STRATEGIC USES OF LITIGATION IN INNOVATIVE PRODUCT COMPETITION

Working Paper #623

Robert E. Thomas
The University of Michigan

I wish to thank Ian Ayres, David Baron, Jeremy Bulow, Avery Katz, Scott Masten, Ted Snyder and Valerie Suslow for helpful discussions and useful comments. This work was supported by the John M. Olin Program in Law and Economics at Stanford Law School.

FOR DISCUSSION PURPOSES ONLY

None of this material is to be quoted or reproduced without the expressed permission of the Division of Research

Copyright 1989
University of Michigan
School of Business Administration
Ann Arbor, Michigan 48109-1234
1 Introduction

In a full-information setting, rational individuals will resolve litigated disputes immediately. They will agree on the probabilistic resolution of the dispute and the costs that they will collectively incur. As a result, they will agree on some settlement that leaves both parties better off than they would be after a judicial resolution of their dispute. Consequently, much of the research on litigation has concentrated on the role of incomplete information in inhibiting the settlement process.\(^1\)

However, when dispute resolution is not a shared objective of involved parties, the immediate settlement outcome described above may not occur. The presence of litigation can have a stifling effect on a continuing business. Litigation creates market uncertainty about the ability of a firm to market a product, complete a project or sell property. This ancillary effect has long been identified as a cause of nuisance lawsuits – lawsuits filed when the expected payoff from a judicial resolution of the dispute is negative.\(^2\) By threatening a firm with the adverse effects of a nuisance lawsuit, a plaintiff can extort from the firm a settlement that exceeds the value of the issues litigated. The defendant firm must either accept the costs resulting from the market uncertainty engendered by the lawsuit or pay the plaintiff's extortionary demand. If this payment to the plaintiff is less than the expected cost of the market uncertainty, the firm will settle with the plaintiff.

Litigation-generated costs in their most extreme form can destroy the market for a firm's product, especially when the product requires continued service or support from the producer or third parties. For example, the future viability of a computer producer is essential for the successful marketing of the firm's products in the present because consumers are reluctant to purchase a product for which there will be no third-party software or future service. Hence, if one potential outcome of a lawsuit is the withdrawal of the firm's product, current demand for that firm's product is likely to drop precipitously.\(^3\)

\(^1\)P'ng (1983), Salant (1984), Bebchuk (1984) and Reinganum and Wilde (1986) all consider models in which imperfect information impedes or thwarts settlement efforts.


\(^3\)An example of this demand reduction due to litigation is evident in a press release concerning a
The ability of litigation to close product markets invites nuisance lawsuits because the extortionary value of such cases is likely to be high. However, this ability may also invite lawsuits from the dominant firm in the market who is seeking to maintain economic rents on products or a technology that is essential for production. The plaintiff in such lawsuits will prolong litigation and refuse to settle as long as he is able to profit from the ongoing dispute – even if the delayed resolution requires him to incur substantial litigation expenses without an equal or greater expected judicial award. This strategic use of litigation is analogous to the predatory behavior described in Krattenmaker and Salop (1986), Ordover, Sykes and Willig (1985) and Ordover and Willig (1982) in which dominant firms take actions that increase rivals' costs or reduce demand for a rival's product. In the premised situation, protracted litigation is the predatory behavior that destroys demand for a rival product. By contrast, when such incentives are not present and the plaintiff's expected return is negative, the nuisance litigant continues litigation only as long he believes he can receive an extortionary payoff, and he will drop the lawsuit to avoid costs if the defendant calls his bluff and refuses to settle.

This paper analyzes the use of litigation to maintain economic rents – the rent-maintenance hypothesis – in the context of a lawsuit brought by an incumbent firm to prevent a competitor from marketing an innovative product that allegedly infringes on the incumbent's patent in an exclusive technology. The parties may resolve the dispute by (1) having the incumbent pay the competitor to withdraw his product from the market – a no-competition agreement, (2) having the competitor pay the incumbent to continue producing in the market – a licensing agreement or (3) relying on the court to resolve

_federal district court announcement of a year's delay in hearing Apple Computer's copyright-infringement lawsuit against Microsoft Corporation and Hewlett Packard (H-P). An H-P spokesperson responding to the announcement stated:_

New Wave [H-P's software product] has received a lot of attention because of the case, and people are impressed with it, ... yet it's clear that the cloud of uncertainty has made people reluctant to make a commitment to New Wave.

the dispute. Although the analysis uses a patent infringement scenario, it also applies to any dispute in which a firm's future presence in a market depends on the outcome of a litigated dispute.

I model economic rents as a profit flow and find that when a profit flow is present, settlement depends on whether the incumbent can obtain (or maintain) a monopoly through a "no-competition" agreement. Such agreements may not be possible when there are legal constraints (such as antitrust prohibitions) or agency problems that prevent this type of settlement. If a monopoly is a possible settlement outcome then settlement always occur. However, if a licensing agreement is the only possible settlement the parties will not settle if total post-settlement profits from the duopoly formed pursuant to the agreement are substantially less than profits obtainable from a monopoly. This result holds even when the plaintiff has no chance of winning the case. His refusal to settle is motivated by the profits he receives in excess of litigation expenditures. Thus, rent-maintenance behavior exists when the form of settlement is restricted.

