Rent Seeking and Innovation

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Carnegie-Rochester Conference

May 2, 2003

Overview

- Adam Smith: *A monopoly granted either to an individual or to a trading company has the same effect as a secret in trade or manufacturers*.

- Skills and resources are invested in turning the innovation into monopoly, we call this “rent-seeking”.

- We distinguish between private and public rent-seeking and study their interaction.

- We cast doubt on the presumption that allowing for public rent-seeking may reduce waisteful private rent-seeking.

Intellectual Property

- Are patents (and copyright) a good idea? Yes, for two reasons

1. *<u>Without monopoly, due to increasing returns, too few innovations</u>*

- B&L [2002] shows that even without monopoly innovations produced
- Innovations require as input earlier innovations => monopoly may decrease innovation
- simultaneous discovery means no need for IP
- industrial organization literature has not provided much empirical evidence that monopoly is either necessary or useful

Second argument in favor of intellectual property

2. Legal monopoly may mitigate the costs of private rent-seeking

- ♦ strongest argument against existing intellectual property law is encouragement of socially wasteful rent-seeking and regulative capture in the public sector
- ♦ largely ignored by economists
- ♦ we try to remedy that gap
- ♦ examine the political economy of intellectual property and ask whether allowing public rent-seeking leads to a welfare improvement because of reduction in private rent-seeking

Examples of public rent-seeking

- ♦ Sony Bono copyright extension law
- ♦ 1984 pharmaceutical industry was given extended patent protection
- ♦ 1994 term for all utility patents was extended from 17 to 20 years
- ♦ 1998 courts extend range of patent protection to include “business practices”
- ♦ Reagan administration patent examination system reformed to allow vague claims
- ♦ “submarine patents”
- ♦ patenting of the well-known and obvious widely used to “greenmail” firms into paying licensing fees
- ♦ U.S. has fought long and hard in the WTO to force other countries to conform - retroactively - to our patent and copyright law

Private rent-seeking

- ♦ traditional argument in favor of patent laws
- ♦ grant a legal monopoly in exchange for revealing the “secret” of the innovation
- ♦ apparently a clean way to make innovations widely available in the long run
- ♦ claim not been subject to much scrutiny by economists
- ♦ simplest case it fails: secrets longer and shorter than 20 years
- ♦ survey of R&D lab managers: for processes only 23% indicate patents effective as a means of appropriating returns; for products only 35%; 51% argue that trade-secrecy is effective in both cases

Our case

- ♦ real resources can be expended to make the secret less accessible
- ♦ innovator faces real trade-off between private and public rent-seeking

Conclusions

- ♦ trade-off generally ambiguous, but patents may increase secrecy
- ♦ good idea to require immediate enforcement of patents that are infringed
- ♦ severe problem when public sector is not benevolent or is captured

Related Literature

- information revelation process during patenting (Anton and Yao [2000])
- role in patent races (Battacharya and Ritter [1983)], Horstmann, MacDonald and Slivinski [1985])
- disclosure may be advantageous by changing beliefs)Okuno-Fujiwara et al. [1990])
- disclosure may prevent rival patent (Ponce [2003])
- political economy of patent treaties (Scotchmer [2001])

The Model

- ♦ impact of substitutability between private and public rent-seeking on the rate of adoption of innovations
- ♦ case of a single innovator, innovation already produced, who pays a private cost to reduce chances others imitate his product

Three observations about innovation

- ♦ time to ramp up productive capacity
- ♦ monopoly through secrecy without IP
- ♦ ideas useful only insofar as they are embodied in either people or things

Production and Consumption

- ♦ productive capacity k = stock of capital + idea (secret)
- ♦ initial capacity, held by the sole innovator k_0
- ♦ continuous time model w/ fixed real interest rate
- ♦ Quah's [2002] 24/7 model, or learning by doing: capacity grows at $\dot{k} \leq \gamma k$

