Intellectual Property Rights and Strategic Patent Litigation

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Intellectual Property Rights (IPR)

- Public Good Nature of Knowledge and Information
- Static Efficiency

Price = Marginal Cost

→Information goods should be freely available.

- High Cost of Creating New Information

Static vs. Dynamic Efficiency

- Intellectual Property Rights as a Mechanism to Provide Incentives to Invest in R&D.
- Restore Dynamic Efficiency at the Expense of Static Efficiency
- Solow Residual (1957): the part of growth that cannot be explained through capital accumulation

Intellectual Property Rights

- IPR as a Source of New Revenue and as a Competitive Weapon
- The story of Texas Instruments Inc. (TI)
- Though designed to spur innovation, excessive use of patents can have the opposite effect on future advances in technology.
- "Standing on the Shoulders of Giants"
  - Cumulative Innovation Processes
  - Blocking Patents

Injunctions and "Hold-Up"

- Injunctions as a patent infringement remedy
- Ex Post "Hold-Up" Problem
  - Ex Ante vs. Ex Post Competition
  - True Value of Innovation = Ex Ante value
  - Ex Post Value = Ex Ante + Hold-Up Value
- The eBay Case limits the Grant of Injunctions as a remedy.

Example

- Consider a technology that is superior to the freely available technology by $1.

→ With ex ante Nash bargaining, the negotiated royalty rate would be $0.5.

- With ex post bargaining (after design and marketing of the product), the patent holder can extract half of the redesign costs and lost profits during the redesign period → Hold-Up Value

Standard Essential Patents (SEPs)

- Standard Setting Organizations (SSOs): Interoperability
- Motorola vs. Apple:

  "It only takes only one bullet to kill"

- FRAND Commitments

"**F**air, **R**easonable, **A**nd **N**on-**D**iscriminatory"

- "Reasonable" is not only a subjective term but "perhaps the most litigated word in American history."

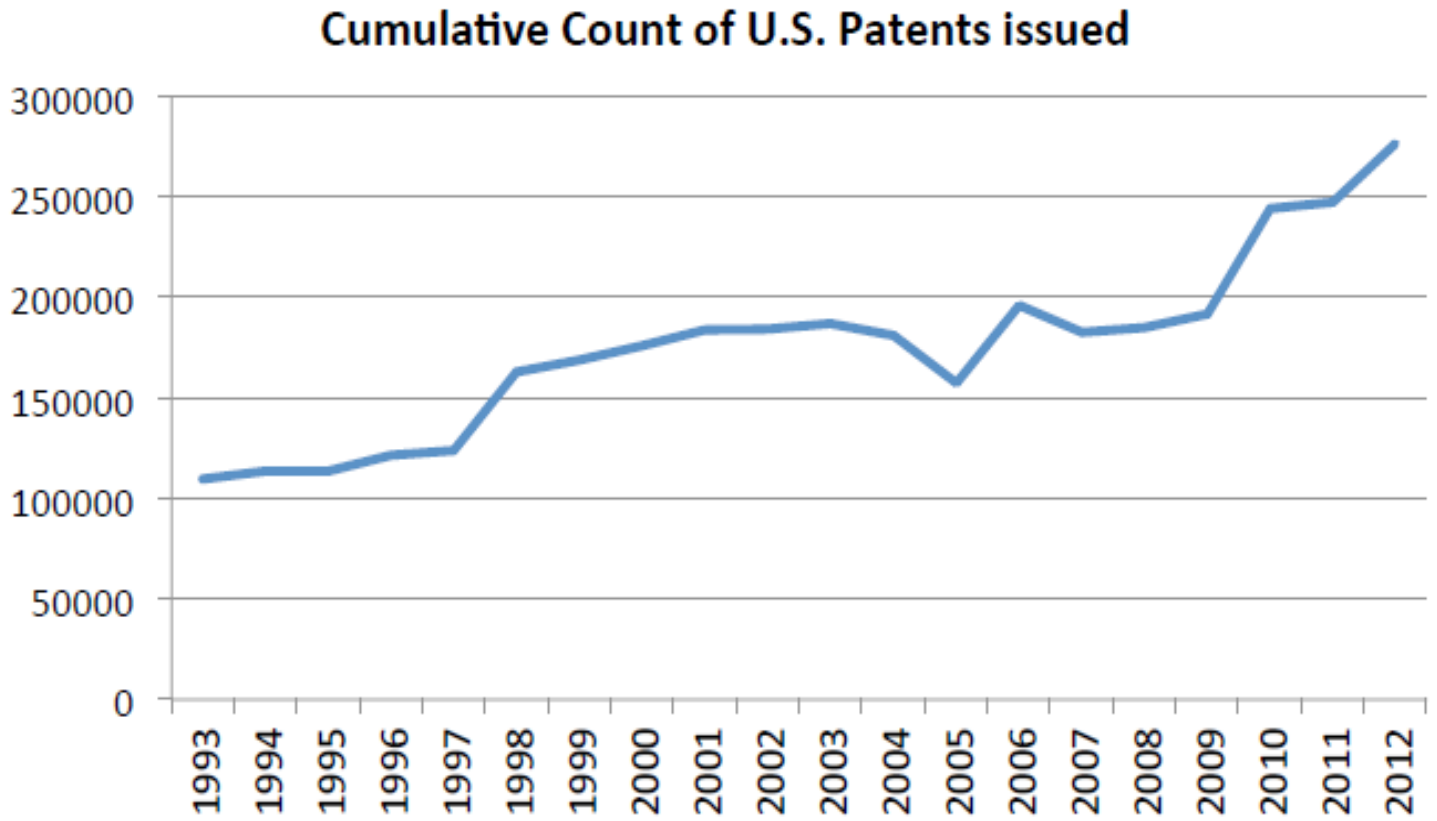
Recent Proposals

- Binding Baseball-Style ("Final Offer") Arbitration (by Lemley and Shapiro, 2013)
- Structured Price Commitments (by Lerner and Tirole, forthcoming)
  - Price Commitments
  - Standard Design
  - Ex Post Pool Formation
  - Independent Licenses
  - User Selection

Patent Explosion

- Recent years have seen a dramatic increase in the number of patent applications and patents granted
- "Patent Portfolio" Races
- Firms accumulate a large amount of related patents in diverse technology fields
  - Mitigate Potential "Hold-Up" Problems
  - Use as a Bargaining Chips in Negotiations with Other Patent Owners