Section 2 presents the litigation model which is derived from Rubinstein's (1981) divide-the-pie sequential-bargaining model. In that model a plaintiff and a defendant alternate making settlement offers in a full-information, multi-period bargaining game in which settlement amounts are determined endogenously. Section 3 considers the model when profit flows are not an issue and shows that settlement occurs immediately for an amount that depends on the magnitude of the potential court judgment and total litigation costs. These results are consistent with those obtained by Bebchuk (1986) in a one-period model. I then identify conditions under which a plaintiff files a prototypical nuisance lawsuit. He files only if the expected payoff from judicial resolution exceeds the cost of waiting an additional period. Thus, the plaintiff's filing decision is independent of the defendant's litigation costs. An important implication of this result is that the plaintiff does not file a lawsuit when he has no chance of winning the case in a full-information

---

4 Ordover and Rubinstein (1987) also model a dispute as a multi-period bargaining game, however, settlements in their model are exogenously determined. Cheung (1988) models disputes as a multi-period bargaining game, however, he concentrates on negotiations prior to the filing of a lawsuit.
setting.

Section 4 contains the profit-flow analysis. In Section 5 I conclude the profit-flow analysis by showing that when a licensing-agreement is the only possible settlement and duopoly profits are low, the litigants may settle their dispute after waiting a finite number of periods. This occurs when the profit flow declines substantially. Thus, rather than the "now or never" settle result suggested by the profit-flow analysis, settlement can occur at an intermediate stage in litigation.

2 The Litigation Model

Each of the two parties in a legal dispute has selfish, risk-neutral preferences that are common-knowledge. Both parties have common beliefs that the court, if given the opportunity to decide the case, will award the plaintiff $A$ with probability $q$ (and 0 with probability $1 - q$) should the parties fail to settle their dispute.  

While preparing for trial the parties enter into negotiations to settle their dispute without third-party intervention. These negotiations take place over time and are modelled as the parties alternating offers each (discrete) period. Hence in period $t$, the plaintiff ($p$) offers to drop the lawsuit for a settlement amount $O_p^t$, and if the dispute continues to period $t + 1$ the defendant ($d$) offers $O_d^t$ to the plaintiff to drop the lawsuit. So, if the plaintiff makes the initial offer, $O_p^t$, he makes offers in $t = 0, 2, 4, \ldots$ as well, and the defendant makes offers in $t = 1, 3, 5, \ldots$.

There is a common-knowledge probability $1 - \pi > 0$ that in any period the court disposes of the case either by decision or by accepting a motion to end the case before trial. This probability reflects the ability of parties to make motions for dismissal, summary judgment, or a directed verdict at the appropriate time during litigation. Because such a motion terminates the judicial proceeding if the court accepts it, the judicial proceeding

---

$^5$Thus, no party has private information, so this is a complete information model.

$^6$Clearly this continuation probability is time-dependent. However, modelling $\pi$ as time-dependent needlessly increases the complexity of the model without significantly increasing the insights gained.
could end in any period. Similarly, the parties can extend the proceeding by requesting continuances, by filing appeals on collateral issues or by prolonging the examination of witnesses. Thus, in any period it is impossible for one party to determine how long the proceeding will last.

2.1 Order of Moves

Figure 1 provides an extensive-form-game depiction of a representative period. Offers occur at the beginning of each period. If the opposing party accepts the offer, the dispute ends with the exchange of the offered amount, and neither party incurs additional costs. If the opposing party rejects the offer, the plaintiff decides whether to continue the lawsuit or to drop it without either party incurring additional costs. Notice that the defendant cannot terminate the lawsuit without the plaintiff’s consent. If he continues the lawsuit, the plaintiff and defendant incur strictly positive litigation costs $C_p$ and $C_d$, respectively. I refer to these costs as “marginal” because they are the additional costs parties incur by extending litigation an additional period. Analogously, when a profit flow is present, the party receiving it obtains marginal profit $P$ at the time he incurs a marginal cost. In order to simplify the notation, in the model without profit flows the parties do not discount subsequent periods’ expected payoffs. Their expected payoffs for period $t$ also include their expectation of a court judgment in that period. The process then moves to the next period with the roles reversed, so the party who made an offer during the preceding period now receives an offer. This series of offers and imposition of costs from trial preparation continues until one party either accepts an offer or the court resolves the case.

2.2 Preferences

If no settlement ever occurs, the plaintiff’s no-settlement expected payoff $U$ is

$$U = [gA(1 - \pi) - C_p](1 + \pi + \pi^2 + \ldots),$$
Figure 1

Extensive-Form Game

Period t-1

P

Offers

\( O^t_p \)

\( D \)

Accepts

\((O^t_p, O^t_p)\)

\( D \)

Drop

\((0,0)\)

\( P \)

Rejects

\( C_t \)

Decides

\((1-\pi)\)

\( (P \text{ Incurs } -C_p)\)

\((D \text{ Incurs } -C_d)\*

\( D \)

Offers

\( O^t+1_d \)

Period t

Period t+1

Ct

The Court's move.

P,D

Nodes where the plaintiff and defendant move, respectively.

*

The incumbent incurs marginal profit \( P \) here when profit flows are present.
or

\[ U = qA - \frac{C_p}{1 - \pi}. \]  

(1)

Analogously, the defendant’s no-settlement expected payoff \( L \) is

\[ L = -qA - \frac{C_d}{1 - \pi}. \]  

(2)

Because \( U \) is the plaintiff’s net expected payoff from litigation, his lawsuit is a nuisance when \( U < 0 \).\footnote{However, the lawsuit may have high merit – \( q > 0.5 \). This would occur when the plaintiff is likely to prevail, but the court award is small or his litigation expenses are extremely high.}

Define the plaintiff’s continuation value \( V_p^t \) as the largest payoff that he can receive in period \( t \) if settlement negotiations fail. For example, without a profit flow \( V_p^t \) is

\[ V_p^t = (1 - \pi)qA - C_p + \bar{U}_p^{t+1}, \]

where \( \bar{U}_p^{t+1} \) is the highest equilibrium expected payoff that the plaintiff can obtain in the subgame with initial node at \( t + 1 \), and the defendant’s continuation value \( V_d^t \) without a profit flow, is

\[ V_d^t = -(1 - \pi)qA - C_d + \bar{U}_d^{t+1}, \]

where \( \bar{U}_d^{t+1} \) is the largest equilibrium expected payoff that the defendant can obtain in the subgame with initial node at \( t + 1 \).