♦ capacity produces consumption

♦ flow of consumption $c(t) \leq k(t)$

♦ single representative consumer with quasi-linear utility

$$U = r\int_{t=0}^{\infty} u(c(t))e^{-rt}dt + m,$$

♦ instantaneous cost of producing c units of consumption wc

♦ instantaneous profits $\pi(c) = \max\{0, u'(c)c - wc\}$

♦ $\pi(c)$ is single peaked, with a maximum at $c = \zeta$

Monopoly

- under monopoly average present value of profits is maximized by going to $k=\zeta$ as fast as possible, then stay there
- $s=(1/\gamma)\log(\zeta/k_0)$ is the time to the peak

Monopolist payoff is

- $R_1(k)=r\int_0^s e^{-rt}\pi(ke^{\gamma t})dt+(k/\zeta)^{r/\gamma}\pi(\zeta)$

Competition

- innovator still earns the competitive rent

$$r\int_0^{\infty} e^{-rt}\pi(c(t))dt$$

- growth of capacity is out of the control of the innovator
- competition between many producers leads capacity to expand at the greatest possible rate
- output expands to the point at which profits fall to zero
- competitive rent

$$R_0(k) = r\int_0^{\infty} e^{-rt}\pi(ke^{\gamma t})dt.$$

- $R_0(k)$ is maximized at a stock of capital $\zeta_0 < \zeta$

Difference in profits between monopolist and competition is

$$R_1(k) - R_0(k) = (k/\zeta)^{r/\gamma}\left(\pi(\zeta) - R_0(\zeta)\right).$$

increasing function of k

higher productive capacity => stronger incentive to retain monopoly

Private Rent-Seeking

- ♦ effort level of a to keep the secret,

- ♦ secret is lost according to Poisson process with intensity $\lambda(a)$

- ♦ parameter $\lambda(a)$ decreasing in a, and convex

Public Rent-Seeking

- purchase of a legal monopoly
- existing patent terms long (20 years) so we assume monopoly lasts forever

Three costs

- initial: b_0
- at or before secret is revealed: b_1
- prior to use of monopoly: b_2

Example

- chemical compound produced through series of elaborate steps
- stock of productive capital are trained employees
- “missing piece of the puzzle”
- employees do not know it and innovator adds secret ingredient at last minute
- at some point, an employee discovers the secret ingredient
- word quickly spreads over the shop floor
- all the employees leave the employment of the innovator, and start production on their own
- all is not lost to the innovator at this point

- in addition to the profit earned prior to revelation of the secret he gets the entire expected average present value of profits his workers will make on their own once the secret is revealed
- because he can charge them for the knowledge that will eventually become useful to them
- competition among potential employees reduces their profits to zero
- Becker [1971] “Firms introducing innovations are alleged to be forced to share their knowledge with competitors through the bidding away of employees who are privy to their secrets. This may well be a common practice, but if employees benefit from access to salable information about secrets, they would be willing to work more cheaply than otherwise.”

After the Secret is Lost

Ownership of Capacity

- in example all capacity belongs to the employees ($\alpha = 0$), Napster case
- could have machines belonging to employers ($\alpha = 1$), Coca Cola case
- we assume after the secret revealed, only fraction of capacity $0 \leq \alpha \leq 1$ remains with innovator
- remainder $1 - \alpha$ goes to competitors

Behavior of innovator depends on having or not IP

Behavior of Innovator without IP, after loss of secret

- Precommits to keeping industry capacity at ζ after secret lost to maximize sale price of capacity before it is lost
- grow until the industry's profit maximum of ζ reached
- stay at ζ as long as possible by letting own own share α shrink to zero
- earn $R_0(\zeta)$ after capacity is exhausted
- earn a total of

$$R_\alpha(k) = r\int_0^s e^{-rt}\pi(ke^{\gamma t})dt + \left(\frac{k}{\zeta}\right)^{r/\gamma}[\pi(\zeta) - (1-\alpha)^{r/\gamma}(\pi(\zeta) - R_0(\zeta))].$$

- as $\gamma \to \infty$ we have $R_\alpha(k) \to R_0(k)$.

