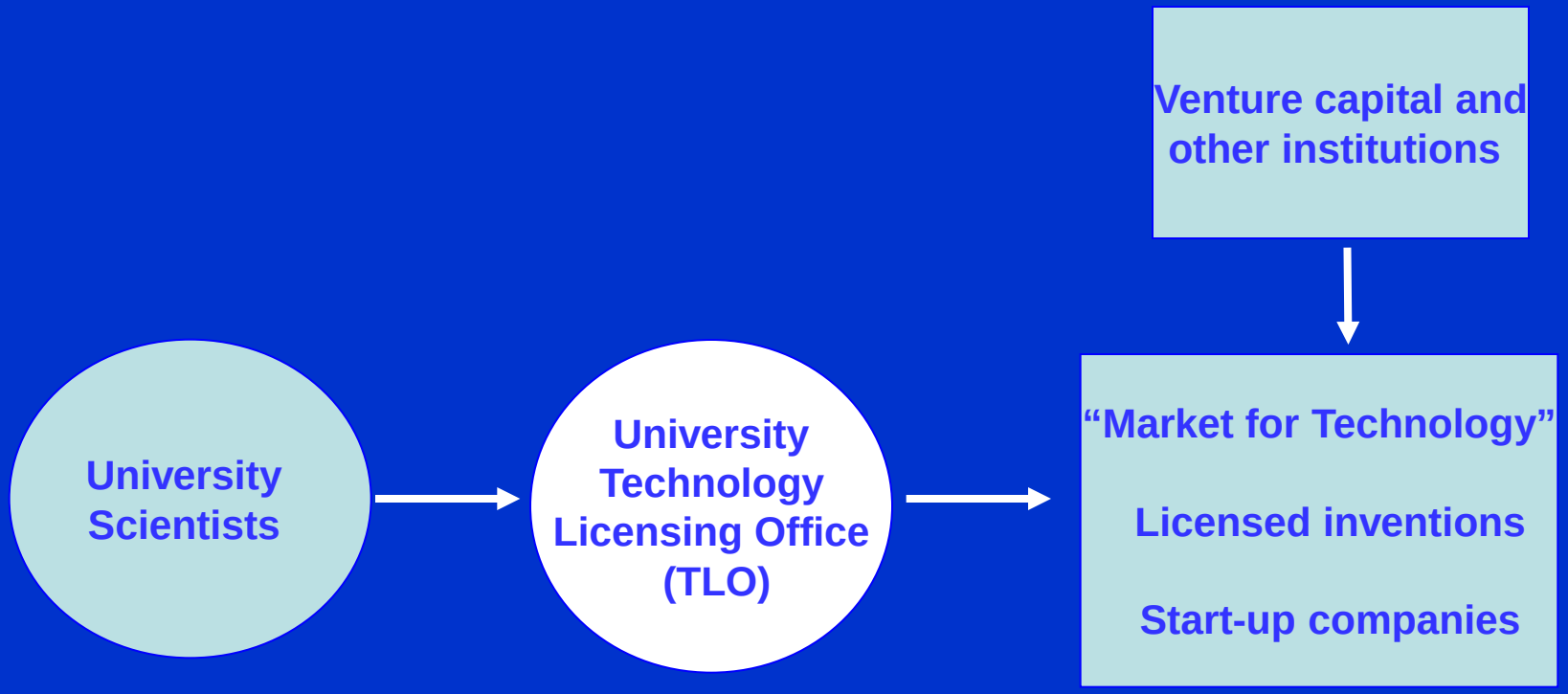


Reform 2: Introduce performance incentives in TLO's. They strongly affect the TLO's performance. But think carefully before adopting local development focus.

Technology transfer 'performance' has multiple dimensions:

- Number of licenses (both exclusive and non-exclusive)
- Number of start ups (how should the mix between licensing to start ups and existing firms be determined)?
- Royalty income (or cash value of equity) per license

Incentives and Local Development Bias in TLO's

	Public University	Private University
Use of Bonus as Incentive (% yes)	**49**	**79**
Objectives (% "important/very important")		
1. Number of licenses	97	100
2. License income	88	93
3. Promoting local development	**88**	**57**

FINDING 2.1: Performance incentives (bonuses) in TLO's raise income per license by 30-45%.

