Innovation and Legal Enforcement for Competition Policy: Theory and International Evidence from Overseas Subsidiaries of the Japanese Auto-Parts Suppliers

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Schumpeter vs. Arrow: the Great Divide on roles of competition in innovation

- Schumpeter (1942): Anti-competition, *Ex post* market structure
- Arrow (1962): Pro-competition, *Ex ante*

Antitrust as Competition Policy

- How antitrust fosters innovation
- OECD initiatives for competition policy
“Do legal enforcements for competition policy have differential effects on innovative R&D activities?”

Conditional on

- Strategic R&D competition between an incumbent and entrants
- Government’s optimal choice of legal schemes
Overseas Subsidiaries of the Japanese Auto-Parts Suppliers

- The Jap. Auto-Parts Suppliers
  - In innovative industries represented by ‘hybrid’ engines
  - Frequent antitrust lawsuits with enormous reparations
    - An example of legal enforcement: corporate leniency policy

- International Deployment
  - ‘Entrant’
  - Different legal schemes in locations where
    - Various ‘law and order’
    - Legal origins: Common law vs. Civil law
  - Time variation
The Bottom Line

“Legal enforcement scheme does matter for innovation”

Whatever scheme for competition policy achieves the first best more likely in countries with higher law & order, which plays an implicit but substantial role in considerations of how antitrust fosters innovation
Roadmap

- A Simple Model of Innovation and Legal Enforcement for Antitrust
  - Setup
  - Subgame-perfect equilibria and testable hypotheses

- Empirical Analysis
  - Data
  - Estimation
Setup

A SIMPLE MODEL OF INNOVATION AND LEGAL ENFORCEMENT FOR ANTITRUST
Two equal-sized firms: an **incumbent** and a potential entrant with a firm scale $S$

- Successful innovation makes an entrant (with patent) displace the old incumbent
- If innovation fails, then monopoly of the incumbent continues
A potential entrant does R&D activities $R_1$ or $R_2$ ($>R_1$) for raising a probability of successful innovation
- $R_1$: zero cost, the prob. $P_1$
- $R_2$: costs $SC$, the prob. $P_2$($>P_1$)

An incumbent does ‘R&D-deterring’ activities (preventing patent license, compatibility, standardization, etc.) $Q_1$ or $Q_2$ ($>Q_1$)
- $Q_1$: zero cost, no effect on the prob.
- $Q_2$: costs $SC$, lowering entrant’s prob. of innovation down to $P_1$

‘Monopoly’ profits of the incumbent
- $SE = SD- R&D$-deterring or R&D activity costs, where $SD$: social profits of innovation

A firm maximizes expected profits (excluding R&D or R&D-deterring cost and expected fine for incumbent and entrant)
- Assumption 1: $(P_2-P_1)D>C$, Socially efficient for an entrant to take $R_2$ without incumbent’s R&D-deterrance, A rationale of antitrust policy for entrant
Legal Enforcement for Antitrust

- Government (Judge and Regulator)
  - Can detect
    - High R&D-deterring incumbent w/exogenous prob. \( P_D \)
    - Low R&D entrant w/exogenous prob. \( P_L \)
    - Assumption 2: \( P_D < P_L \)
    - Assumption 3: \((1-P_1)P_D < P_2 - P_1\)
  - Pure three law enforcement schemes: fine \( F \)
    1. **Strict liability**: fine both incumbent and entrant any time no innovations occur
    2. **Negligence**: fine either incumbent or entrant if no innovations in high R&D-deterring activities or low R&D activities, respectively
    3. **Regulation**: fine either incumbent or entrant if high R&D-deterring activities or low R&D activities found, respectively
  - Subversion
    - \( X \): Maximum fine enforceable without subversion=then-incumbent’s investment for protection from law (‘lobbying’ or ‘corruption’)
    - If \( X \) lower than the fine, then-incumbent subvert justice than submit to the law
    - Higher \( X \) possessing higher levels of “law and order”
  - Maximizes expected social profits from innovations excluding R&D and R&D-deterring costs
    - First-best: Generating (Incumbent, Entrant) = \((Q_1, R_2)\)
    - Second-best: \((Q_2, R_2)\)
One Period

- **Timing 0:** Gov. choice of legal scheme
- **Timing 1:** Incumbent’s R&D-detering activities
- **Timing 2:** Entrant’s R&D activities
- **Timing 3:** Innovation outcome and Legal enforcement or Subversion
Subgame-Perfect Equilibria and Testable Hypotheses
Best Responses of Incumbent and Entrant in Anarchy