### 2.3 Strategies

A strategy \( S_i \) for player \( i \) is

\[ S_i \equiv \{ s_i^1, s_i^2, \ldots \} \]

where \( s_i^t \) identifies player \( i \)’s strategy in period \( t \) based on actions taken prior to his decision in period \( t \).

Strategies for the respective players constitute an equilibrium only if they are optimal or best responses to each other at each point in time. That is, equilibrium strategies satisfy the subgame-perfection requirement. An equilibrium is subgame perfect if at any time
the strategies specified for the subgame with initial node at time $t$ are equilibrium strategies for that subgame. Define the projection of $S_i$ on the subgame beginning at time $t$, $S^t_i$, to be

$$S^t_i \equiv \{s^t_i, s^{t+1}_i, \ldots\}.$$ 

Thus, $S^t_i$ is simply a strategy $S_i$ restricted to period $t$ on. With these definitions, $(S_p, S_d)$ are equilibrium strategies provided that, for all $t$, $(S^t_p, S^t_d)$ are best responses to each other for the subgame with initial node at $t$. Therefore, I can define an equilibrium as:

**Equilibrium.** An equilibrium consists of strategies $(S_p, S_d)$ such that for all $t$ 1) given $S^t_d$, $S^t_p$ maximizes the plaintiff’s expected payoff for the remainder of the game and 2) given $S^t_p$, $S^t_d$ maximizes the defendant’s expected payoff for the remainder of the game.

In addition, I assume that the plaintiff only files a lawsuit when his expected payoff is strictly positive, and he continues a case from period $t$ to period $t + 1$ only if his continuation value $V^t_p$ is strictly positive as well.

## 3 Equilibrium Analysis Without Profit Flows

Proposition 1 which follows is premised on the plaintiff having a positive continuation value for every period. This assumption makes continuing the dispute a dominant strategy because the plaintiff can get at most zero from dropping the lawsuit. Because it is possible for the plaintiff’s continuation values to be positive when $U$ is negative, nuisance lawsuits can occur. Proposition 2 then removes the restrictions on $V^t_p$ and identifies conditions that deter the plaintiff from filing a lawsuit.

**Proposition 1.** Provided $V^t_p > 0$ for all $t$, the unique equilibrium requires settlement during the initial period for a defendant-to-plaintiff payment of

$$O^0_p = qA + \frac{C_d - \pi C_p}{1 - \pi^2}$$

when the plaintiff makes the initial settlement offer and for a defendant-to-plaintiff pay-
ment of

\[ O_d^0 = qA + \frac{\pi C_d - C_p}{1 - \pi^2} \]

when the defendant makes the initial offer.

Table 1 outlines the reasoning of the Proposition 1 proof.

<table>
<thead>
<tr>
<th>Period</th>
<th>Who</th>
<th>Plaintiff Gets at Most</th>
<th>Defendant gets at Least</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Plaintiff</td>
<td>( C_d + (1 - \pi)qA + \pi(-C_p + (1 - \pi)qA + \pi M) )</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Defendant</td>
<td>( C_p - (1 - \pi)qA - \pi M )</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Plaintiff</td>
<td>( M )</td>
<td></td>
</tr>
</tbody>
</table>

PROOF: The proof of this proposition follows that of Shaked and Sutton (1984) and Sutton (1986). Suppose the plaintiff makes the initial (period 0) offer. Let \( M \) represent the supremum of the possible expected payoffs that the plaintiff can obtain in period 0. This implies that \( M \) is his maximum period 2 payoff as well because the game in period 2 is structurally identical to the game in period 0. It follows that \(-C_p + (1 - \pi)qA + \pi M\) is the most that the plaintiff can receive in period 1. Because the plaintiff accepts any defendant offer that exceeds this maximum payoff, the defendant can receive at least \( C_p - (1 - \pi)qA - \pi M \) (the negative of the plaintiff’s maximum period 1 payoff) in period 1. This amount is in fact the infimum of the defendant’s expected payoff.

Because the defendant rejects any period 0 offer that is less than her period 0 specific expected payoff, \(-C_d - (1 - \pi)qA\), plus the discounted value of what she can get by waiting one period, the plaintiff can get at most \( C_d + (1 - \pi)qA + \pi(-C_p + (1 - \pi)qA + \pi M) \) in period 0. This maximum payment is the supremum of the plaintiff’s period 0 expected payoffs and, therefore, equals \( M \). It follows that

\[ M = C_d + qA(1 - \pi^2) - \pi C_p + \pi^2 M, \quad (3) \]
or after simplifying

\[ M = qA + \frac{C_d - \pi C_p}{1 - \pi^2}. \]  \hfill (4)

Now defining \( M \) to be the infimum of the plaintiff’s period 0 payoffs and repeating the
above arguments with maximum replacing minimum and infimum with supremum and so
on implies that (4) is also the infimum of the plaintiff’s expected payoffs. Therefore, the
plaintiff’s equilibrium offer \( O_p^0 \) is uniquely defined by (4).