FINDING 2.2: Incentives do not affect the number licenses per invention.

- Why? Because managers can more easily monitor the number of licenses than income per license -- "what might have been" -- so incentives are less important. ["Monitoring versus incentives"]

FINDING 2.3: Incentives do not affect the number of start-ups per license (i.e., the licensing mode).

But all this depends on how incentives are structured, and this should depend on what the underlying objectives are.

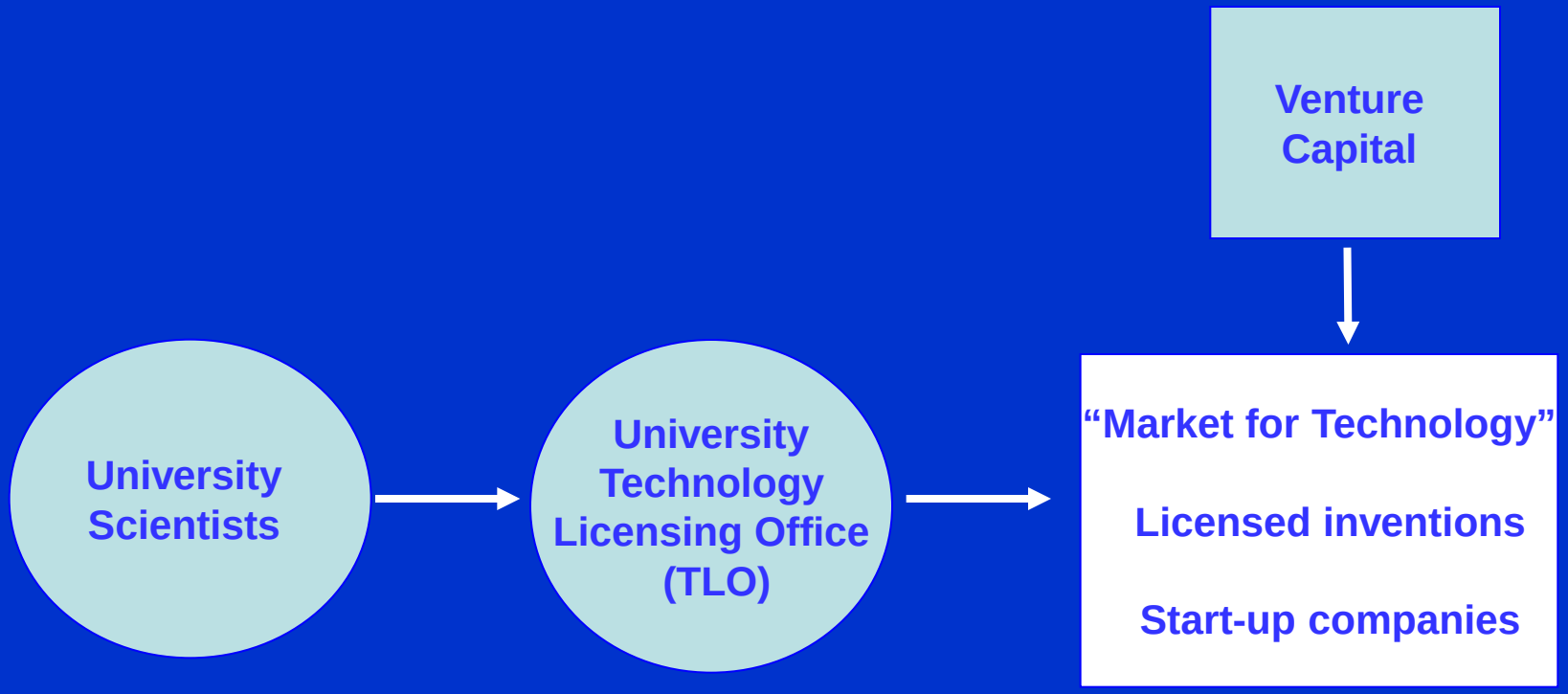
Finding 2.4: Strong local development bias reduces income per license by 30% but raises licenses per invention by 30% (higher ‘quantity’, lower ‘quality’ licenses**)**

- Local development bias has a large implicit “cost” – ‘inefficient delegation’ and less licensing income.
- Do the ‘local multiplier’ (agglomeration) effects, or other benefits, make this licensing policy worthwhile?