Patent Explosion



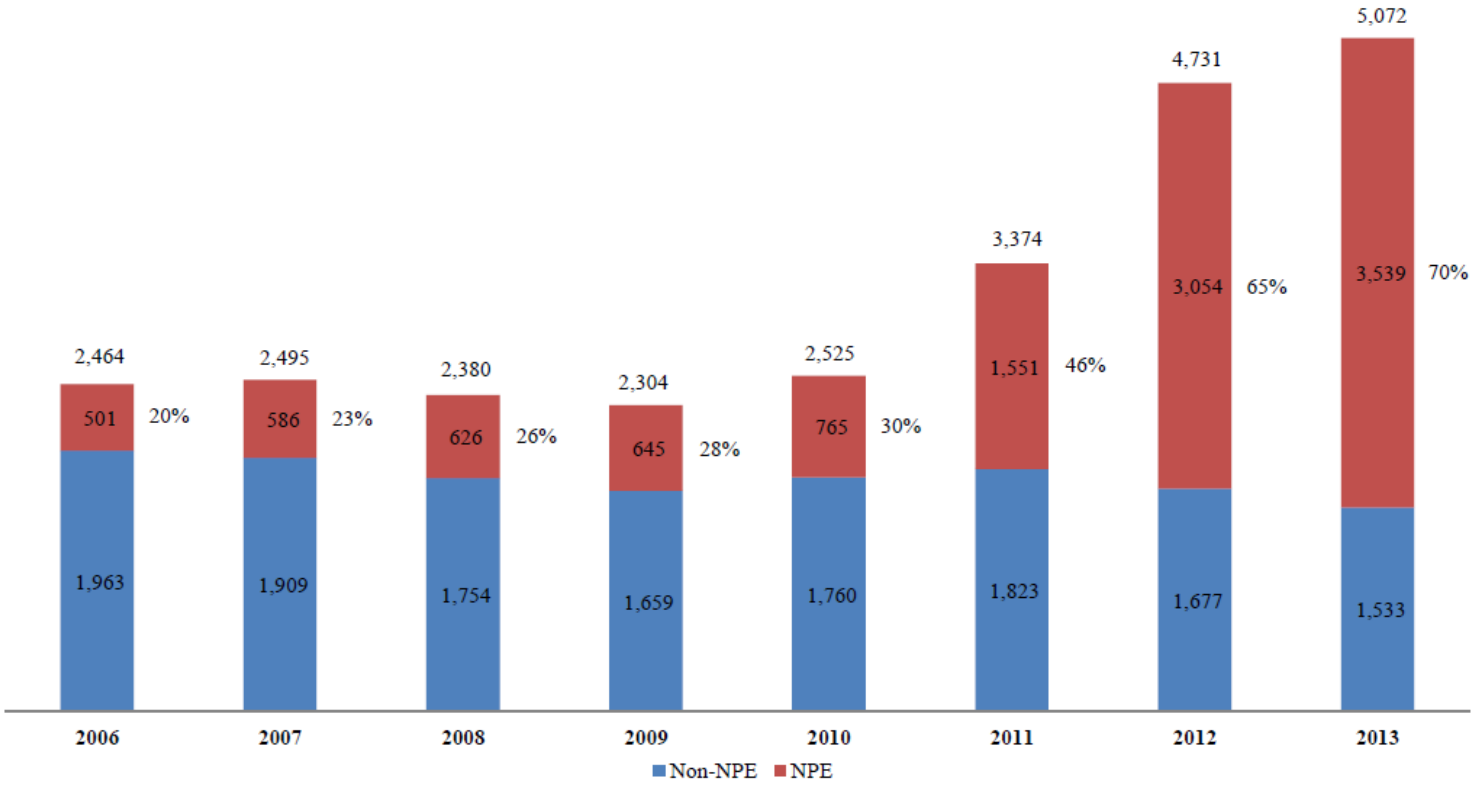
Patent Portfolio Acquisitions

- The acquisition of Nortel Network's patent portfolio by the Rockstar consortium (whose members include Apple, Microsoft, Research in Motion, Ericsson and Sony)
- Google, which lost its bid for Nortel patents, responded with its own acquisition of Motorola Mobility at the price of $12.5 billion.

Non-Practicing Entities (NPE), Patent-Asserting Entities (PAE), and Patent "Trolls"

- Non-Practicing Entities (NPE) as the most controversial patent intermediaries (Hagiu and Yoffie, 2013)
- In 2011, NPEs brought 1211 lawsuits targeting 5,031 operating companies.
- Defensive Aggregators (RPX, Allied Security Trust)

Growth of NPE Cases (Morton and Shapiro, 2013)



Troll

Patent Trolls

- Coined by Intel's Lawyer Peter Detkin (who later co-founded Intellectual Ventures)
- Value of patents based on "exclusionary" value with "ambush" tactics
  - $612.5 Million Settlement between Research in Motion and NTP
- Secrecy: Intellectual Ventures has created more than 1200 shell companies.

Patent Portfolios and Litigation

- The sheer number of patents held by other firms makes it impractical for firms to develop new products that avoid inadvertent infringement on other firms' patent portfolio with certainty.
  - "minefield" patents
  - secrecy by "trolls"

Independent Invention/ Inadvertent Infringement

- Particularly pertinent in many high-tech industries where technologies are rapidly advancing and cumulative drawing upon the existing stocks of knowledge.
- Mulligan and Lee (forthcoming) estimate that "it would require roughly 2 million patent attorneys working full-time, to compare every firm's products with every patent issued in a given year" to avoid accidental infringement.

Digital Convergence and Complementary Patents

- Multi-component Products in ICT: The development of new products often requires access to and integration of numerous complementary technologies.
- Smartphones that employ a variety of technologies in the areas of wireless communication, GPS, camera, digital technology, high speed broadband, and so on.

Patent Litigation

- Probabilistic Patents
  - Patents as a Lottery: “argued by professionals and decided by amateurs”
  - Signpost System (vs. Fencepost)
  - Doctrine of Equivalents
- Patent Explosion with Weak Patents
  - Lack of Relevant Databases of Prior Art in the New Subject Areas such as Software

    → “Patent Thickets”

Patent Explosion with Weak Patents

- Limited Resources and Lack of Incentives at the Patent Office
  - Ex Parte Relationship
  - High Turnover Rate of Examiners
- Grant Rate in the US = 97%