- **‘Anarchy’** (neither litigation nor regulation)
  - Entrant’s best response at timing 2:
    - $R_2$ to incumbent’s $Q_1$
    - $R_1$ to incumbent’s $Q_2$
  - Incumbent’s expected profit at timing 1:
    - $Q_1$: $(1-P_2)SD$
    - $Q_2$: $(1-P_1)SD - SC > (1-P_2)SD$, on assumption 1
  - $(Q_2, R_1)$ the worst choice always attained
Strict Liability

Entrant’s best response at timing 2:
- $R_2$ to incumbent’s $Q_1$
- $R_1$ to incumbent’s $Q_2$

Incumbent’s expected profit at timing 1:
- $Q_1$: $(1-P_2)(SD-F)$
- $Q_2$: $(1-P_1)(SD-F)-SC$

The first-best $(Q_1, R_2)$ attained if

\[
\frac{F}{S} > \frac{(P_2 - P_1)D - C}{P_2 - P_1}
\]
Negligence

Entrant’s best response at timing 2:
- $R_2$ to incumbent’s $Q_1$
- To incumbent’s $Q_2$,
  - $R_1$ if $\frac{F}{S} < \frac{C}{(1 - P_1)P_L}$
  - $R_2$ if $\frac{F}{S} > \frac{C}{(1 - P_1)P_L}$

Incumbent’s expected profit at timing 1:
- $Q_1$: $(1 - P_2)SD$
- $Q_2$: $(1 - P_1)(SD - P_D F) - SC$

The first-best $(Q_1, R_2)$ attained if
- $\frac{F}{S} > \frac{(P_2 - P_1)D - C}{(1 - P_1)P_D}$
Best Responses of Incumbent and Entrant under Regulation

- **Regulation**
  - **Entrant’s best response:**
    - $R_2$ to incumbent’s $Q_1$
    - To incumbent’s $Q_2$,
      - $R_1$ if $\frac{F}{S} < \frac{C}{P_L}$; $R_2$ if $\frac{F}{S} > \frac{C}{P_L}$
  - **Incumbent’s expected profit:**
    - $Q_1$: $(1 - P_2)SD$
    - $Q_2$: $(1 - P_1)SD - P_D F - SC$
  - The first-best $(Q_1, R_2)$ attained if
    - $\frac{F}{S} > \frac{(P_2 - P_1)D - C}{P_D}$
With possible subversion: depending on law and order, relative to firms’ scale X/S

- If X<F, then incumbent would commit to subversion instead of observing law & order
- Otherwise, either legal enforcement scheme chosen by government avoiding subversion

Case 1
\[
\frac{C}{P_L} > \frac{(P_2 - P_1)D - C}{P_D}
\]

Case 2
\[
\frac{C}{P_L} < \frac{(P_2 - P_1)D - C}{P_D} < \frac{C}{(1 - P_1)P_L}
\]

Case 3
\[
\frac{C}{(1 - P_1)P_L} < \frac{(P_2 - P_1)D - C}{P_D}
\]
Average effects of legal enforcement on R&D activities, conditional on a covariate, law & order $\mathcal{X}$

- Controlling firms’ scale-variable $S$

Average treatment effect on potential outcome for the treated (ATET)

- Treatment 1: Regulation
- 2: Strict liability
- 3: Negligence

$$E(y_i - y_j | t = k; x, s)$$

$$i, j(\neq i), k = 1, 2, 3$$
ATET of R&D Activities Conditional on Regulation (Case 3)

\[
E(y_1 - y_2 | t=1) > 0 \\
E(y_1 - y_3 | t=1) > 0 \\
E(y_2 - y_3 | t=1) > 0
\]

\[ \frac{C}{P_L} (1 - P_L) \]

\[ \frac{(P_2 - P_1)D - C}{P_D} \]

\[ \frac{(P_2 - P_1)D - C}{P_2 - P_1} \]

\[ \frac{(P_2 - P_1)D - C}{(1 - P_1)P_D} \]

Regulation

Strict Liability

Negligence

First Best \((Q_1, R_2)\)

First Best \((Q_1, R_2)\)

First Best \((Q_1, R_2)\)

Second Best \((Q_2, R_2)\)

Second Best \((Q_2, R_2)\)

Second Best \((Q_2, R_2)\)