Solving the Model

Optimal Strategies for an Innovator

After the secret is revealed gain over $R_\alpha(k)$ from paying b_1 and b_2 subsequently is

$$M(k) = \begin{cases} R_1(k) - R_\alpha(k) - b_1 - (k/\zeta)^{r/\gamma} b_2 & k < \zeta \\ \pi(\zeta) - R_\alpha(\zeta) - b_1 - b_2 & k \geq \zeta \end{cases}$$

$M(k)$ can be either positive or negative

Strategy NIP

Do not use the b_0 option. If $k_0 > \xi_\alpha$ reduce capacity to ξ_α; if $k_0 < \xi_\alpha$ grow capacity to ξ_α. If ξ_α is reached before the Poisson event, stay there until the Poisson event occurs. Once the Poisson event occurs, follow the continuation path yielding R_α. This requires: grow capacity until the profit maximizer ζ is reached; from there, decrease own capacity until it is a negligible fraction of the total, earning competitive rents from then onward.

Gross profit (excluding the initial cost a) from the NIP strategy

$$\Pi_{NIP}(a,\xi_\alpha) = R_\alpha(k_0) + (k_0/\xi_\alpha)^{(\lambda(a)+r)/\gamma}[frac]r\lambda(a) + r\,(\pi(\xi_\alpha) - R_\alpha(\xi_\alpha)).$$

we find ξ_α by maximizing these profits.

Strategy IP

Use the b_0 option. If $k_0 > \zeta$ reduce capacity to ζ; if $k_0 < \zeta$ grow capacity to ζ. If ζ is reached before the Poisson event, stay there; when the event occurs pay $b_1 + b_2$. If the Poisson event occurs before ζ is reached and $M(k) < 0$ do not use the remaining parts of the b option, go instead for payoff R_α. If $M(k) \geq 0$ when the Poisson event occurs, expend b_1 and allow capacity to grow until ζ is reached. When ζ is reached expend b_2 and remain a monopolist forever.

Gross profit (excluding the initial costs a, b_0) from the IP strategy

$$\Pi_{IP}(a) = R_\alpha(k_0) + (k_0/\zeta)^{(\lambda(a)+r)/\gamma} \frac{r}{\lambda(a)+r}[\pi(\zeta) - R_\alpha(\zeta)] + \\ + \int_0^\infty \lambda(a) e^{-(\lambda(a)+r)t} \max\{M(k_0 e^{\gamma t}), 0\} dt$$

Theorem: The optimal innovator strategy is the following. If

$$\max_{a} \Pi_{IP}(a) - a - b_0 > \max_{a,\xi} \Pi_{NIP}(a,\xi) - a;$$

pay the b_0 fee, choose a to maximize $\Pi_{IP}(a) - a$ and follow strategy IP; otherwise do not pay the b_0 fee, choose a, ξ to maximize $\Pi_{NIP}(a,\xi) - a$ and then follow strategy NIP.

Remark: the level of capital at which accumulation stops (until the Poisson event hits) in the NIP case satisfies $\zeta_\alpha < \xi_\alpha < \zeta$; this is a source of inefficiency, relative to the IP strategy.

Opting for Public Rent-Seeking

IP strategy characterized by threshold stock when Poisson event takes place: if $k \geq \kappa$ pay b_1

expected gain from paying b_0 is equal to

$$\Pi_{IP}(a_{ip}) - \Pi_{NIP}(a_{nip}, \xi_\alpha) + (a_{nip} - a_{ip}).$$

break into two pieces

$$O(a_{ip}) = \int_0^\infty \lambda(a_{ip}) e^{-t\lambda(a_{ip})} \max\{e^{-rt} M(k_0 e^{\gamma t}), 0\} dt$$

and difference between

$$(k_0/\zeta)^{(\lambda(a_{ip})+r)/\gamma} \frac{r}{\lambda(a_{ip}) + r} [\pi(\zeta) - R_\alpha(\zeta)] - a_{ip}$$

and

$$(k_0/\xi_\alpha)^{(\lambda(a_{nip})+r)/\gamma} \frac{r}{\lambda(a_{nip}) + r} [\pi(\xi_\alpha) - R_\alpha(\xi_\alpha)] - a_{nip}.$$