  (67% in Europe, 64% in Japan)
  - Smucker's "Uncrustables"
  - Gemstar-TV Guide

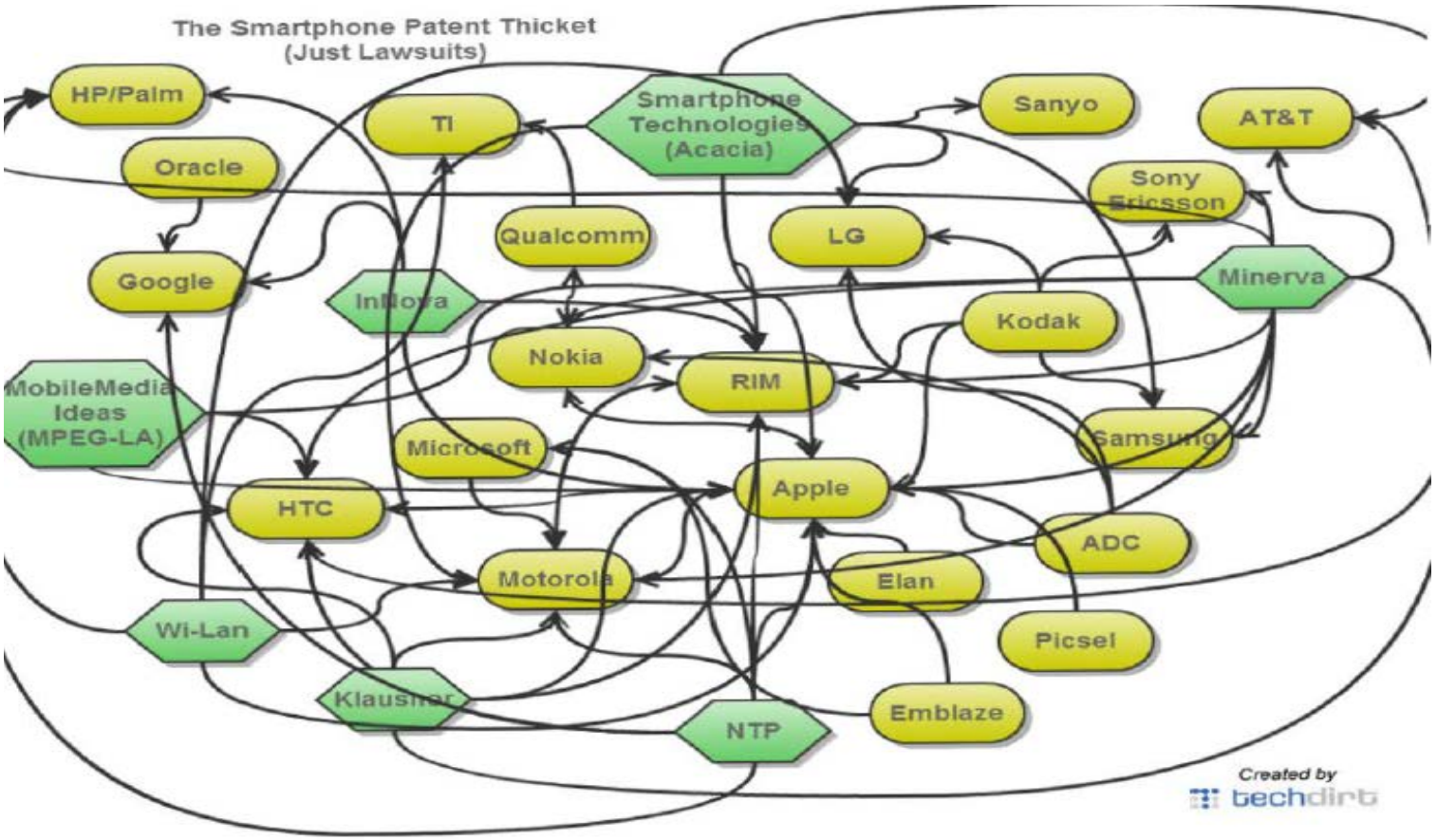
Patent Invalidation?

- Q: Can the Litigation Process be Relied on to Restore Competition When Imperfect Market Outcome is Sustained through Patents of Suspect Value?
- A: Patent Invalidation as a Public Good (Choi, 1998)

Patent Portfolios and Litigation

- Fuzzy Boundary: The amassment of patents inevitably leads to overlapping claims and litigations.
- Apple is being embroiled in more than 150 IP lawsuits in 2012 as a plaintiff, defendant, and counter-claimant, as witnessed by the global litigation with Samsung.

Litigation in the Smartphone Market

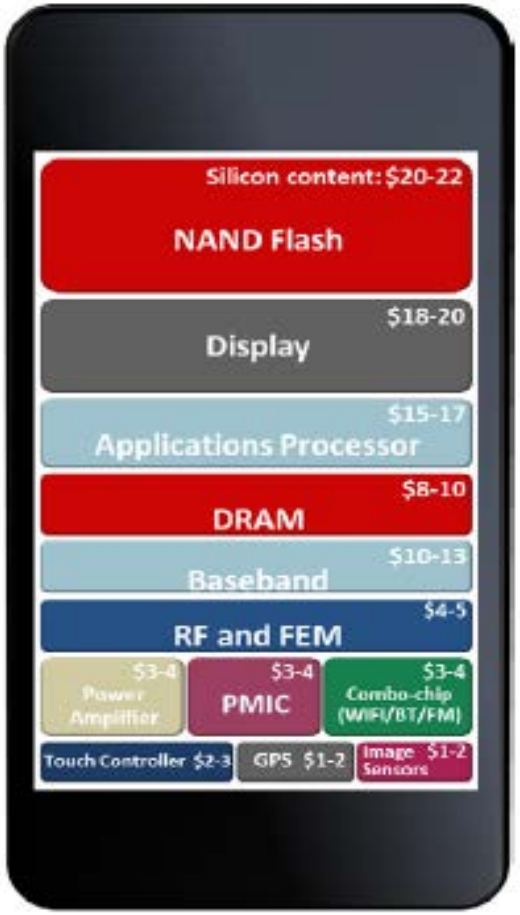


Research Agenda

- How the Relative Position of Patent Portfolios vis-à-vis Competitors Influences
  - Incentives to Litigate
  - Incentives to Develop a New Product
- Incentives to Acquire Patent Portfolios
  - Patent Portfolio Size
  - Composition
- Implications for Patent Reform?

Royalty Stacking in the Smartphone

Source: Armstrong, Mueller, and Syrett (2014)



Royalty Stacking

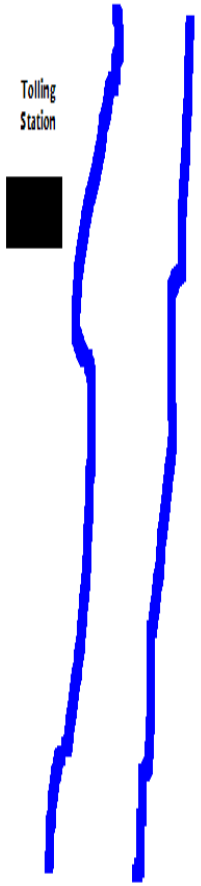
Source: Armstrong, Mueller, and Syrett (2014)

Technology	Potential Royalty Demands
Cellular Baseband Chip (Standardized)	$54
Wi-Fi/802.11	$50
AAC	$0.20
MP3	$0.95
H.264	$10.60
Operating system software (Microsoft or Android)	$5-8
Total (approx.)	**$121-124**

Pricing Inefficiency with Independent Licensing

- Imagine that there is a **river**.
- The **river** is the easiest way to deliver goods to market.
- There is a kingdom that controls the river and is able to charge a toll for the passage.
- The Rhine River Example

