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Economic Analysis of Patent Law Exemption for Research *

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*Based on the paper with Reiko Aoki, Institute of Economic Research, Hitotsubashi University (Nagaoka and Aoki (2007))

Outline

- Introduction
- A pioneer and the follower research model
  Extension of Scotchmer (2004)
- Perpetual R&D competition model
  Based on the framework of Segal and Whinston (2005)
- Conclusions

1 Introduction

- Patent right is very extensive:

  “Except as otherwise provided in this title, *whoever without authority makes, uses, offers to sell, or sells any patented invention*, within the United States or imports into the United States any patented invention during the term of the patent thereof, infringes the patent “ (US Patent law)

  →Using the other’s invention for a research purpose is an infringement according to this definition.
- Does this restrain the process of cumulative innovation?

Licensing solution?

- Coase theorem

- A contract can ensure efficient use of resources, if the property right is well defined.

- A patent right may facilitate licensing.

-zero marginal cost for the licensor to expand the use of knowledge

-a firm may choose secrecy, if exemption exists.

Constraints to licensing solution

- Private costs

- transaction cost

- double markups

- Social costs

- Difficulty to internalize the externality to consumers

  Willingness to license is constrained by the profit incentive of the licensor

- Coordination failure

  coalition formation (see Aoki and Nagaoka(2005))

  contracting over generations

Two types of exemption rules

1. Experimentation and research **on** the subject matter of the patent,

   EU and in Japan have statutory exemption for such experimentation and research,

   while there do not exist such exemption in the US.

   → My presentation examines this exemption rule.

2. Academic (non-commercial) research **with** the patented invention.

   The court decision on Duke vs.Madey(2002) made it clear that the distinction by user was not intended by the case law of the US.

2 A pioneer and the follower research model

- Cumulative innovation process in which the follower uses the invention disclosed in the pioneering patent for its own research
- Without an exemption for the research on improving subject matter, the follower must obtain a license before undertaking research, i.e., an ex-ante license has to be negotiated.

Case without research exemption

- Without research exemption, the ex-ante licensing and investment will take place if and only if the expected joint profit increases.
- Profit incentive
- Does not reflect the consumers' gain from innovation
- Prevents inefficient duplicative or imitative investments

Algebra for the condition for ex-ante licensing

- The follower invests *x* (exogenous for simplicity) in follow-up research. It will succeed with probability *p* and fail with probability $1 - p$.
- When it succeeds, the invention will be an improvement which enhances the value of the pioneer's patent from v^0 to $v^0 + v$ with probability θ, or it will invent-around the first patent through a drastic innovation with probability $1 - \theta$. In the drastic innovation case the follower will achieve the value $v^0 + w$, $w > v$, while the value of pioneer's patent will drop to zero.
- the condition for ex-ante licensing

  $\pi^I > v^0$

  where $\pi^I = (1 - \theta)pv + \theta pw + v^0 - x$.

