Pay-for-Delay with Settlement Externalities

Authors: Emil Palikot and Matias Pietola

Toulouse School of Economics

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Presented by Matias Pietola
How Patents (Should) Work: Strong, Indisputable Patents

Figure: Entry to a Market Protected by a Patent
How Patents (Really) Work: Weak, Disputable Patents

**Figure:** Entry to a Market Protected by a Patent
How Patents (Really) Work: Settlements

Legal Monopoly

Innovation | Strong Patent Expires | Weak Patent Expires

Settlements

Entry

Figure: Entry to a Market Protected by a Patent
How Patents (Really) Work: Pay-for-Delay

Figure: Entry to a Market Protected by a Patent
Does the Number of Entrants Matter?

A puzzling observation: some entrants are delayed while the others are accommodated, either through licensing or litigation

- Why licensing and pay-for-delay agreements coexist?
- Why some patent disputes do not settle but go to court?
- What is the benefit from costly litigation?
- How patent strength relates to pay-for-delay?
This Paper

Figure: The Main Result
Settlement Externalities

- A settlement with one entrant imposes an externality to the other entrants
- When one more entrant is delayed from entering the market, there is less competition and the litigation threat from the other entrants is increased
- To monopolize the market, the incumbent must compensate each entrant with missed duopoly profit
This paper relates to two strands of economic literature:

- Licensing and litigating uncertain patents (Farrell and Shapiro, 2008; Lemley and Shapiro, 2005; Kamien and Tauman, 1986; Katz and Shapiro, 1987)

- Pay-for-delay settlement agreements (Shapiro, 2003; Meunier and Padilla, 2015; Elhauge and Krueger, 2012; Edlin et al., 2015; Manganelli, 2014; Gratz, 2012)

We contribute by connecting these areas of economic research.
Setup of the Model

- There is one incumbent patent holder and two symmetric entrants (extends to $n$ entrants)
- The incumbent has a legal monopoly unless a court of law declares the patent invalid
- The patent is valid with probability $\theta$ (patent strength)
- The entrants can challenge patent validity at date 0 and the patent expires at date 1
The Offer Game

At date 0, the incumbent makes take-it-or-leave it settlement offers to each entrant; an offer stipulates

▶ A payment $p \in \mathbb{R}$ from the entrant to the incumbent
▶ A future entry date $t \in [0, 1]$ for the entrant

After observing these offers, each entrant chooses from three strategies:

1. Litigate over patent validity
2. Wait for the market to open
3. Settle with the incumbent
The Litigation Payoff

\[ \theta \]

\[ \max \{ t, l \} \]

(litigate) or (wait)

\[ \pi(3) \]

Figure: The Litigation Payoff
The Litigation Payoff

Figure: The Litigation Payoff
The Waiting Payoff

Figure: The Waiting Payoff
The Waiting Payoff

Figure: The Waiting Payoff
The Settlement Payoff

Figure: The Settlement Payoff
The Settlement Payoff

Figure: The Settlement Payoff
The Settlement Payoff

Figure: The Settlement Payoff
Credibility of the Litigation Threat

There is no credible litigation threat for a sufficiently strong patent:

\[ \theta > \hat{\theta} \equiv 1 - \frac{c}{(1-l)\pi} (3) \]

- We say that the litigation threat is credible when \( \theta \leq \hat{\theta} \)

<table>
<thead>
<tr>
<th></th>
<th>Litigate</th>
<th>Wait</th>
<th>Settle</th>
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<td>Litigate</td>
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<td>Settle</td>
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*Table: Potential Equilibria under a Credible Litigation Threat*
Licensing and Pay-for-Delay

Lemma
There are only two types of settlements in equilibrium:

1. Licensing agreements with an entry date \( t = l \) and a licensing fee

\[
p = (1 - l) \theta \begin{cases} 
\pi(2) & \text{(delay)} \\
\pi(2) & \text{(litigate)} \\
\pi(3) & \text{(license)} \end{cases} + \begin{cases} 
0 & \text{(litigate)} \\
c & \text{otherwise} \end{cases}
\]

from the entrant to the incumbent.

2. Pay-for-delay agreements with an entry date \( t = 1 \) and a reverse payment

\[
-p = (1 - l)(1 - \theta) \begin{cases} 
\pi(2) & \text{(delay)} \\
\pi(3) & \text{(litigate)} \\
\pi(3) & \text{(license)} \end{cases} - \begin{cases} 
0 & \text{(litigate)} \\
c & \text{otherwise} \end{cases}
\]

from the incumbent to the entrant.
Payoff from Two Settlements: \((\text{Delay,Delay})\)

**Figure:** The Incumbent’s Payoff from \((\text{Delay,Delay})\)
Payoff from Two Settlements: (License, Delay)

Figure: The Incumbent’s Payoff from (License, Delay)
Payoff from Two Settlements: \((\text{License},\text{License})\)

\[
\begin{align*}
\text{Get} \quad 2c \quad & \quad \Pi(1) \\
0 \quad & \quad l \\
\theta \quad & \quad 1 - \theta \\
l \quad & \quad \Pi(3) \\
l \quad & \quad \Pi(3) + 2\pi(3) \quad & \quad 1
\end{align*}
\]

**Figure:** The Incumbent’s Payoff from \((\text{License},\text{License})\)
Payoff from Litigation: (Litigate, Wait)

\[ \text{Figure: The Incumbent’s Payoff from (Litigate, Wait)} \]
Payoff from Litigation: (Litigate, License)