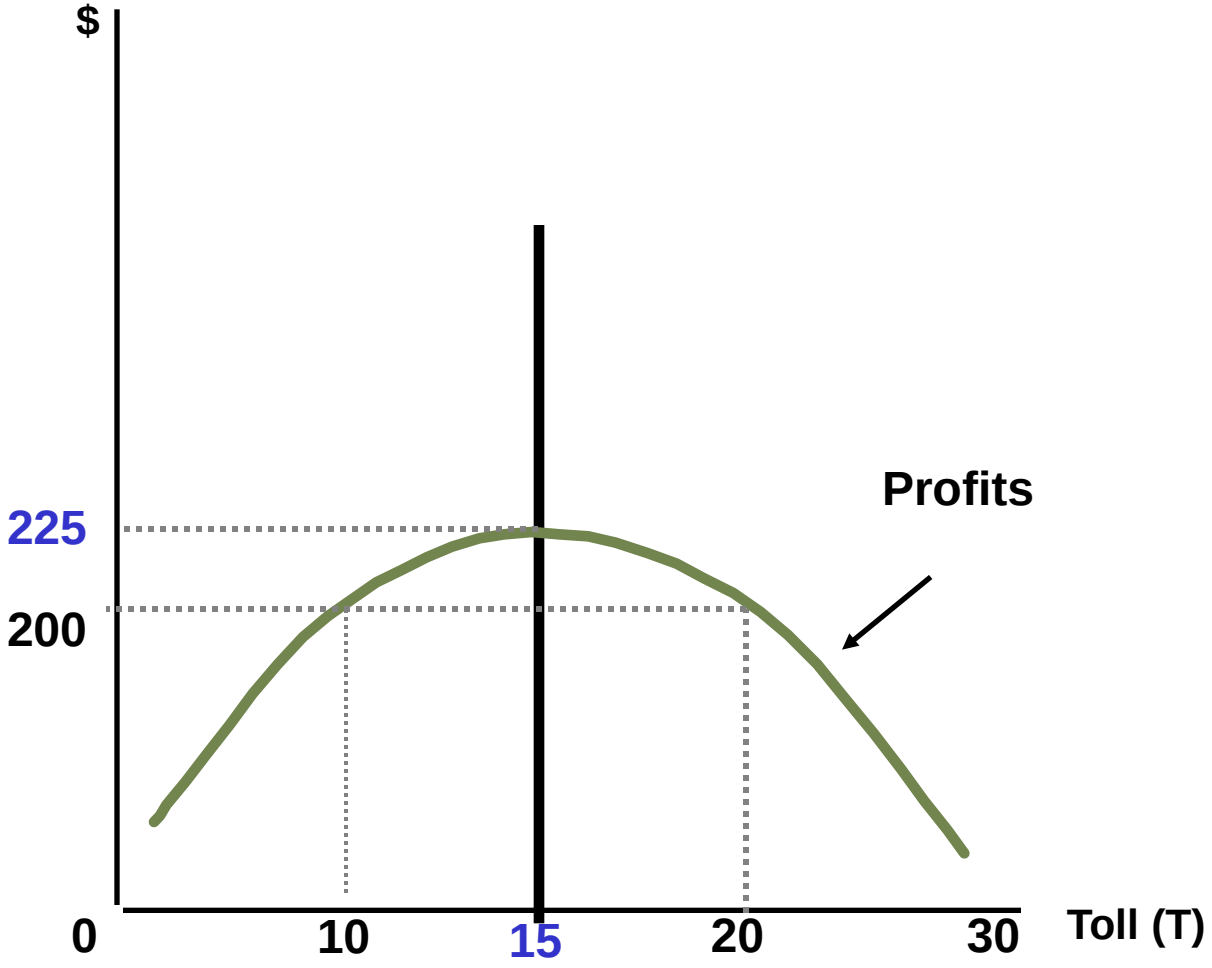
Tolling Example



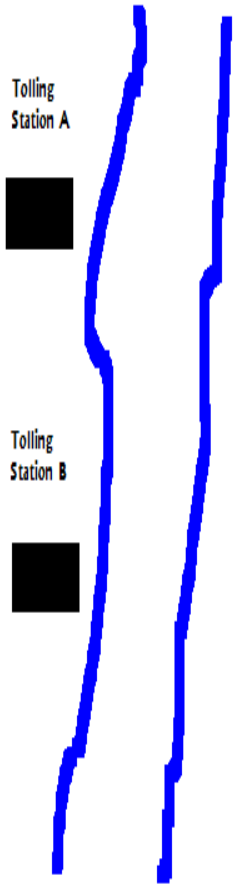
- Q = 30 – T
- What is the Optimal Toll to Maximize the Revenue?

Toll (T)	Q	Revenue
10	20	200
15	15	225
20	10	200

Profit Maximization with One Station



Tolling Example with 2 Stations



- Q = 30 – T
- What is the total toll ($T = t_A + t_B$) in equilibrium?
- Game-Theoretic Situation with Strategic Interdependence

Strategic Interdependence

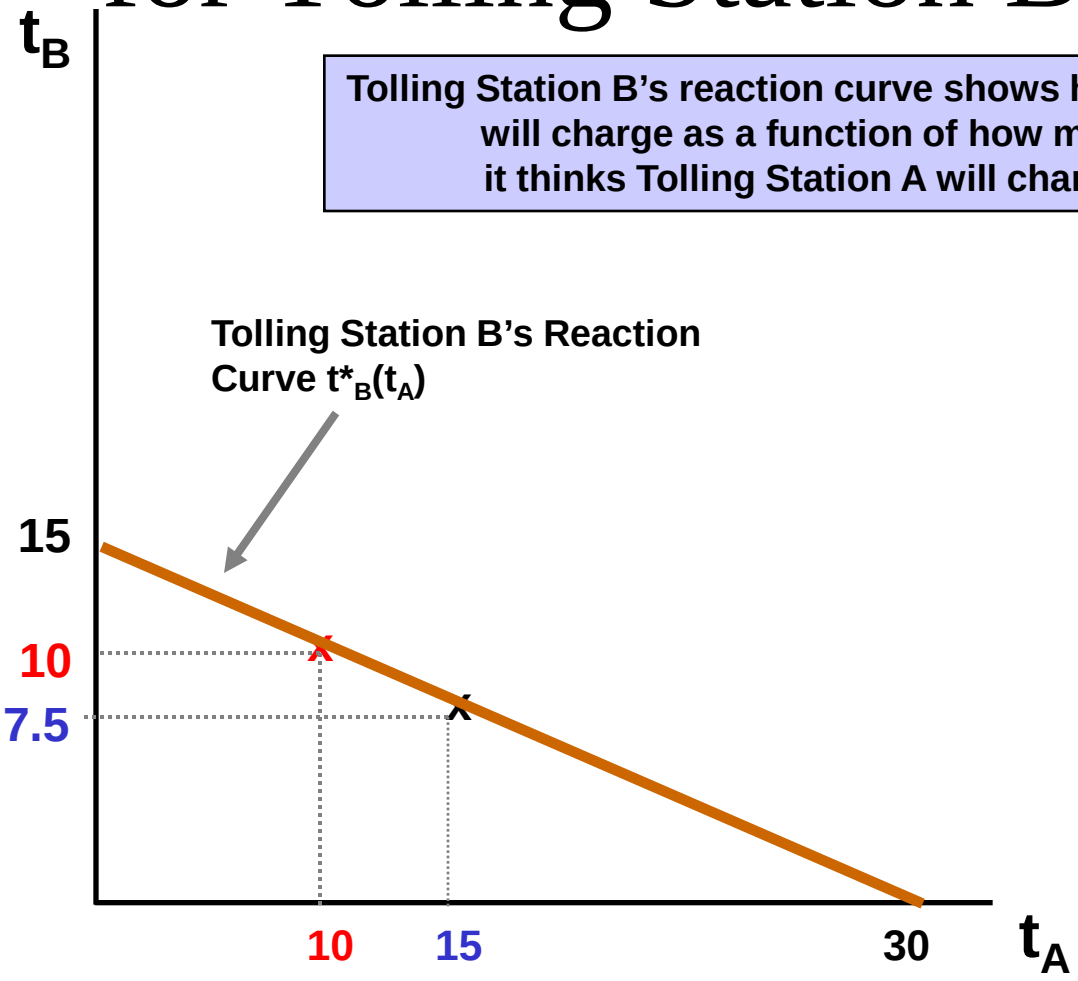
- Toll Station B's Optimal Decision Given $t_A = 10$