Finding 2.5: Strong local development bias increases local knowledge spillovers

- So there is a “benefit” to this policy, to be weighed against the income loss we discussed earlier

University-Private Sector S&T Links



Reform 3: Ensure an Efficient Market Structure

Current institutional arrangements in U.S.

- TLO has a monopoly to commercialize inventions (“right of first refusal”).
- Most TLO’s are very small (average size < 5 professionals).
- Broadly similar arrangements in Japan since 2004. The main exception is the very interesting case of the Kansai TLO, a private organization that is the exclusive licensing agent for a number of universities.

Does this market structure make sense? Are there others that might be more efficient?

Some Alternative Institutional Structures

1. How much specialisation and consolidation should there be? It depends on where we think the ***economies of scale/scope*** are.
   - Administrative economies (spreading fixed overheads)
   - Informational economies: identifying potential licensees
     - Specializing in technology field cutting across regions? [I know of no examples]
     - Specializing by region cutting across technology fields? [California central TLO, Munich]

2. Monopoly or competition in technology licensing activity?
   - Should the university TLO be the gatekeeper? Why do we think "island monopolies" makes sense here, but not in other contexts?

What form might competition take?

1. **Competition "for" the Market**: Exclusive (competitive) contracts to private licensing firm for a fixed period of time

   [e.g., Kansai TLO in Japan – an example worthy of more attention]

2. **Limited Monopoly:** Impose time limits on the exclusive rights of the TLO. Give inventors the right to use other agents after that.

3. **Competition "in" the Market:** Remove TLO monopoly (or preferably, privatize them). Require inventors to register inventions with a central university 'Information Repository' , but also the right to use private licensing intermediaries (royalty sharing can be adjusted if university does not do the licensing) – e.g., some Canadian universities

What Else is Needed in the Innovation Ecosystem?

1. Vibrant venture capital markets
   - Facilitate new start-ups built on university research and innovations, and 'democratize' commercialization activity among many firms
     - Role for start-ups and established firms varies by sector
     - Opening this up is especially important in Japan, where large firms currently dominate the commercialization process

       [as argued by Robert Kneller, *Bridging Islands*)

2. "Flexibility to Fail" (and Restart): Institutions that underpin risk-taking are key to high-tech entrepreneurship
   - Bankruptcy rules
   - Flexible labour markets (low costs of hiring and firing workers)
   - Cultural 'acceptance' of risk-taking and failure

Summary of Key Findings and Policy Messages

1. Strong incentives for scientists and clarity of property rights are important for stimulating innovation and licensing by universities

2. Need to coordinate policies on inventor incentives and TLO effectiveness

3. Strong incentives within the TLO are effective, and not widely used

4. Local development objectives are costly but generate more local knowledge spillovers. Policy debate about their desirability is needed.

5. Institutional (market) structure of technology licensing activity is important and badly structured. There is a serious need to redesign policy and to introduce effective competition into the system.

Key References

Saul Lach and Mark Schankerman (2008), “Incentives and Invention in Universities,” *RAND Journal of Economics,* 39: 403-433

Sharon Belenzon and Mark Schankerman (2009), “University Knowledge Transfer: Private Ownership, Incentive and Local Development Objectives,” *Journal of Law and Economics*, 52: 111-144

Sharon Belenzon and Mark Schankerman (2013), “Spreading the Word: Geography, Policy and Knowledge Spillovers,” *The Review of Economics and Statistics*, 95(3): 884-903