Evaluating Private Rent-Seeking

$\hat{a} = (k_0/\zeta)^{r/\gamma}(\pi(\zeta) - R_\alpha(\zeta));\ \iota = \lambda(\hat{a})$

optimal choice of a must result in $\lambda \geq \iota$ giving bounds

$$a_{nip} \leq \left(\frac{k_0}{\xi_\alpha}\right)^{(\iota+r)/\gamma} \frac{r}{r+\iota}(\pi(\xi_\alpha) - R(\xi_\alpha))$$

$$a_{ip} \leq \left(\frac{k_0}{\zeta}\right)^{(\iota+r)/\gamma} \frac{r}{r+\iota}(\pi(\zeta) - R(\zeta)) + \Delta O$$

ΔO largest variation in option value O attributable to decrease in λ

two bounds not generally rankable

Secrecy with and without IP

boundary of the set where NIP is optimal

$$\Pi_{NIP}(a_{nip}, \xi_\alpha) - a_{nip} = \Pi_{IP}(a_{ip}) - a_{ip} - b_0,$$

♦ is a_{nip} and a_{ip}, is higher at this point?

cost of increasing a same in both cases

examine payoffs from decreasing λ via a rise in a

$$\frac{d\Pi_{NIP}}{d\lambda} = \left[\Pi_{NIP}(\lambda, \xi_\alpha) - R_\alpha(k_0)\right]\left[-t(k_0, \xi_\alpha) - \frac{1}{\lambda + r}\right]$$

$$\frac{d\Pi_{IP}}{d\lambda} = \left[\Pi_{IP}(\lambda) - R_\alpha(k_0) - O(\lambda)\right]\left[-t(k_0, \zeta) - \frac{1}{\lambda + r}\right] + O'(\lambda)$$

where

$$O'(\lambda) = -\int_{t=0}^{\infty} \lambda(a) e^{-\lambda t}(t - (1/\lambda)) \max\{e^{-rt} M(k_0 e^{\gamma t}), 0\} dt.$$

$1/\lambda$ (expected length of time until secret leaks out) smaller than the time at which κ is reached ($t_\kappa = \log(\kappa/k_0)/\gamma$) then $O'(\lambda) > 0$

compare derivatives term by term, holding λ constant at $\lambda(a_{NIP})$

$$\frac{d\Pi_{NIP}}{d\lambda} = [\Pi_{NIP}(\lambda,\xi_\alpha) - R_\alpha(k_0)]\left[-t(k_0,\xi_\alpha) - \frac{1}{\lambda + r}\right]$$

$$\frac{d\Pi_{IP}}{d\lambda} = [\Pi_{IP}(\lambda) - R_\alpha(k_0) - O(\lambda)]\left[-t(k_0,\zeta) - \frac{1}{\lambda + r}\right] + O'(\lambda)$$

first square bracket is positive

second square bracket negative

$\zeta > \xi_\alpha$ implies second square bracket term larger in absolute value with IP

first square bracket is maximized by ξ_α so larger in absolute value without IP

so ambiguous in general

class of examples where $a_{ip} > a_{nip}$ *equivalently* $\lambda_{nip} < \lambda_{ip}$