Worst Choice \((Q_2, R_1)\)
ATET of R&D Activities Conditional on Strict Liability (Case 3)

\[ E(y_1 - y_3 | t=2) > 0 \]
\[ E(y_2 - y_1 | t=2) = 0 \]
\[ E(y_2 - y_3 | t=2) < 0 \]

First Best
\((Q_1, R_2)\)

Second Best
\((Q_2, R_2)\)

Worst Choice
\((Q_2, R_1)\)

\[ \frac{C}{P_L} \]
\[ \frac{(1 - P_L)C}{P_L} \]

\[ \frac{(P_2 - P_1)D - C}{P_D} \]
\[ \frac{(P_2 - P_1)D - C}{P_2 - P_1} \]
\[ \frac{(P_2 - P_1)D - C}{(1 - P_1)P_D} \]
**ATET of R&D Activities Conditional on Negligence (Case 3)**

\[
\begin{align*}
E(y_1 - y_2 | t=3) &> 0 \\
E(y_3 - y_1 | t=3) &> 0 \\
E(y_3 - y_2 | t=3) &> 0
\end{align*}
\]

**Worst Choice**  
\( (Q_2, R_1) \)

**Second Best**  
\( (Q_2, R_2) \)

**First Best**  
\( (Q_1, R_2) \)

**Regulation**

**Strict Liability**

**Negligence**

\[
\begin{align*}
\frac{(P_2 - P_1)D - C}{P_D} &\quad \frac{(P_2 - P_1)D - C}{P_2 - P_1} &\quad \frac{(P_2 - P_1)D - C}{(1 - P_1)P_D} \\
\end{align*}
\]
## Hypothetical Signs on ATET of R&D Activities R

<table>
<thead>
<tr>
<th>$E(y_i - y_j \mid t=k)$</th>
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<td><strong>k</strong></td>
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<td></td>
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<tr>
<td>3 Negligence</td>
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<td>(3,2)</td>
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</table>
**Hypothetical Signs on ATET of R&D-Deterring Activities Q**

| E(yᵢ−yⱼ | t=k) | Case |
|-------|-----|-----|-----|-----|
| k     | (i,j) | 1   | 2   | 3   |
| 1 Regulation | (1,2) | -   | -   | -   |
|        | (1,3) | -   | -   | -   |
|        | (2,3) | -   | -   | -   |
| 2 Strict Liability | (1,3) | -   | -   | -   |
|        | (2,1) | 0   | 0   | 0   |
|        | (2,3) | -   | -   | -   |
| 3 Negligence | (1,2) | 0   | 0   | 0   |
|        | (3,1) | 0   | 0   | 0   |
|        | (3,2) | 0   | 0   | 0   |
Data
Pooled Data

- Sample years: 2003-2011
- Industrial classification no.: 1601,1602 (*Basic Survey of Overseas Business Activities*)
  - Motor vehicles, motor vehicle bodies and trailers
  - Motor vehicle parts and accessories
- *Basic Survey of Overseas Business Activities* (*Location*)
  - R&D expenses $R_1$ or $R_2$
  - Some proxies for a local subsidiary’s scale $S$
    - Total sales
    - Local sales
- *Basic Survey of Japanese Business Structure and Activities*
  - Amount of overseas technical transfer
    - Parent’s firm’s receipts from patent licensees Overseas
    - How less deterrent a subsidiary is to R&D activities of rival competitors
    - A negatively-correlated proxy for R&D-deterring activities $Q_1$ or $Q_2$
  - Controlling variables
    - Total sales
    - Current net profit
    - Capital adequacy ratio
    - Foreign-owned capital ratio
    - Patent rights maintained
      - Controlling how active a parent’s firm is in acquiring patent rights
1. Regulation: Countries following civil law tradition (La Porta, Lopez-de-Silanes and Shleifer, 2008)

2. Strict Liability: Countries with
   - Common law tradition
   - Less index than median of the index of enforcing contracts (efficiency of the judicial system by following the evolution of a commercial sale dispute over the quality of goods and tracking the time, cost and number of procedures involved from the moment the plaintiff files the lawsuit until payment is received)

3. Negligence: Common-law countries else than ones of strict liability
Some proxies for law & order X: The World Bank *Worldwide Governance Indicators*

- **Control of Corruption**: Capturing perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as “capture” of the state by elites and private interests.
- **Rule of law**: Capturing perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence.
- **Political Stability and Absence of Violence/Terrorism**: Capturing perceptions of the likelihood that the government will be destabilized or overthrown by unconstitutional or violent means, including politically motivated violence and terrorism.
- **Regulatory Quality**: Capturing perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development.
- **Government Effectiveness**: Capturing perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies.
- **Voice and Accountability**: Capturing perceptions of the extent to which a country's citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and a free media.