t_B	π_B
5	75
10	100
15	75

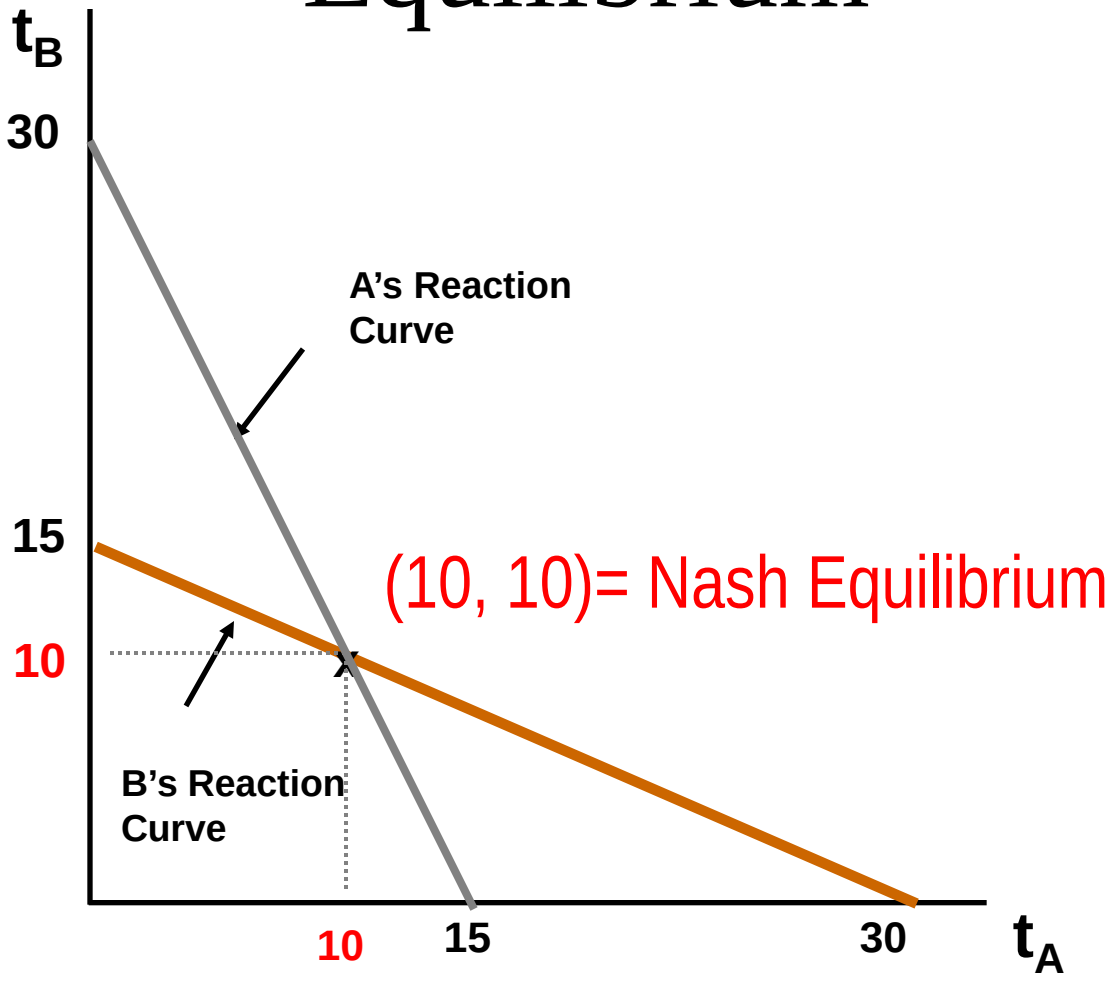
- Toll Station B's Optimal Decision Given $t_A = 15$