Through analogous reasoning, the defendant’s offer \( O_d^0 \) when she makes the initial
settlement offer is

\[ O_d^0 = qA + \frac{\pi C_d - C_p}{1 - \pi^2}. \]  \hfill (5)

The parties make and accept these offers in the initial period. Because neither party
can obtain a better payoff than \( O_p^0 \) or \( O_d^0 \), these offers and the responses to these offers
are components of a perfect equilibrium. \hfill Q.E.D.

Proposition 1 provides results that are consistent with Bebchuk (1986) in that the
settlement amount is increasing in both the expected court award \( qA \) and the defendant’s
costs \( C_d \), and is decreasing in the plaintiff’s costs \( C_p \). The results are also consistent
in that settlement occurs immediately in the absence of private information. The result
differs in that Proposition 1 provides an exact settlement value – a common characteristic
of sequential-bargaining games.

An additional difference concerns nuisance lawsuits which Bebchuk does not consider.
Because both (4) and (5) are larger than \( U \) – the plaintiff’s no-settlement expected payoff
from litigation – there are situations in which the plaintiff files a nuisance lawsuit, i.e.,
when \( U \) is negative. For example when \( qA = 10, \pi = 0.9 \), and \( C_p = C_d = 1.5 \), \( U \) is \(-5\),
whereas \( M \) is 11.5 (from (4)) and \( O_d^0 \) is 8.5 (from (5)). This occurs because his maximum
litigation payoff depends not only on his own costs but on the defendant’s costs as well.
The defendant is willing to make a payment to the plaintiff in order to avoid the expense
of litigation. In the above example the defendant’s no-settlement expected payoff is -25,
so a settlement that requires her to pay 11.5 or 8.5 leaves her strictly better off than
continuing litigation.
The defendant makes a settlement payment in a given period when $U$ is negative only if the plaintiff’s threats to litigate are credible, i.e., when the plaintiff’s continuation value is positive. If this continuation value is not positive, the defendant knows that the plaintiff will drop the lawsuit before she incurs any costs, and as a result, she does not settle with the plaintiff. Proposition 2 identifies conditions for the plaintiff to have a positive continuation value and file a lawsuit.

**Proposition 2.** The plaintiff files a lawsuit if and only if

$$C_p < qA(1 - \pi).$$

**Proof:** Consider the case in which the plaintiff makes the period 0 settlement offer. The plaintiff files a lawsuit if and only if his maximum period 0 payoff $\bar{U}_p^0$ is positive. Define $C_p^*$ to be the lowest value of the plaintiff’s marginal litigation cost such that he does not file. This implies

$$\bar{U}_p^0|c_p = c_p^* = 0 = qA(1 - \pi) - C_p^* + \pi O_d^0(C_p^*)$$  \hspace{1cm} (6)

where $O_d^0(C_p^*) = O_d^0(C_p)$ – the defendant’s equilibrium offer when she makes the initial settlement offer and $C_p = C_p^*$. The defendant’s settlement offer $O_d^0(C_p)$ is

$$O_d^0(C_p) = qA(1 - \pi) - C_p^* + \pi \bar{U}_p^0|c_p = c_p^*.$$

because $\bar{U}_p^0 = 0$ when $C_p = C_p^*$. Substituting $O_d^0(C_p^*)$ into (6) implies

$$C_p^* = qA(1 - \pi).$$

Notice that this also implies

$$O_d^0(C_p^*) = 0,$$

so the plaintiff does not file a lawsuit when the defendant makes the initial offer either. Hence, the plaintiff files a lawsuit if and only if $C_p < qA(1 - \pi)$. Q.E.D

Proposition 2 identifies the minimum ratio of the expected award to marginal litigation costs required in order for a lawsuit to be filed. The plaintiff in deciding whether to
continue a lawsuit considers only the costs that he will incur by continuing one period—not his total expected litigation costs. Thus even if the total cost of litigation is extremely high, if the marginal litigation costs are low the plaintiff’s threats to continue the case will be credible. As a result the defendant finds settling to be her least-cost alternative. By contrast, when the costs of initiating litigation are substantial—for example, if the plaintiff has to post a sizeable bond—the defendant does not consider the plaintiff’s threats to continue litigation credible when $qA$ is small and, therefore, does not make a settlement payment to the plaintiff. As a consequence the prototypical nuisance lawsuit, in which the plaintiff drops the lawsuit if the defendant rejects his settlement demands, cannot occur in a full-information setting.

The implications of Proposition 2 differ significantly from those of other full-information models of nuisance lawsuits. Both Cooter and Ulen (1988) and Rosenberg and Shavell (1985) conclude that filing nuisance lawsuits depend on the defendant’s costs $C_d$. When this cost is significant—greater than zero in Rosenberg and Shavell and greater than $C_p$ in Cooter and Ulen—plaintiffs file nuisance lawsuits. They obtain these results by not considering the sequential nature of litigation. If the plaintiff cannot commit to continuing the case, the defendant does not make a positive settlement offer. However, if the plaintiff can commit to continuing the case, then by Proposition 1, the size of the settlement depends on $C_d$ as in Rosenberg and Shavell and Cooter and Ulen.

4 Litigation with Profit Flows

The previous section considered settlement negotiations in which the parties’ only considerations were the potential court award and litigation costs. In that situation the parties find immediate settlement to be the most satisfactory resolution of their dispute. This

---

8 This result depends strongly on the assumption that $\pi$ is constant. If $\pi$ declines over time—indicating that judicial resolution is more likely to occur later in the proceeding—a plaintiff may still file a lawsuit even when $C_p > qA(1 - \pi)$ initially.

section examines litigated disputes in which litigation costs and the court award are not the only pecuniary considerations. In such situations, one or both parties may find that the alternatives to continuing litigation do not provide a satisfactory payoff and, therefore, do not settle the dispute.

