Shirking, Shelving and Sharing Risk: The Role of University License Contracts

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MOTIVATION

UNIVERSITY LICENSE CONTRACTS (%)

Fixed fees 84
Running royalties 84
Annual payments 78
Milestones 58
Equity 23
Consulting 58

EXISTING THEORY CAN’T EXPLAIN COMPLEXITY
MULTIPLE INCENTIVE PROBLEMS

Risk
Moral Hazard
  Noncontractible inventor effort
  Shirking
Adverse selection
  Noncontractible firm effort
  Shelving

POLICY ISSUE—BAYH DOLE

Contingent university ownership
March-in rights
The basic setting

Development stage

TTO finds a firm

contract

Technical stage

Inventor exerts effort $e$

Firm invests $X$

Commercial stage

Firm invests $C$

Commercialization

Obtain $\pi(x)$ with probability $q$
Basic Model

- Invention that needs inventor & firm effort
  - Firm: expected profit
  - Inventor: expected utility
  - TTO: revenue + successful commercialization (*march in*)

<table>
<thead>
<tr>
<th>Development</th>
<th>Commercialization</th>
</tr>
</thead>
<tbody>
<tr>
<td>$-V(e)$</td>
<td>$-C$</td>
</tr>
<tr>
<td>$-X$</td>
<td>$p(e, X)$</td>
</tr>
<tr>
<td>$p(e, X)$</td>
<td>$q$</td>
</tr>
<tr>
<td>$\Pi(x)$</td>
<td>$-L$</td>
</tr>
</tbody>
</table>

$$\pi(e, x) = \Pi(x) - C - V(e)$$
Noncontractible Inventor Effort

- Moral hazard solved by $m$ without distortion of raising licensee marginal cost

- Royalty optimal only if firm is risk averse

- Consulting a complement for milestones/royalty
Intentional shelving

If the first firm turns the offer down or the TTO decides to take back the license, the TTO can search (once) at a cost $K$ to find another firm with probability $z < 1$.
Firm effort $X$ is observable by the inventor

If...

- “shelving incentives” are not too high compared to “commercialization incentives”
- the search cost is low and the probability of a second firm is sufficiently high

then the TTO can enforce the second best \{m**, f**\} even in the presence of shelvers. In equ., shelvers separate from non-shelvers by turning down the contract.

Intuition:

- The inventor has an incentive to turn in a firm that shirked.
- In equilibrium, the inventor reports truthfully given contract offered to the second firm (i.e., does not turn in a firm that worked).
Firm effort $X$ is not observable by the inventor

The second best \( \{m^{**}, f^{**}\} \) cannot be supported in a PBE in the presence of shelvers.

If...

- “shelving incentives” are not too high compared to “commercialization incentives”
- the search cost is low and the probability of a second firm is sufficiently high

then, in the unique PBE in pure strategies, \( f > f^{**} \) and \( m < m^{**} \).

In equ., shelvers separate from non-shelvers by turning down the contract.
**Intuition:**

- A high upfront fee that shelvers refuse to pay is required in order to separate (substitutes for the inventor’s report),
- Distortion: the milestone is lower, so effort is lower,
- Note: Shelvers saty out, so in this equ., the TTO never takes back the license.
Unintentional shelving

- Separating contract
  - sufficiently high probability of finding second firm
  - an additional fee to be paid after the first milestone
  - annual payments
Summary of results

<table>
<thead>
<tr>
<th></th>
<th>Risk</th>
<th>Moral Hazard</th>
<th>Unintentional Shelving</th>
<th>Intentional Shelving</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fixed fees</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Upfront</strong></td>
<td></td>
<td></td>
<td></td>
<td>+</td>
</tr>
<tr>
<td><strong>Annual</strong></td>
<td>+</td>
<td>+</td>
<td></td>
<td>+</td>
</tr>
<tr>
<td><strong>Milestone</strong></td>
<td>+</td>
<td>+</td>
<td></td>
<td>+</td>
</tr>
<tr>
<td>Royalty</td>
<td>+</td>
<td>+</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Consulting</td>
<td>+</td>
<td></td>
<td></td>
<td>-</td>
</tr>
</tbody>
</table>

Table 1: Theoretical results
Table 2. Business Survey Questions
On Importance of Payment Types

1. When you license-in an *early* stage technology (e.g., proof of concept or lab scale prototype only), how important to you is it to include the following payment types?

2. When you license-in a *late* stage technology (e.g., nearly ready for commercial use), how important to you is it to include the following payment types?

3. When faculty input *is* critical for further development of a technology, how important is it that the license-in agreement include the following payment types?

4. When faculty input *is not* critical for further development of a technology, how important is it that the license-in agreement include the following payment types?
\[ R_{ip} = \beta_0 + \beta_1 \text{EARLY}_{ip} + \beta_2 \text{CRIT}_{ip} + \beta_3 \text{NOTCRIT}_{ip} + \epsilon_{ip} \]

\[ i = 1, \ldots, n \quad p = 1, \ldots, 4 \]

\( R_{ip} \) = importance respondent \( i \) attaches to payment type \( p \)

\( \text{EARLY}_{ip} \) = 1 if early stage invention

\( \text{CRIT}_{ip} \) = 1 if faculty are critical

\( \text{NOTCRIT}_{ip} \) = 1 if faculty are not critical
Milestones

1. Can be used to solve moral hazard
2. Can be used to share risk
Milestone Results

- Faculty Critical
- Early Stage
- Faculty Not Critical = Late Stage
Royalties

1. Can be used to share risk and early stage riskier than late stage
2. Harder to define royalties for early stage than for late stage
3. Can be used to solve moral hazard
Running Royalties Results

• Late Stage
• Early Stage
• Faculty Critical = Faculty Not Critical
## Consulting: IV Results

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coef.</th>
<th>t-Stat</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPONRESEARCH</td>
<td>-0.588</td>
<td>-1.54</td>
</tr>
<tr>
<td>DISTANCE</td>
<td>-0.026</td>
<td>-2.39  **</td>
</tr>
<tr>
<td>SMALL</td>
<td>19.073</td>
<td>1.81 *</td>
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<tr>
<td>PROOF</td>
<td>0.016</td>
<td>0.1</td>
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<tr>
<td>PROTOTYPE</td>
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<tr>
<td>MILESTONE_IMPORT</td>
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<td>3.11 ***</td>
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<tr>
<td>CONSTANT</td>
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<td>5.24 ***</td>
</tr>
<tr>
<td>No. Obs.</td>
<td>36</td>
<td></td>
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<tr>
<td>r-Square</td>
<td>0.5</td>
<td></td>
</tr>
</tbody>
</table>

**Significantly different from zero at 10% level.**

**Significantly different from zero at 5% level.**

**Significantly different from zero at 1% level.**
University Questions

In what circumstance is it desirable to include annual license fees in a license agreement instead of running royalties?

Have you had problems with companies despite proper due diligence terms acquiring a technology and shelving it to prevent its commercialization?

When the university has terminated an agreement, what was the most common reason?