Another data source of *Transparency International*

- **Corruption Perceptions Index**: Based on how corrupt their public sector is perceived to be. A composite index – a combination of polls – drawing on corruption-related data collected by a variety of reputable institutions. Reflecting the views of observers from around the world, including experts living and working in the countries and territories evaluated.
Estimation

EMPIRICAL ANALYSIS
Potential-outcome model

- Linear
- Dependent var:
  - R&D expenses/ total sales
  - Amount of overseas technical transfer/ total sales
- Independent vars:
  - Each of X variables
  - TFP estimates from Levinson-Petrin productivity estimator
  - Controls including macroeconomic variables of each country
    - Real GDP growth rate
    - Dependence ratio on foreign trade((import+export)/GDP)
  - Time dummies

Treatment model

- Multinomial logit
- Independent vars:
  - The same X variable that in the potential-outcome model
  - The macro variables
  - Time dummies

Robust standard errors used
## Result on R&D Expenses

\[ E(y_i - y_j | t=k); \ #5291 \]

**X:** law & order (from World Bank, *Worldwide Governance Indicators*, if not specified)

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<tr>
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E(y_i-y_j|t=k); #2006

X: law & order (from World Bank, *Worldwide Governance Indicators*, if not specified)
Presenting a game-theoretic model of innovation and legal enforcement for competition policy

The model implies some testable hypotheses of signs on ATET

ATET estimations suggest evidence
  - Strong for the model in case of R&D expenses
  - Weaker for explaining overseas technical transfer

The bottom line: “Legal enforcement scheme does matter for innovation”
  - Whatever scheme for competition policy achieves the first best more likely in countries with higher law & order, which plays an implicit but substantial role in considerations of how antitrust fosters innovation
Dynamic effects on Innovation: Segal and Whinston (2007) for a winner-takes-all competition

- Antitrust policy: “More protective of entrants from predatory behavior of incumbent reducing entry probability in innovative industries”
- Front-loading effect: Net effects on entrant’s initial profits and on discounted expected profits as an incumbent thereafter

Law & Econ. on Litigation vs. Regulation

- Judicial uncertainty necessitates regulation, instead of litigation
- Effect of legal enforcement on ‘activities’
  - Endogenous legal enforcement theory: Glaeser and Shleifer(2003); Schwartzstein and Shleifer(2013)
## Data

**Source:** Basic Survey of Overseas Business Activities

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<td>Philippines (39)</td>
<td>UK (37)</td>
<td>Malaysia (36)</td>
</tr>
<tr>
<td>10</td>
<td>UK (37)</td>
<td>Philippines (35)</td>
<td>UK (36)</td>
</tr>
</tbody>
</table>

**total** | 1156               | 1197               | 1321               |
A Simple Model of Innovation and Legal Enforcement for Antitrust
  - Setup
  - Subgame-Perfect Equilibria
  - Testable Hypotheses

Empirical Analysis
  - Data
  - Estimation

Conclusion
Subgame-Perfect Equilibria of Incumbent and Entrant Activities

A SIMPLE MODEL OF INNOVATION AND LEGAL ENFORCEMENT FOR ANTITRUST
Without possible subversion: according to fine relative to firms’ scale F/S

- **Case 1**
  \[
  \frac{C}{P_L} > \frac{(P_2 - P_1)D - C}{P_D}
  \]

- **Case 2**
  \[
  \frac{C}{P_L} < \frac{(P_2 - P_1)D - C}{P_D} < \frac{C}{(1 - P_1)P_L}
  \]

- **Case 3**
  \[
  \frac{C}{(1 - P_1)P_L} < \frac{(P_2 - P_1)D - C}{P_D}
  \]
Case I

\[ \frac{C}{P_L} > \frac{(P_2 - P_1)D - C}{P_D} \]

---

First Best

Regulation

First Best

Strict Liability

First Best

Negligence

Worst Choice

(Q₂, R₁)

\[ \frac{(P_2 - P_1)D - C}{P_D} \quad \frac{(P_2 - P_1)D - C}{P_2 - P_1} \quad \frac{(P_2 - P_1)D - C}{(1 - P_1)P_D} \]

\[ (Q_₁, R₂) \]

\[ F \]

\[ S \]