To investigate this phenomenon, I consider equilibrium behavior in which the plaintiff receives a profit flow whose continuation depends on the resolution of the dispute.\footnote{With minor changes the results also apply to a lawsuit in which the defendant receives the profit flow.} This section shows that when a profit flow exists and a licensing agreement is the only settlement alternative, there may not exist a satisfactory settlement that the plaintiff would accept or offer. These conditions result in a delay in settlement beyond the initial settlement period.

4.1 Settlement With Profit Flows

Consider a dispute in which the incumbent firm can earn a profit of $P$ per period in an exclusive market and in which both parties discount future payoffs by the factor $\delta$. As with litigation costs, I refer to $P$ as a marginal profit to distinguish it from total profits available over the span of litigation (and beyond). If the incumbent obtains a marginal profit during litigation, he obtains it at the same time he incurs a marginal cost. The incumbent's monopoly in this market is based on his alleged exclusive right to a certain technology. The incumbent may sue the rival alleging patent infringement or a copyright violation if she enters the market. The probability of a favorable ruling for the plaintiff is $q$. I assume that the lawsuit reduces the rival's product demand to zero during the time the suit is in progress. If the court resolves the dispute, a favorable ruling results in a return to the plaintiff of the sum of his requested court award $A \geq 0$ plus the present value of future profits that the plaintiff will receive as a result of his continued exclusivity. Formally, when the court judgment is in favor of the plaintiff, he receives

$$A + P \sum_{t=1}^{\infty} \delta^t = A + \frac{P}{1-\delta}.$$
If the court rules for the defendant, the plaintiff receives an award of zero and the rival’s market share increases. I assume that parties split the market with the plaintiff receiving an \( m \) fraction and the defendant receiving an \( n \) fraction of the marginal profit \( P \), and with \( m + n \leq 1 \). For example, if the parties enter into a Cournot duopoly after an adverse court judgment with identical linear price and cost functions, then \( m = n = 4/9 \). If the market becomes perfectly competitive after an adverse ruling and economic profits go to zero, then \( m = n = 0 \).

From this description of litigation (see the extensive-form-game depiction of litigation with a profit flow in Figure 2) the plaintiff’s no-settlement expected payoff \( U^* \) when he receives a profit flow is

\[
U^* = \frac{(1 - \pi) [q(A + \delta \frac{P}{1-\delta}) + (1-q)m\delta \frac{P}{1-\delta} ] + P - C_p}{1 - \pi \delta},
\]

(7)

and the defendant’s no-settlement expected payoff \( L^* \) when the plaintiff receives a profit flow is

\[
L^* = \frac{(1 - \pi) [qA - (1-q)n\delta \frac{P}{1-\delta} ] + C_d}{1 - \pi \delta}.
\]

(8)

The bracketed terms in (7) and (8) replace the judgment component of the parties’ respective expected payoffs \( U \) and \( L \) without a profit flow. If a judgment occurs, the plaintiff receives, with probability \( q \), an award \( A \) from the defendant and a profit stream with present value \( \delta P/(1 - \delta) \). With probability \( (1 - q) \) he loses and receives a zero judgment and a profit stream with present value \( m\delta P/(1 - \delta) \), and the defendant receives an infinite profit stream with present value \( n\delta P/(1 - \delta) \). Because the parties receive these payoffs only when the court judgment occurs, and a judgment occurs in this period with probability \( 1 - \pi \), these bracketed sum are discounted by that probability. The remaining component of \( U^* \) is the revised marginal component \( P - C_p \). This revision reflects the fact that the plaintiff now obtains \( P \) every time he incurs \( C_p \) in costs. Notice that (8) can be positive because of the market opportunity.

As an alternative to judicial resolution, the parties can resolve the dispute by settling. The settlement could take several forms including an agreement not to compete in markets
currently served by the incumbent. Other settlement forms include a licensing agreement in which the rival pays the incumbent a fee for using the incumbent’s technology or an agreement to revise the rival’s product so that it is non-infringing. I examine both the no-competition agreement under which the market remains exclusive and the licensing agreement under which the market becomes a duopoly. Under the no-competition agreement post-settlement profits are $P/(1 - \delta)$, whereas under the licensing agreement total post-settlement profits are $(m + n)P/(1 - \delta)$.

Under a no-competition agreement, settlement requires one party to pay the other party a sum $S$ that is sufficient to induce the other party to exit the market. I assume without loss of generality that the plaintiff makes the no-competition settlement payment $S$ and obtains the exclusive market. Under a licensing agreement the defendant pays the licensing fee $S$ to the plaintiff and both parties split the market.

Regardless of the dispute’s resolution, the rival cannot gain market share until the conclusion of the dispute. This reflects the marketplace’s unwillingness to purchase the rival’s product when that rival’s continued market presence is uncertain.\footnote{Some journalists have identified this potential effect of litigation as a possible motivation in Apple Computer’s action against Microsoft Corporation and Hewlett Packard. \textit{PC Week}, p. 5, col. 2, April 5, 1988.}

\textbf{Settlement Under a No-Competition Agreement}

The following proposition considers the feasibility of a no-competition settlement and finds that when this type of settlement is possible the existence of litigation-contingent profits does not thwart settlement.