t_B	π_B
5	50
7.5	56.25
10	50

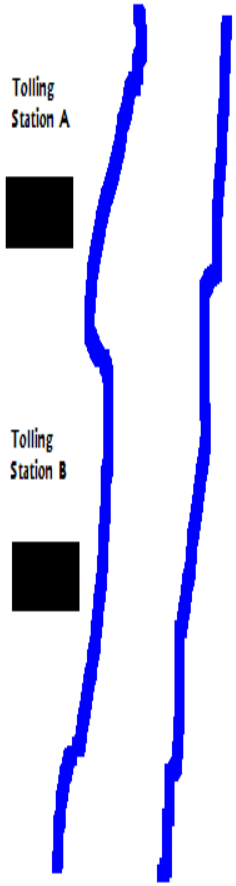
Reaction Curve for Tolling Station B



Reaction Curves and Cournot Equilibrium



Tolling Example with 2 Stations

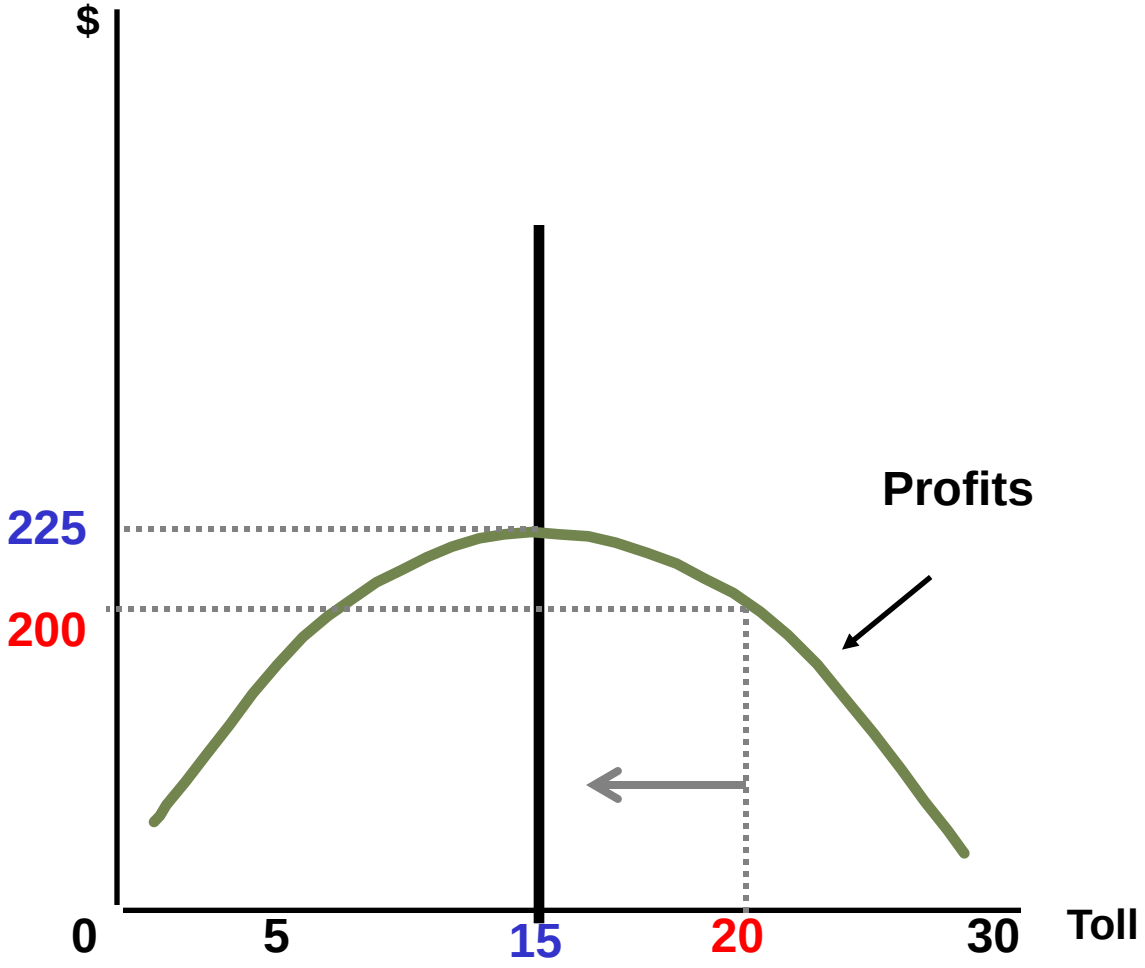


- In Nash equilibrium, $t_A = t_B = 10$ in equilibrium with the total toll of $T = 20$.
- Each toll station receives a revenue of 100

Pricing Inefficiency with 2 Stations

	1 Station	2 Stations
Total Toll (T)	15	20 (= 10 +10)
# of Passage	15	10
Total Revenue	225 (112.5+112.5)	200 (100+100)

Profit Maximization with 2 Stations



Why Inefficiency with 2 Stations?

- Each Station Ignores the Effects of Its Own Price on the Other Station $\Rightarrow$ Elevated Price Level Compared to the Optimal One
- Analogy between Toll Stations and Patent-holders of Complementary Technologies.
- Calls for Pricing Coordination between Toll Stations/Patent-holders

Other Examples of Pricing Inefficiency

- Historical Rhine River Example: In 1400 there were 60 independently run tolls along the Rhine
- Toll Roads
- Decentralized Bribing Scheme with Multiple Permits for Business
- Competing Mafias

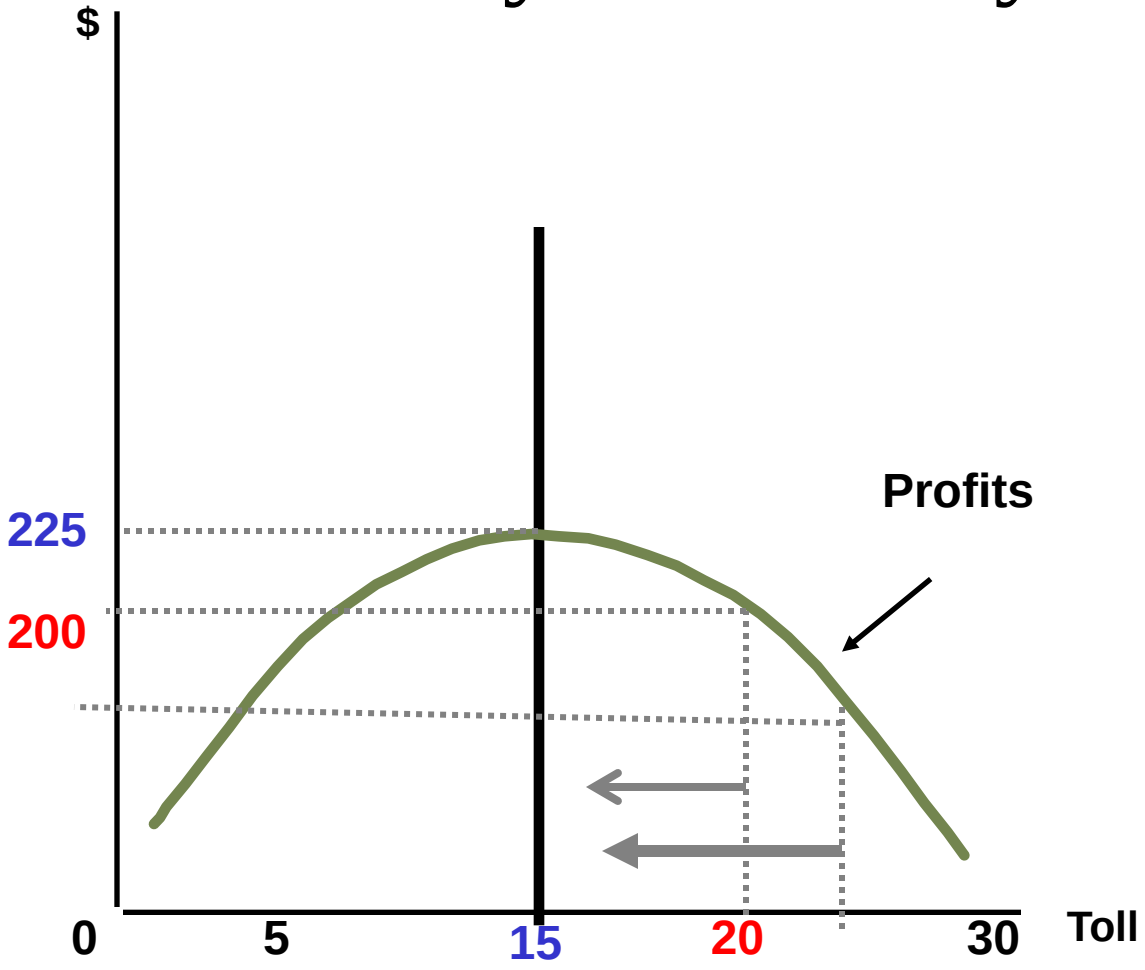
Examples of Package Selling with Discounting

- Travel Package with Air, Hotel, and Car Rental
- A Win-Win Strategy for All Parties Involved $\Rightarrow$ The Reason Why Antitrust Authorities are Lenient Towards Patent Pools with Complementary Technologies

Optimal Discount Rates for Complementary Technologies with Patent Pool

The number of complementary programs	Optimal Discount Rates with Package Licensing	Percentage Increase in Profits with Package Licensing
2	25%	12.5%
3	33%	33%
4	37.5%	56.25%
5	40%	80%
6	41.7%	104%
7	42.9%	129%

Inefficiency with Many Stations



Patent Pools: Price Effects

- The competitive effects of patent pools depend crucially on the relationship among constituent patents.
  - Complementary Patents: Procompetitive
  - Substitute Patents: Anticompetitive
- This simple conclusion may not hold if we entertain the possibility that patents are probabilistic and can be invalidated in court.