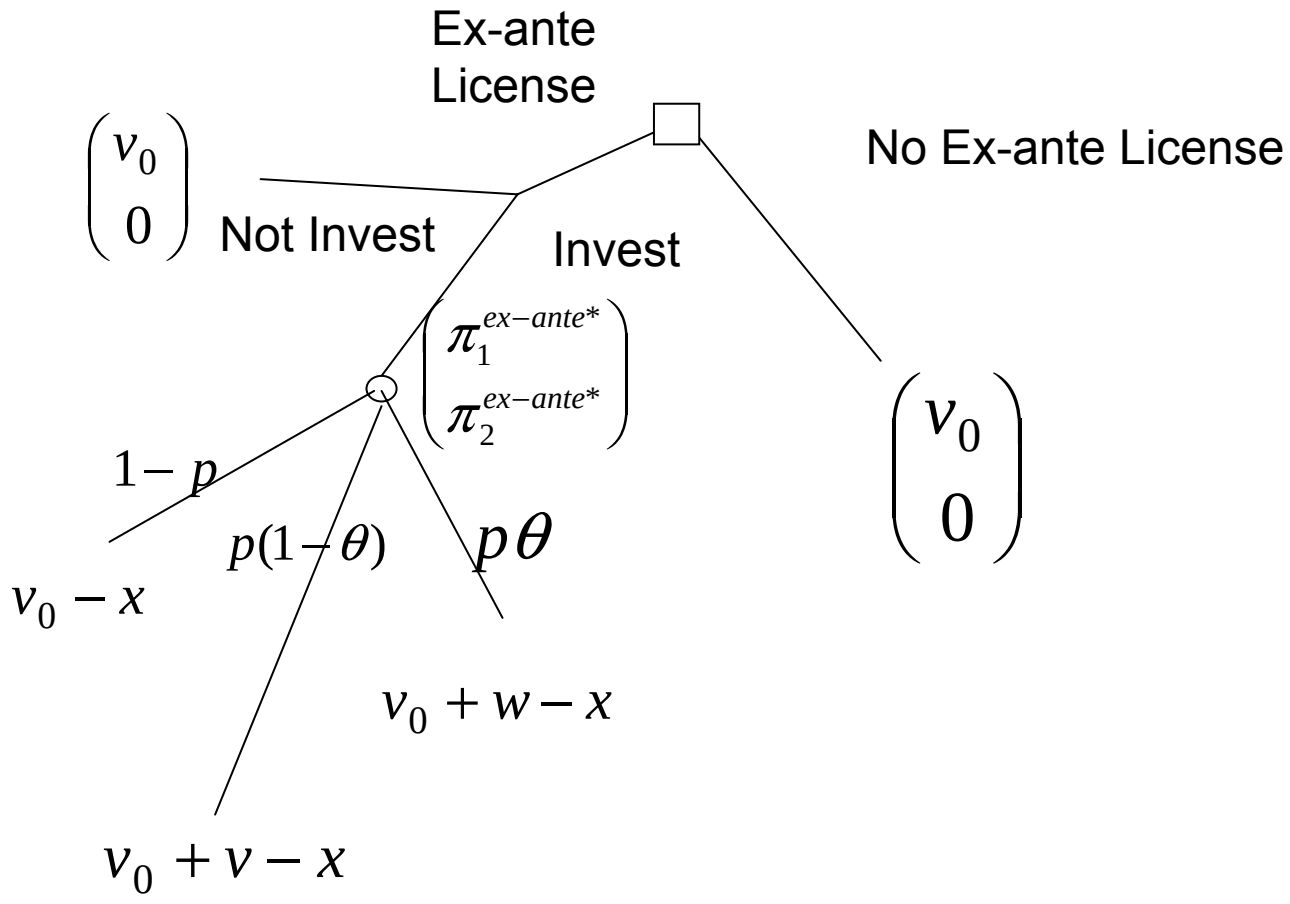


Fig 1: No Research Exemption

Case with research exemption

- With research exemption, the follower has the option of undertaking research without the research license and getting an ex-post license for production when necessary.
- Ex-ante licensing is still possible (if anti-trust restriction is not binding) but not forced.
- If ex-ante licensing is not taken,

(1) The follower bears the full cost of research (sunk when a negotiation takes place)

(2) On the other, it can gain all the monopoly profit $v_0 + w$ when it succeeds in inventing-around the pioneer.

- Three potential outcomes (Table) which determines the threat point for ex-ante negotiation.

Table 1

Three potential outcomes of no-ex-ante negotiation (ex-post license when necessary)	*Effects of ex-ante negotiation*
1.Low expected profit so that no investment takes place	May enable investment by facilitating the sharing of the investment cost
2.investment and the increase of the joint expected profit	the same investment but payoff different from the case of no exemption
3. investment but the decrease of the expected profit decreasing	Ex-ante agreement not to invest (the follower's commitment not to invest +the reverse payment from the pioneer) → likely to be an antitrust violation