\textbf{Proposition 3.} \textit{When the plaintiff receives a profit flow of $P$ per period that would be reduced by an adverse court judgment and the parties have the opportunity to enter into a no-competition settlement agreement, they always settle the lawsuit.}

\textbf{Proof:} The plaintiff can settle by paying the defendant a sum sufficient to induce her to exit the market (or terminate efforts to enter the market) or he can refuse to settle
and receive his period 1 continuation value \( V_p^0 \). He settles provided his net gain, the profit flow \( P/(1-\delta) \) less the settlement \( S \) is no smaller than \( V_p^0 \), or

\[
\frac{P}{1-\delta} - S \geq V_p^0.
\]

The defendant accepts \( S \) only if it provides her with a payoff that is at least as large as \( V_d^0 \) or provided \( S \geq V_d^0 \). Combining these two conditions implies that settlement occurs provided

\[
\frac{P}{1-\delta} - V_d^0 \geq V_p^0,
\]

or

\[
\frac{P}{1-\delta} \geq V_p^0 + V_d^0.
\]

(9)

\( V_p^0 \) is

\[
V_p^0 = (1-\pi) \left( q(A + \frac{\delta P}{1-\delta}) + (1-q)\frac{m\delta P}{1-\delta} \right) + P - C_p + \pi \delta V_p^1,
\]

(10)

and \( V_d^0 \) is

\[
V_d^0 = -(1-\pi) \left( qA - (1-q)\frac{n\delta P}{1-\delta} \right) - C_d + \pi \delta V_d^1.
\]

(11)

Now suppose that the parties are just willing to settle in period 1 for a plaintiff to defendant payment of \( Q^* \). This implies that

\[
V_p^1 = -Q^* + \frac{P}{1-\delta}
\]

and

\[
V_d^1 = Q^*.
\]

However, if the parties are willing to settle in period 1, they will certainly settle in period 0. Therefore, substituting for \( V_p^0 \) and \( V_d^0 \) into (9) yields

\[
\frac{P}{1-\delta} \geq (1-\pi)[q\delta \frac{P}{1-\delta} + (1-q)(m+n)\delta \frac{P}{1-\delta}] + P - (C_p + C_d) + \pi \delta \frac{P}{1-\delta}.
\]

(12)

Solving for \( m + n \) yields the settlement condition

\[
m + n \leq 1 + \frac{1-\delta}{\delta(1-q)(1-\pi)} \left( \frac{C_p + C_d}{P} \right).
\]

(13)
Because $m + n \leq 1$ and the right side of (13) is always greater than 1, this condition is always satisfied, so settlement always occur. \textbf{Q.E.D.}

When it is possible for a party to commit to not competing in a market, thereby leaving an exclusive market for the other party, settlement dominates a judicial resolution regardless of who the incumbent is or who remains in the market. This occurs because obtaining the exclusive-market profit immediately always provides greater total profits than what may be obtained by waiting for an uncertain judicial resolution. The impatience and the uncertain timing of a court’s judgment are the key factors. To see this, notice that even with $m + n = 1$, i.e., when perfect collusion in a duopoly is possible, and $C_p = C_d = 0$ the right side of (12) is still no larger than the exclusive-market profit $P/(1 - \delta)$. Thus, there is always a settlement that one party can offer the other that leaves both parties at least as well off as litigation. Hence, when a no-competition settlement is possible, the model produces the standard result that the parties settle immediately in a full-information setting.

To determine the equilibrium settlement amount, I use an analysis similar to that used to prove Proposition 4. Although I only determine the equilibrium settlement amount for the case when the plaintiff makes the initial settlement offer, the analysis can also be used to determine the equilibrium settlement payoffs when the defendant makes the initial settlement offer.

Let $M$ be the supremum of payoffs that the plaintiff can receive in any equilibrium with initial node at $t = 2$. Then in period 1 the plaintiff accepts any offer that provides him with a payoff greater than the sum of his period 1 specific expected payoff and the present value of what he receives from period 2 on – a payment of at most $\pi \delta M$. This implies that the defendant’s offer $O_d$ is

$$O_d \leq (1 - \pi) \left[ q(A + \delta \frac{P}{1 - \delta}) + (1 - q)m\delta \frac{P}{1 - \delta} \right] + P - C_p + \pi \delta M. \quad (14)$$

So in period 1 the defendant can obtain at least the exclusive market profit $\frac{P}{1 - \delta}$ less the right side of (14). It follows that this difference is the infimum of the defendant’s period 1 expected gain.
In period 0, the defendant rejects any offer that provides her with an expected gain that is less than her period 0 specific expected payoff plus the present value of what she receives from period 1 on. This implies that the plaintiff’s period 0 offer \(O_p^0\) is

\[
O_p^0 \geq -(1-\pi)[qA - (1-q)\delta \frac{P}{1-\delta}] - C_d + \pi \delta \left[ \frac{P}{1-\delta} - (1-\pi) \left( q[A + \delta \frac{P}{1-\delta}] + (1-q)m\delta \frac{P}{1-\delta} \right) \right] - P + C_p - \pi \delta M.
\]

(15)

It follows then that the supremum of the plaintiff’s period 0 expected payoff is the exclusive-market profit \(P/(1-\delta)\) less the right side of (15). However, because of the identity between the subgame beginning in period 0 with the subgame beginning in period 2, \(M\) is equal to this difference. Therefore, solving for \(M\) yields

\[
M = \frac{P}{1-\delta} \left( \frac{1-\pi}{1+\pi \delta} \left( qA(1+\pi \delta) + \delta \frac{P}{1-\delta} [q\pi \delta + (1-q)(m\pi \delta - n)] \right) \right) \left( \frac{1-\pi \delta}{1-\pi^2 \delta^2} \right) + \pi \delta (P - C_p) + C_d.
\]

(16)