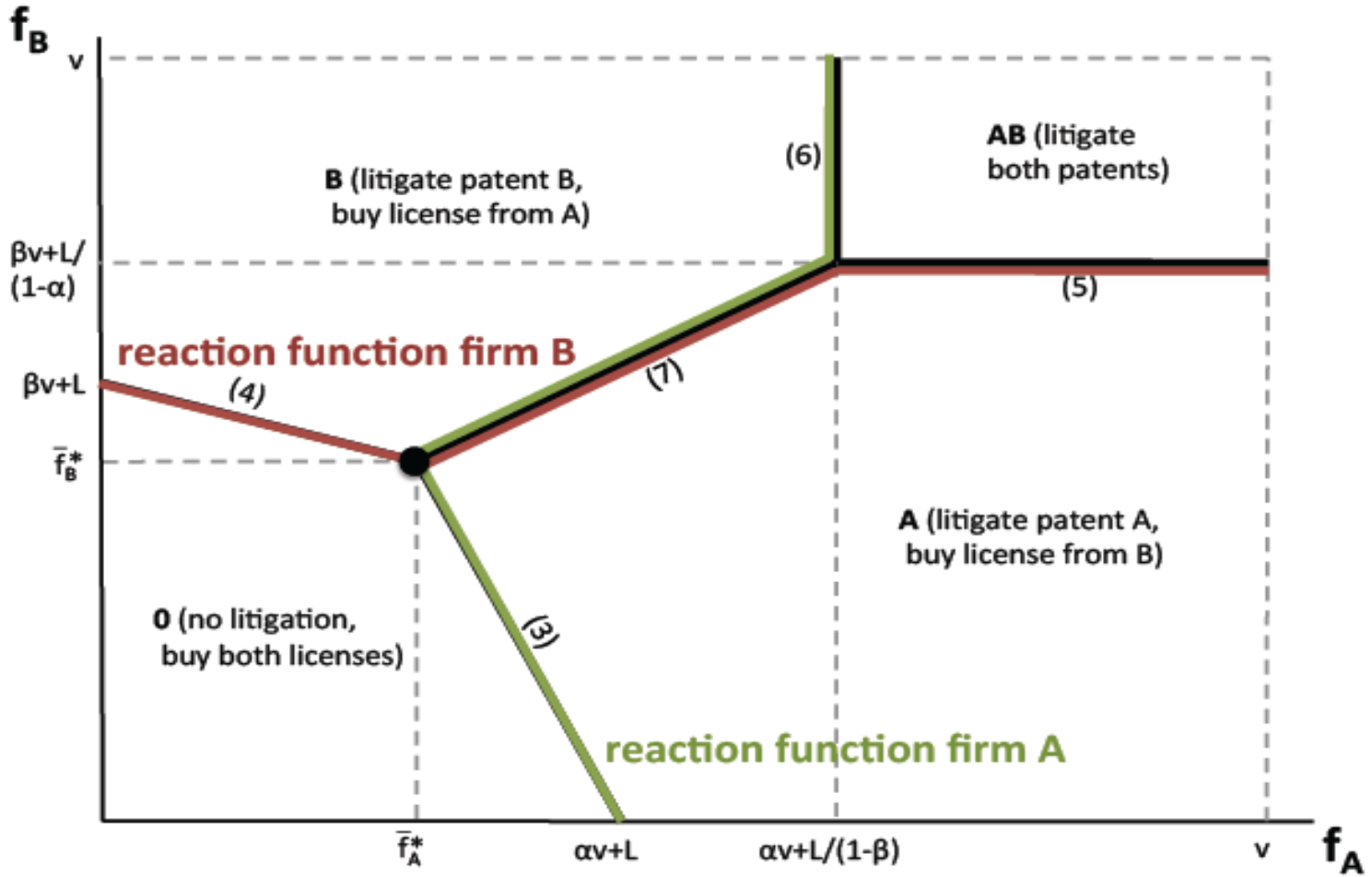
Patent Pools and Probabilistic Patents

- The royalty rates reflect the strength of patents.
- If patents are weak, the overall royalty rates can be low with independent licensing.
- Patent pools of complementary patents can be used as a mechanism to discourage patent litigation and enable them to charge higher royalty rates.

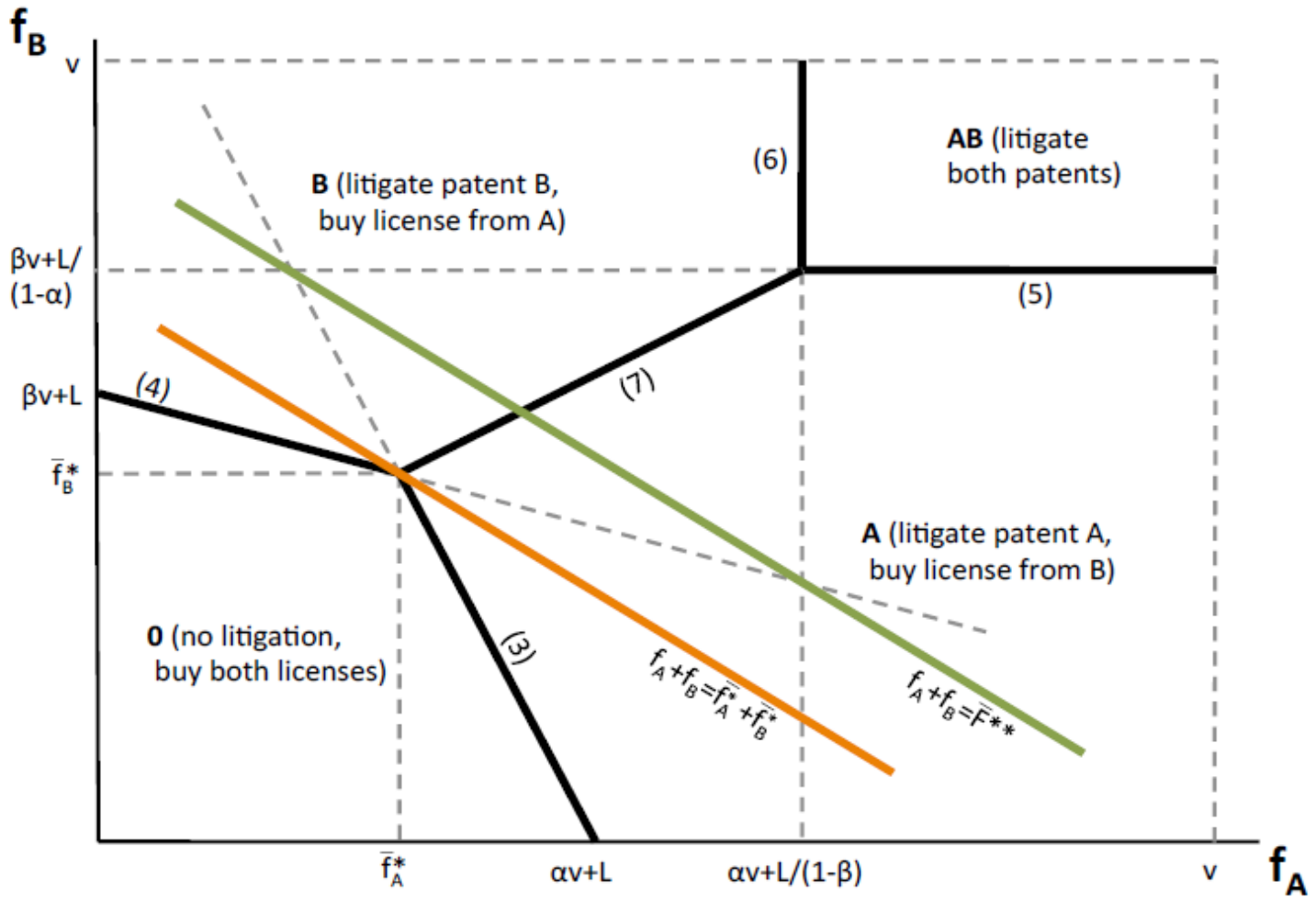
Duplan vs *Deering Milliken*

"the ... patents in suit were known ... to be weak and, ..., they [the parties] were confident that these patents could be invalidated. The main purpose of the patent pool in the case was to protect the parties from challenges to the validity of their patents in order to gain the power to fix and maintain prices in the form of royalties which they...exercised thereafter."