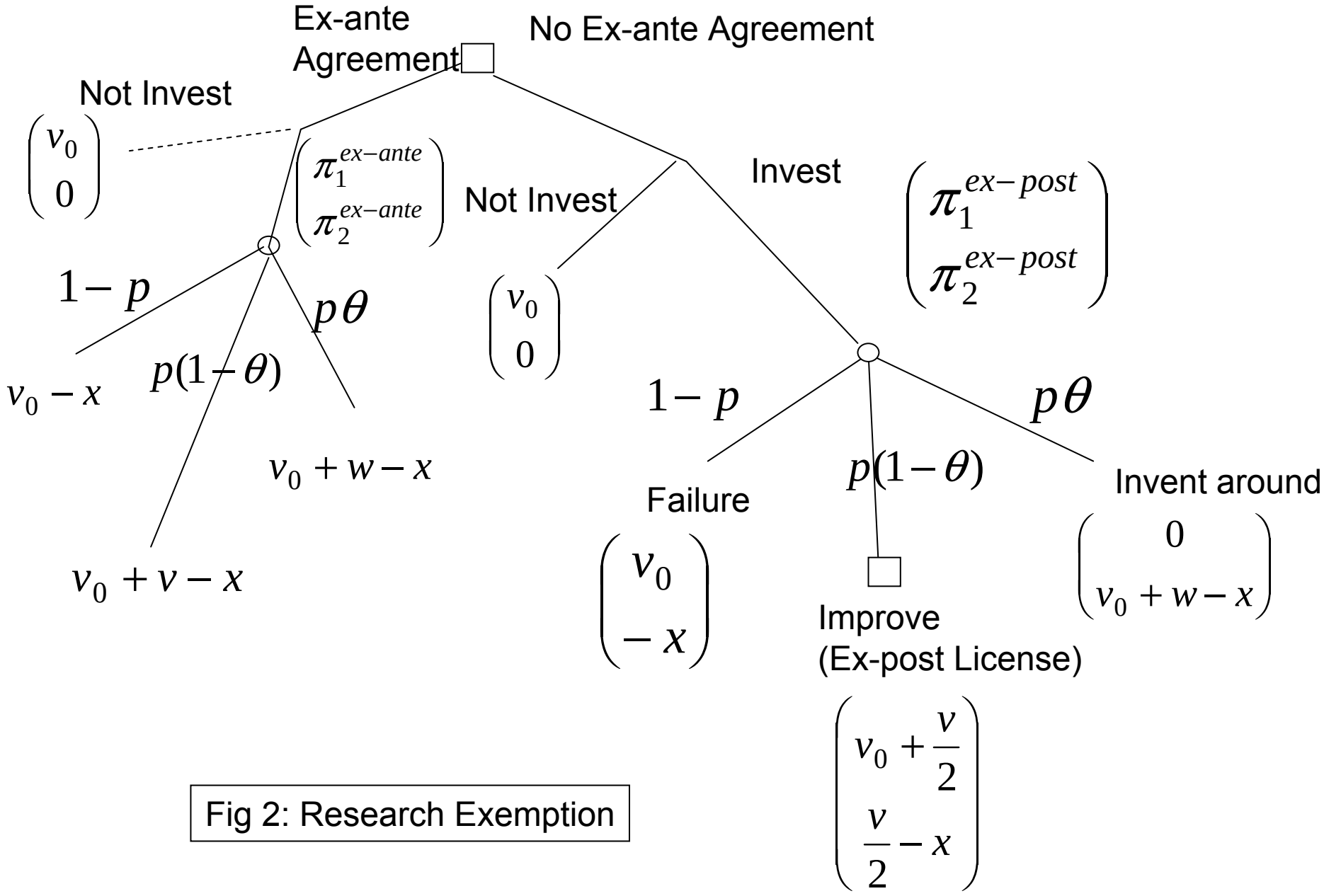


Fig 2: Research Exemption

- Given the antitrust restriction on the agreement not to invest, we have
- Proposition 1.

(1)Research exemption always enhances the investment by the follower.

(2)It can reduce the follower's profit and enhance the pioneer's profit (Scotchmer (2004)) , but only when the probability of inventing around is sufficiently low .

(3)It can reduce economic welfare by discouraging efficient ex-ante contracting if the inventing-around is easy.

Discussions

- the follower' loss from research exemption (Scotchmer (2004))

  If research exemption exists, the follower would choose to bear the full innovation cost if the ex-ante license were denied. Thus, the threat point shifts in favor of the pioneer.

  This result is reversed if the possibility of inventing around is large.

- With research exemption and the antitrust restriction on the agreement not to invest, a significant possibility of inventing around makes the ex-post licensing a real outcome.

3 Perpetual R&D competition model

- In many industries, innovation is perpetual :any innovation depends on past innovations as its knowledge basis, and it in turn contributes to future innovations: no beginning and no end in the innovation process.
  →Two-stage framework is not appropriate.