Defining \(M\) to be the infimum of the plaintiff’s expected payoff for any subgame equilibrium beginning at period 2 and repeating the Proposition 4 arguments for the analogous portion of that proof indicates that (16) is also the infimum of the plaintiff’s period 1 expected payoffs. Therefore, when the plaintiff is the incumbent the plaintiff’s unique period 1 settlement demand \(O_p^0\) is (16). Because the payoffs of both parties must total \(P/(1-\delta)\) the settlement payment \(S\) to the defendant is the difference between what the plaintiff receives \(O_p^0\) and total profits \(\frac{P}{1-\delta}\), or

\[
S = \frac{\pi \delta \frac{P}{1-\delta}}{1+\pi \delta} \left( \frac{1-\pi}{1+\pi \delta} \left( qA(1+\pi \delta) + \delta \frac{P}{1-\delta} [q\pi \delta + (1-q)(m\pi \delta - n)] \right) \right) \left( \frac{1-\pi \delta}{1-\pi^2 \delta^2} \right) + \pi \delta (P - C_p) + C_d.
\]

(17)

These equilibrium payoffs (16) and (17) are composed of two fractions. The first fraction is the division of the exclusive-market profit (one party receives their share as a payment), and the second fraction represents the division of the gain from avoiding litigation. The first-mover advantage is present here in that the defendant’s share of the exclusive-market
profit are discounted by $\pi$ and $\delta$. However, the advantage is mitigated somewhat by a similar discounting of the plaintiff's net marginal profit $P - C_p$ and expected profits $\delta P/(1 - \delta)[q + m(1 - q)]$ from a court judgment. It is a simple exercise to show that the reverse (i.e., that the discount factor $\pi\delta$ shifts to the plaintiff's share of the exclusive-market profit and to the defendant's profit share from a court judgment) holds when the defendant makes the initial offer. It follows from Proposition 3 that settlement occurs in the initial period for the payoffs identified above.

When $P = 0$ and $\delta$ goes to 1 the litigation term (the second fraction in (16)) is identical to (4). When $q$ is small the defendant's probability of success is large, so the amount she must pay the plaintiff to settle is smaller. If in addition $n > m\pi\delta$, the litigation term may be smaller than (4) or even negative.

**Settlement Under a Licensing Agreement**

The previous subsection revealed that the efficient outcome of immediate settlement is always obtained when it is possible for the parties to enter into a no-competition agreement. However such agreements may not be possible when there are legal constraints or agency problems that prevent this type of settlement. A no-competition agreement may be considered a violation of antitrust provisions, or a board of directors or stockholders may consider any agreement to withdraw a product from a marketplace unacceptable. In these cases a settlement would have to take the form of a licensing agreement with both parties having the right to remain in the market as a duopoly.

Hence, when a licensing agreement is the only possible settlement alternative, a party can obtain an exclusive market only through the legal sanction of a court judgment. Therefore, if settlement occurs, the parties enter into a duopoly with total profits that may be substantially less than the exclusive-market level. This difference between the exclusive-market and duopoly profit levels determines whether settlement occurs.

The following proposition considers the feasibility of a licensing agreement and finds that unless total duopoly profits are fairly close to the exclusive-market profit, the parties
do not find settlement beneficial. Thus, the gain from settlement is not sufficient to induce the incumbent to forgo his chance (through litigation) of obtaining an exclusive market and the associated profits.

**Proposition 4.** When the plaintiff receives a profit flow of $P$ per period that would be reduced by an adverse court judgment and a licensing agreement is the only possible settlement, they settle the lawsuit if and only if

$$m + n \geq 1 - \frac{1 - \delta}{1 - \delta[1 - q(1 - \pi)]} \left(\frac{C_p + C_d}{P}\right).$$

**Proof:** The defendant can settle by paying the plaintiff a sum sufficient to induce him to license the technology to her or she can refuse to settle and receive her period 0 expected payoff $V^0_d$. From the proof of Proposition 3 it follows that settlement occurs provided

$$(m + n)\frac{P}{1 - \delta} \geq V^0_p + V^0_d. \tag{18}$$

Now suppose the parties are just willing to settle in period 1 for a defendant to plaintiff payment of $Q^*$, This implies that

$$V^1_p = Q^* + \frac{mP}{1 - \delta}$$

and

$$V^1_d = -Q^* + \frac{nP}{1 - \delta}.$$  

However, if the parties are willing to settle in period 1, they will certainly settle in period 0. Therefore, substituting for $V^0_p$ and $V^0_d$ into (18) (using (10) and (11)) yields

$$(m + n)\frac{P}{1 - \delta} \geq (1 - \pi)[q\delta \frac{P}{1 - \delta} + (1 - q)(m + n)\delta \frac{P}{1 - \delta}] + P - (C_p + C_d) + \pi \delta (m + n)\frac{P}{1 - \delta}. \tag{19}$$

Solving for $m + n$ yields the settlement condition

$$m + n \geq 1 - \frac{1 - \delta}{1 - \delta[1 - q(1 - \pi)]} \left(\frac{C_p + C_d}{P}\right). \tag{20}$$

Therefore, $m + n$ must be no less than the right side of (20) in order for settlement to occur through a licensing agreement. 

Q.E.D.

19
The reason settlement fails under a licensing agreement is that the plaintiff's minimum demand is based on his possible receipt of monopoly profits, whereas the defendant's maximum offer is based on her receipt of duopoly profits. When monopoly profits are large compared to duopoly profits, the plaintiff's minimum demand exceeds the defendant's maximum offer making settlement impossible. This wedge cannot exist when a no-competition agreement is possible because both the plaintiff's demand and the defendant's offer are based on the receipt of monopoly profits. Thus, although it is socially efficient for the parties to settle immediately under a licensing agreement, it is not privately efficient for them to do so.