Nash Equilibrium in License Fees with Independent Licensing



Independent Licensing vs. Patent Pool



Model of Patent Pools

- Two Patents Owned by Two Separate Firms: A and B
- The Relationship between the Two Patents can be either Complementary or Substitutable (Lerner-Tirole, 2004)
- A Continuum of Heterogeneous Potential Licensees/Users of Patents, Indexed by θ.

Relationship between the Two Patents

- Type θ's Gross Surplus:
  - Use Only One Innovation: $v + \theta$
  - Use Both Innovations: $V + \theta$, with $V \geq v$
- $\Delta = V - v$: Incremental Value of the Second Patent
  - $\Delta = 0$: Perfect Substitutes
  - $\Delta = V$: Perfect Complements

The Demand for the Bundle of Both Patents

- Assume $\theta \in (-\infty, 0) \sim F(.)$
- The Demand for the Bundle of Both Patents:

  $$Q(R) = \Pr(V+\theta-R \geq 0) = 1-F(R-V)$$

- α, β: the probabilities that the court will uphold the validity of patents A and B

  $\Rightarrow$ Common Knowledge

Market Outcome with Ironclad Patents

- Assuming that licensees are constrained to purchase both patents:

$$\underset{r_A}{Max}\ r_A \cdot Q(r_A + r_B) \Rightarrow r_A = \Theta_A(r_B)$$

- Symmetric Nash Equilibrium:

$$\hat{r}_A = \hat{r}_B = \hat{r}\,, \quad \hat{R} = 2\hat{r}$$

Incentive Compatibility for Both Patents to be Licensed

$$V - \hat{R} \geq v - \hat{r} \Leftrightarrow \Delta \geq \hat{r}$$

- $\Delta \geq \hat{r}$: Demand Margin Binds
- $\Delta < \hat{r}$: Competitive Margin Binds
- Equilibrium Royalty Rate: $r^* = \min(\Delta, \hat{r})$

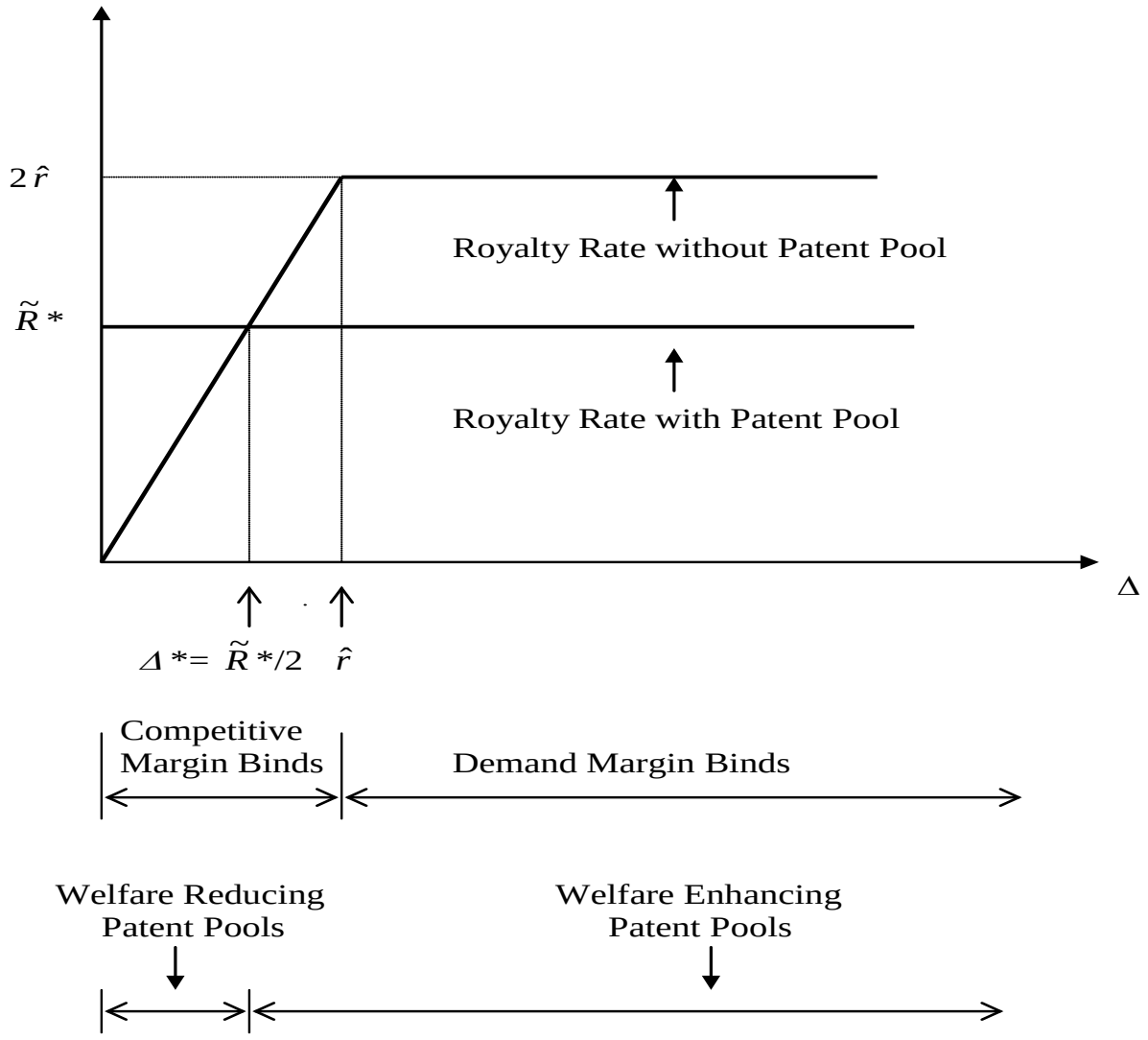
An Example

- V=5, v =4, Δ=1, $\hat{r}$ =2
- In this case the licensees choose to licensee only one technology ⇒ Competitive Margin Binds
- r*= min (Δ, $\hat{r}$) =1

Patent Pools

$$\underset{R}{Max} \quad R \cdot Q(R) \qquad \Rightarrow \quad \tilde{R}^*$$

Proposition 1 (Lerner-Tirole, 2004). There is a critical level of Δ such that $R^*=r_A^*+r_B^* > \tilde{R}^*$ if and only if $\Delta>\Delta^*$, where $\Delta^*= \tilde{R}^*/2$


$2\hat{r}$
$\tilde{R}*$
Royalty Rate without Patent Pool
Royalty Rate with Patent Pool
Δ
$\Delta*=\tilde{R}*/2$
$\hat{r}$
Competitive Margin Binds
Demand Margin Binds
Welfare Reducing Patent Pools
Welfare Enhancing Patent Pools

An Example

- Q(R) = V – R
- $\tilde{R}^*$ = V/2

$$r^* = \begin{cases} \Delta, & \text{if } \Delta < V/3 \\ V/3, & \text{if } \Delta \geq V/3 \end{cases}$$

- Δ^*=V/4