39
Case 2

\[
\frac{C}{P_L} < \frac{(P_2 - P_1)D - C}{P_D} < \frac{C}{(1 - P_1)P_L}
\]

First Best

\((Q_1, R_2)\)

Strict Liability

Negligence

Worst Choice

\((Q_2, R_1)\)

Second Best

\((Q_2, R_2)\)

First Best

\((Q_1, R_2)\)

Regulation

\[
\frac{(P_2 - P_1)D - C}{P_D} \quad \frac{(P_2 - P_1)D - C}{P_2 - P_1} \quad \frac{(P_2 - P_1)D - C}{(1 - P_1)P_D}
\]
Case 3

\[
\frac{C}{(1 - P_1)P_L} < \frac{(P_2 - P_1)D - C}{P_D}
\]

Worst Choice \((Q_2, R_1)\)

Second Best \((Q_2, R_2)\)

First Best \((Q_1, R_2)\)

Regulation

Strict Liability

Negligence

\[
\frac{(P_2 - P_1)D - C}{P_D} \quad \frac{(P_2 - P_1)D - C}{P_2 - P_1} \quad \frac{(P_2 - P_1)D - C}{(1 - P_1)P_D}
\]
Possible Subversion

- With possible subversion: depending on law and order, relative to firms’ scale X/S
  - If X<F, then -incumbent would commit to subversion instead of observing law & order
  - Otherwise, either legal enforcement scheme chosen by government avoiding subversion
Legal Enforcement Scheme: Case I

- When \( \frac{X}{S} < \frac{(P_2 - P_1)D - C}{P_D} \), anarchy
  - Worst choice \((Q_2, R_1)\)

- When \( \frac{(P_2 - P_1)D - C}{P_D} < \frac{X}{S} < \frac{(P_2 - P_1)D - C}{P_2 - P_1} \), regulation
  - First best \((Q_1, R_2)\)

- When \( \frac{(P_2 - P_1)D - C}{P_2 - P_1} < \frac{X}{S} < \frac{(P_2 - P_1)D - C}{(1 - P_1)P_D} \), regulation/strict liability
  - First best \((Q_1, R_2)\)

- When \( \frac{(P_2 - P_1)D - C}{(1 - P_1)P_D} < \frac{X}{S} \), regulation/negligence/strict liability
  - First best \((Q_1, R_2)\)
Legal Enforcement Scheme: Case 2

- When $\frac{X}{S} < \frac{C}{P_L}$, anarchy
  - Worst choice ($Q_2, R_1$)

- When $\frac{C}{P_L} < \frac{X}{S} < \frac{(P_2 - P_1)D - C}{P_D}$, regulation
  - Second best ($Q_2, R_2$)

- When $\frac{(P_2 - P_1)D - C}{P_D} < \frac{X}{S} < \frac{(P_2 - P_1)D - C}{P_2 - P_1}$, regulation
  - First best ($Q_1, R_2$)

- When $\frac{(P_2 - P_1)D - C}{P_2 - P_1} < \frac{X}{S} < \frac{(P_2 - P_1)D - C}{(1 - P_1)P_D}$, regulation/strict liability
  - First best ($Q_1, R_2$)

- When $\frac{(P_2 - P_1)D - C}{(1 - P_1)P_D} < \frac{X}{S}$, regulation/negligence/strict liability
  - First best ($Q_1, R_2$)
When $\frac{x}{s} < \frac{c}{p_L}$, anarchy
- Worst choice ($Q_2$, $R_1$)

When $\frac{c}{s} < \frac{x}{p_L} < \frac{c}{(1-p)p_L}$, regulation
- Second best ($Q_2$, $R_2$)

When $\frac{c}{(1-p)p_L} < \frac{x}{s} < \frac{(P_2-P_1)D-C}{p_D}$, regulation/negligence
- Second best ($Q_2$, $R_2$)

When $\frac{(P_2-P_1)D-C}{p_D} < \frac{x}{s} < \frac{(P_2-P_1)D-C}{P_2-P_1}$, regulation
- First best ($Q_1$, $R_2$)

When $\frac{(P_2-P_1)D-C}{P_2-P_1} < \frac{x}{s} < \frac{(1-p)p_D}{(1-p)p_D}$, regulation/strict liability
- First best ($Q_1$, $R_2$)

When $\frac{(1-p)p_D}{(1-p)p_D} < \frac{x}{s}$, regulation/negligence/strict liability
- First best ($Q_1$, $R_2$)
Testable Hypotheses