$b_2 = 0$ for simplicity

γ large

♦ favorable to NIP forces ξ_α to approachs ζ so NIP distortion small

make k_0 small to keep time to profit peak from getting shorter as γ gets larger

as $\gamma \to \infty$, $\kappa \to 0$, where $M(\kappa) = 0$

set $k_0 = \kappa e^{-\gamma/\lambda_{nip}}$ this fixes the time at which κ is reached to $1/\lambda_{nip}$ giving $O'(\lambda) < \underline{O} < 0$ even in the limit difference between the first term of profit derivatives

$$\left(\frac{\kappa e^{-\gamma/\lambda_{nip})}}{\xi_\alpha}\right)^{(\lambda_{nip}+r)/\gamma} \frac{r}{r+\lambda_{nip}}[\pi(\xi_\alpha) - R_\alpha(\xi_\alpha)] -$$

$$\left(\frac{\kappa e^{-\gamma/\lambda_{nip}}}{\zeta}\right)^{(\lambda_{nip}+r)/\gamma} \frac{[r}{r+\lambda_{nip}}[\pi(\zeta) - R_\alpha(\zeta)] \to 0$$

which gives the class of counterexamples

role of α

a increases as α decreases

♦ larger competitive fringe gives a stronger incentive to invest in keeping the secret

with public rent-seeking threshold level κ lower when α is small

♦ α small gives stronger incentive to grab the legal monopoly

Welfare Implications

Mechanism Design Perspective

- ♦ IP has deadweight loss of consumer surplus

$$(k_0/\zeta)^{r/\gamma}\left[U(\zeta) - u(\zeta)\right]$$

weighted by probability that IP option is used

- ♦ both IP, NIP social cost due to secrecy w_a

- ♦ without IP innovator produces less prior to loss of secret clearest case from above

γ and k_0 small

IP leads to more secrecy than no IP

plus ξ_α is close to ζ so not much NIP distortion (third bullet item)

since we held fixed the probability the IP option is used at the probability of exceeding mean time to loss of secret [note to Michele: in the paper we say $\kappa < k_0$ which we have ruled out in our example] the deadweight loss of consumer surplus remains significant when there is IP

conclude that not IP is better than IP

similar conclusion when λ large

choose b_1 large enough that no grabbing of the IP option occurs before ξ_α is reached

Endogenous Patent Cost

- no benevolent planner trying to design the socially optimal mechanism
- instead own-profit maximizer setting the vector b in order to maximize own benefits.
- obviously planner sets b high enough to make the innovator almost indifferent between the IP and the NIP strategy

Mandatory Patents

- with optional patenting innovator gets at least return as without the patent system
- in practice the patent may be awarded to someone else
- unless the government can commit to giving the patent to the right party, there is a hold up problem
- patent acts like a business license - a firm cannot do business without the patent, since if they do not get it someone else will
- extreme case: all rent extracted *ex post,* innovator earns nothing – and there is no innovation

- if it is impossible to charge for the license until until after the secret leaks out profits can be either smaller or bigger than competitive rent
- government may not have the blanket right to charge instead it randomly allocates the rights by issuing vague patents to general ideas; not that while government may be able to solve the holdup problem through precommitment, small patent holders probably cannot (problem of the submarine patent)
- reiterate this point: if the government divides up the world of all ideas, giving each individual a small piece – i.e. well defined “property rights” via a gold-rush method – the predictable consequence is that there will be ***NO*** innovation at all
- political economy of patents not well understood by large multi-national (read U.S.) corporations lobbying most intensively in favor of international patent protection through the WTO: think ice-skating judges at the Olympic games

Conclusion

legal protection of IP may play a socially valuable role if

(i) sole innovator has access to a costly private technology to keep secrecy

(ii) social cost induced by private secrecy is high

- ♦ benevolent central planner: IP protection is desirable only under special parametric circumstances
- ♦ optimal patent policy treats different goods, industries, and markets differently
- ♦ government pursuing self-interest reduces the welfare benefit of IP
- ♦ without commitment, innovation may cease entirely

Policy Conclusion

- ♦ allowing government to grant monopolies extremely dangerous
- ♦ demand clear and compelling evidence before doing so
- ♦ theory not sufficient; empirical work non-existent; anecdotal evidence suggests IP laws work badly
- ♦ so strong presumption ***AGAINST*** patents and copyright
- ♦ abolish them until and unless someone has really strong evidence they do some good