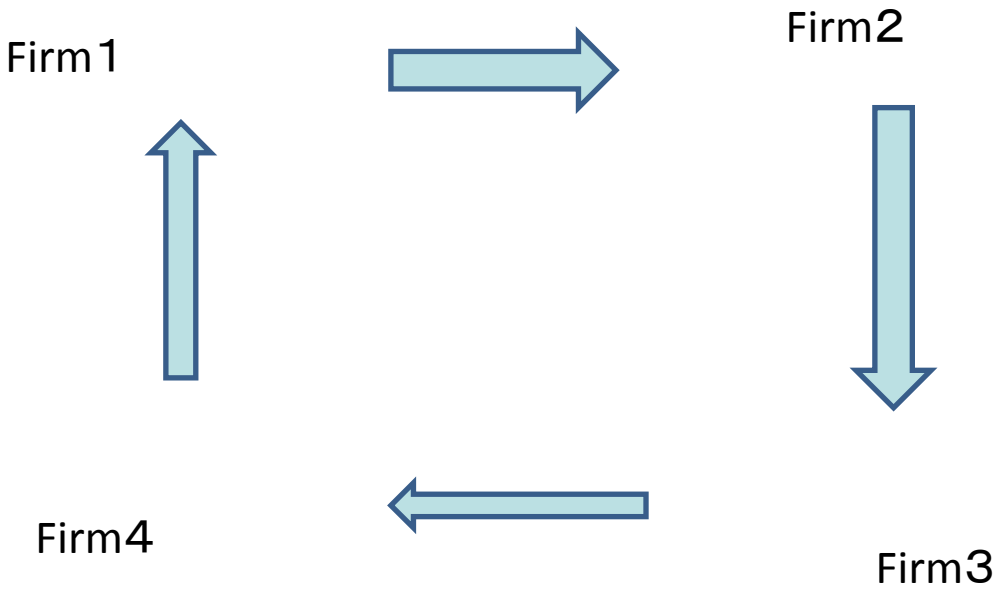
- We consider a perpetual stochastic R&D innovation process, where each firm is leap frogged by a drastic innovation by another firm.

- We compare the equilibrium investments of the stationary Markov equilibrium with and without research exemption, using the framework of Segal and Whinston (2007)).

Figure 2 Knowledge flow

Pioneer and follower model (biotechnology?)

Perpetual innovation (software?)



Model

- an incumbent (*I*) and an entrant or a non-incumbent (*E*).
- The incumbent monopolizes the product market for profit π^m, and only the entrant does research.
- the continuation values of incumbent and the entrant: V_I and V_E.
- the antitrust policy prohibits the agreement between the two firms not to invest.

- The entrant replaces the current incumbent with probability Φ with cost $c(\Phi)$ and becomes the incumbent, in which case it pays the former incumbent the share *a (royalty rate)* of the monopoly profit for research license.
- When research exemption does not exist, we assume that *royalty rate* rate is negotiated before entrant's decision on Φ.

  The level of *a* is determined by an alternative research technology available for the entrant.
- *a*=0 if research exemption exists.

Two effects of higher *a* (or absence of research exemption) on the incentives for innovation

1. The effect on this period profit from innovation is **negative**:

   It forces the entrant to pay more for the research license when it innovates and rewards the entrant as a licensor when it does not innovate.

2. The effect on the change of the continuation value due to the status change from the entrant to the incumbent is also **negative** :

   This is because incumbent pays the license fee for the research when it was an entrant.

Some algebra

- The expected profit of the entrant

$$\Phi(1-a)\,\pi^m + (1-\Phi)a\,\pi^m + \delta\{\Phi\, V^I + (1-\Phi)V^E\} - c(\Phi) \quad (1)$$

, where δ is the discount factor.

- An entrant chooses Φ, *so as to maximize*

$$\Phi\, w - c(\Phi) = \Phi\{(1-2a)\,\pi^m + \delta\,(V^I - V^E)\} - c(\Phi) \quad (2)$$

- The marginal profitability of innovation is given by *w.*
- In the Markov stationary equilibrium, we have

$$V^I - V^E = \{(1-2\Phi)(1-2a)\,\pi^m + \delta\, c(\Phi)\}/(1-\delta+2\delta\Phi) \quad (3)$$

which declines with *a* for Φ <1/2.

- Proposition 2.

  Research exemption increases innovation by increasing the difference between the return from new innovation and that from the old innovation.

- The transaction cost and the inefficiency of double markups strengthens the results.

- The result can be generalized to two entrants.

Discussions

- Economic rationale for the scope of copy right protection

  It only protects expression but not idea.

- Design of the scope of exemption rule

  research on subject matter

  research with subject matter

Conclusions

- The economic effects of exemption for research on improving or inventing-around the subject matter depend critically on innovation process.
- Such exemption is socially beneficial in the context of perpetual R&D competition, by enhancing the return from new innovation and reducing the return from old innovation.

- On the other hand, it can reduce economic welfare by discouraging efficient ex-ante contracting in the context of a pioneer and a follower research context, even though it always enhance the follower's research.

- The best approach might be to provide broad research exemption on the research on subject matter, while stronger protection is provided for pioneer invention in product market in terms of the breadth of claims.

Thanks a lot for listening!!

Key references

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