A SIMPLE MODEL OF INNOVATION AND LEGAL ENFORCEMENT FOR ANTITRUST
ATET of R&D Activities Conditional on Regulation (Case 1)

\[ E(y_1 - y_2 | t=1) > 0 \]
\[ E(y_1 - y_3 | t=1) > 0 \]
\[ E(y_2 - y_3 | t=1) > 0 \]
ATET of R&D Activities Conditional on Strict Liability (Case 1)

\[ E(y_1 - y_3 | t=2) > 0 \]
\[ E(y_2 - y_1 | t=2) = 0 \]
\[ E(y_2 - y_3 | t=2) > 0 \]
ATET of R&D Activities Conditional on Negligence (Case 1)

\[ E(y_1-y_2|t=3)=0 \]
\[ E(y_3-y_1|t=3)=0 \]
\[ E(y_3-y_2|t=3)=0 \]
ATET of R&D Activities Conditional on Regulation (Case 2)

\[ E(y_1 - y_2 | t=1) > 0 \]
\[ E(y_1 - y_3 | t=1) > 0 \]
\[ E(y_2 - y_3 | t=1) > 0 \]

- **First Best (Q₁,R₂)**
  - **Strict Liability**
    - **Second Best (Q₂,R₂)**
      - **Negligence**

\[
\begin{align*}
E(y_1 - y_2 | t=1) & > 0 \\
E(y_1 - y_3 | t=1) & > 0 \\
E(y_2 - y_3 | t=1) & > 0
\end{align*}
\]

\[
\begin{array}{c}
(P - P)D - C \\
2 \hspace{2cm} 1
\end{array}
\]

\[
\begin{array}{c}
P \hspace{2cm} D \\
2 \hspace{2cm} 1
\end{array}
\]
ATET of R&D Activities Conditional on Strict Liability (Case 2)

\[ E(y_1 - y_3 | t=2) > 0 \]
\[ E(y_2 - y_1 | t=2) = 0 \]
\[ E(y_2 - y_3 | t=2) > 0 \]

\[ \begin{align*}
    &\text{First Best} \\
    &\quad (Q_1, R_2) \\
\end{align*} \]

\[ \begin{align*}
    &\text{Second Best} \\
    &\quad (Q_2, R_2) \\
\end{align*} \]

\[ \begin{align*}
    &\text{First Best} \\
    &\quad (Q_1, R_2) \\
\end{align*} \]

\[ \begin{align*}
    &\text{First Best} \\
    &\quad (Q_1, R_2) \\
\end{align*} \]

\[ \begin{align*}
    &\text{Second Best} \\
    &\quad (Q_2, R_2) \\
\end{align*} \]

\[ \begin{align*}
    &\text{First Best} \\
    &\quad (Q_1, R_2) \\
\end{align*} \]
ATET of R&D Activities Conditional on Negligence (Case 2)

\[ E(y_1 - y_2 | t=3) = 0 \]
\[ E(y_3 - y_1 | t=3) = 0 \]
\[ E(y_3 - y_2 | t=3) = 0 \]

Second Best \((Q_2, R_2)\)

First Best \((Q_1, R_2)\)

Regulation

Strict Liability

Negligence

First Best \((Q_1, R_2)\)

Second Best \((Q_2, R_2)\)

\[
\begin{align*}
C & \quad \quad \quad \quad (P - P)D - C \\
\end{align*}
\]

\[
\begin{align*}
(1 - P)L & \quad (P - P)D - C \\
\end{align*}
\]

\[
\begin{align*}
(1 - P)L & \quad (P - P)D - C \\
\end{align*}
\]

\[
\begin{align*}
P & \\
\end{align*}
\]

\[
\begin{align*}
P & \\
\end{align*}
\]

\[
\begin{align*}
(1 - P)P & \quad (1 - P)L \\
\end{align*}
\]

\[
\begin{align*}
D & \\
\end{align*}
\]

\[
\begin{align*}
D & \\
\end{align*}
\]

\[
\begin{align*}
D & \\
\end{align*}
\]
Presenting a game-theoretic model of innovation and legal enforcement for competition policy

The model implies some testable hypotheses of signs on ATET

ATET estimations suggest evidence
- Strong for the model in case of R&D expenses
- Weaker for explaining overseas technical transfer

The bottom line: "Legal enforcement scheme does matter for innovation"

Whatever scheme for competition policy achieves the first best more likely in countries with higher law & order, which plays an implicit but substantial role in considerations of how antitrust fosters innovation
Some References