Figure: The Incumbent’s Payoff from (Litigate, License)
Payoff from Litigation: (Litigate, Delay)

Figure: The Incumbent’s Payoff from (Litigate, Delay)
Figure: The Equilibrium of the Game when $\Pi(1) < \bar{\Pi}$
Policy Implications

Conditional settlement terms are anti-competitive

- Never entry before patent expiration: if settlement entry dates apply only when the patent stays valid, a successful litigating always faces full competitive pressure
- Settlement externalities are eliminated

Antitrust limits to patent settlements

- Consumers benefit from licensing agreements
- Banning pay-for-delay agreements may remove the incentives to license
Take-away

- Settlement externalities explain divide and conquer strategies
- Licensing and litigation are substitutes: both have an anti-competitive object to reduce the cost of entry delay
- Patents with intermediate strength are litigated
Thank You!
Proposition

For any patent strength $\theta \leq \hat{\theta}$, the equilibrium of the game is (delay, delay) if the gain from monopolization is sufficiently high,

$$\Pi(1) \geq \bar{\Pi} \equiv 2\pi(2) + \max\{\Pi(3), \Pi(2) - \pi(3)\}$$

Otherwise, there exists an interval $\Theta \subseteq [0, \hat{\theta}]$ of patent strength such that there is litigation in equilibrium if $\theta \in \Theta$ and no litigation otherwise. The interval shrinks in total litigation costs $C + 2c$ and is empty for costs large enough. In particular, for zero litigation costs, $\Theta = [0, 1]$. 
Supplementary: the Payoffs of the Incumbent

Payoff from two settlements:

\[ 2c + l\Pi (1) + (1 - l) \begin{cases} 
\Pi (1) - 2(1 - \theta)\pi (2) & \text{(delay,delay)} \\
\Pi (2) + \theta\pi (2) - (1 - \theta)\pi (3) & \text{(licence,delay)} \\
\Pi (3) + 2\theta\pi (3) & \text{(licence,license)}
\end{cases} \]

Payoff from litigation:

\[ -C + l\Pi (1) + (1 - l) \begin{cases} 
\theta\Pi (1) + (1 - \theta)\Pi (2) - (1 - \theta)\pi (3) & \text{(litigate,delay)} \\
\theta\Pi (2) + (1 - \theta)\Pi (3) + \theta\pi (2) & \text{(litigate,license)} \\
\theta\Pi (1) + (1 - \theta)\Pi (3) & \text{(litigate,wait)}
\end{cases} \]

where \( C \geq 0 \) denotes the incumbent’s litigation cost
Supplementary: Payoffs from Litigate, Wait or Settle

The litigation payoff

\[-c + (1 - \theta) (1 - l) \pi (3) + (1 - \theta) [\pi (2) - \pi (3)] \begin{cases} \max \{x - l, 0\} & \text{(settle)} \\ 0 & \text{otherwise} \end{cases}\]

The waiting payoff:

\[
\begin{cases} 
(1 - l) (1 - \theta) \pi (3) & \text{(litigate)} \\
0 & \text{otherwise}
\end{cases}
\]

The settlement payoff:

\[-p + (1 - t) \pi (2) - [\pi (2) - \pi (3)] \begin{cases} 
(1 - \max \{t, l\}) (1 - \theta) & \text{(litigate)} \\
0 & \text{(wait)} \\
(1 - \max \{t, x\}) & \text{(settle)}
\end{cases}\]
Supplementary: Litigation for Intermediate Patents

Proposition
For any patent strength $\theta \leq \hat{\theta}(n)$, there are $n$ delayed entrants in equilibrium if the gain from monopolization is sufficiently high,

$$\Pi(1) \geq \Pi(n) \equiv n\pi(2) + \max_{d < n} \left\{ \Pi(1 + n - d) - d\pi(2 + n - d) \right\}$$

Otherwise, there exists an interval $\Theta \subseteq [0, \hat{\theta}]$ of patent strength such that there is litigation in equilibrium when $\theta \in \Theta$ and no litigation otherwise. The interval shrinks in total litigation costs and is empty for costs large enough. In particular, for zero litigation costs, $\Theta = [0, 1]$. 
Supplementary: No Litigation

Proposition

Suppose $\Pi(1) < \overline{\Pi}$, $\theta \notin \Theta$ and $\theta \leq \hat{\theta}$. Then, in equilibrium, there are $n - d(\theta)$ licensees and

$$d(\theta) \in \arg \max_d \left\{ \Pi(1 + n - d) + (n-d) \theta \pi (1 + n - d) - d(1 - \theta) \pi (2 + n - d) \right\}$$

delayed entrants, where $d(\theta)$ is weakly increasing in patent strength $\theta$. 
Proposition

Suppose $\pi(1) < \bar{\pi}$ and $\theta \in \Theta$. Then, in equilibrium, one entrant litigates, $n - \hat{d} - 1$ entrants wait and there are

$$
\hat{d} \in \arg \max_d \left\{ \pi(1 + n - d) - d\pi(2 + n - d) \right\}
$$

s.t $d < n$

pay-for-delay agreements, where $\hat{d}$ does not depend on patent strength $\theta$. 

Supplementary: Litigation


Gratz, L. (2012). Economic analysis of pay-for-delay settlements and their legal ruling. Discussion papers in economics, University of Munich, Department of Economics.


Manganelli, A.-G. (2014). Delay competition to increase competition: Should reverse payments be banned per se?
Meunier, V. and Padilla, J. (2015). Should reverse payments be prohibited per se?