The following corollary aids in interpreting the implications of Proposition 4 by relating the settlement requirement to the no-settlement expected payoffs $U^*$ and $L^*$ (as such terms are defined on page 13) respectively. Specifically, the parties settle only if total post-settlement profits are no smaller than the sum $U^* + L^*$ of no-settlement expected payoffs. This sum represents the total expected private gain from litigation. Thus, unless the total gain from settlement is at least as large as the total expected private gain from litigation, settlement does not occur.

**Corollary 4.1.** When the plaintiff receives a profit flow of $P$ per period that would be reduced by an adverse court judgment and the parties have the opportunity to enter into a licensing agreement, they settle the lawsuit if and only if

$$ (m + n) \frac{P}{1 - \delta} \geq U^* + L^*. $$

**Proof:** Because

$$ (m + n) \geq 1 - \frac{1 - \delta}{1 - \delta[1 - q(1 - \pi)]} \left( \frac{C_p + C_d}{P} \right) $$

if and only if

$$ (m + n) \frac{P}{1 - \delta} \geq U^* + L^*, $$

the result follows immediately from Proposition 4. Q.E.D.
To examine the implications of Proposition 4, define $J^*$ by

$$J^* = 1 - \frac{1 - \delta}{1 - \delta(1 - q(1 - \pi))} \left( \frac{C_p + C_d}{P} \right).$$

Thus, by Proposition 4 settlement occurs anytime $m + n \geq J^*$.

As one might expect, $J^*$ is increasing in $\delta$ and $1 - \pi$, meaning that the probability of settlement is decreasing in these terms. When $\delta$ is high, the plaintiff is not impatient, so he is not as concerned about waiting for a court resolution. When $1 - \pi$ is large, early court resolution is likely, so the plaintiff does not have to wait long for a court resolution. As a result his settlement demand is high in both cases.

The probability of settlement is also decreasing in $q$. This result differs from the previous literature which identifies only imperfect information, Bebchuk (1984), and divergent beliefs, Shavell (1982), as causes of settlement failure. Even though the parties agree on the plaintiff’s probability of prevailing, a high $q$ increases the probability that the plaintiff receives monopoly profits. Therefore, his demand increases. The defendant, whose expected payoff is decreasing in $q$, is unwilling to pay the plaintiff’s high demand when $q$ is high so settlement fails.

The relation between the settlement decision and the award $A$ also differs from the relation in Bebchuk. Here the settlement decision is independent of $A$, whereas in Bebchuk the settlement decision is increasing in the ratio of litigation costs to the award $A$.\footnote{This is most apparent in Bebchuk when the defendant’s density function is assumed to be uniform.} In a full information setting the expected award, $qA$, is a transfer that both parties treat equivalently, so it cannot influence the settlement decision. Instead of depending on the relation between total costs and $A$, the probability of settlement is increasing in $(C_p + C_d)/P$. In Bebchuk when total costs are high relative to the court award, the uninformed plaintiff makes a low offer that is more likely to be accepted because his expected payoff from continuing litigation is lower. In this model, the high costs-to-profit ratio reduces the plaintiff’s demand (or increases the defendant’s offer) by increasing the costs to the parties of failing to settle. Thus, the wedge between the demand and offer is smaller or nonexistent when the costs-to-profit ratio is high.
Perhaps the most striking implication of Proposition 4 is the support it provides for the rent-maintenance hypothesis. According to this hypothesis, a plaintiff continues a lawsuit as long as the profits received as a result of his refusal to settle exceeds the costs of litigating. This behavior occurs even when the expected judicial payoff—the expected value of a court judgment less litigation costs—is negative. Thus, the plaintiff brings the lawsuit not to resolve the lawsuit but to continue receiving a profit flow. To see how Proposition 4 supports this hypothesis, consider \( J^*\) when \( q = 0\), meaning that the case is meritless. This implies

\[
J^* = 1 - \frac{C_p + C_d}{P}.
\]  

Equation (21) is decreasing in the ratio of marginal costs to the marginal profit \( P\). Thus, when the marginal profit from litigating is significantly larger than total litigation costs, the plaintiff refuses to settle a lawsuit even though his probability \( q\) of winning the case is zero. Because the plaintiff has no chance of receiving a judicially-sanctioned monopoly when \( q = 0\), the wedge between his demand and the defendant's offer is not the factor that deters settlement. Instead it is that the positive difference between the marginal profit and total marginal costs accrued in each period are so large in comparison to duopoly profits that litigation provides the plaintiff with a better payoff than settling.\(^{13}\)

To see this, notice that when \( q = 0\) and the parties are unable to settle, the following condition holds:

\[
(m + n) \frac{P}{1 - \delta} < \frac{P - (C_p + C_d)}{1 - \pi \delta} + \frac{1 - \pi}{1 - \pi \delta} (m + n) \delta \frac{P}{1 - \delta}.
\]  

This condition states that litigation continues only when total duopoly profits are less than the total benefit from continuing litigation. The right side of (22) consists of two fractions, one containing the difference between the marginal profit and total marginal costs and the other representing the expected payoff from a judicial decision mandating a duopoly. Because the value of settlement (the left side of (22)) dominates the expected

\(^{13}\)Equivalently, \( J^* = 1 - (C_p + C_d)/P \) when \( \pi = 1\), meaning that the court never resolves the dispute. Thus, the plaintiff continues litigating without any expectation of a judicial resolution as long it is profitable for him to do so.
payoff from a judicial decision, the positive difference between the marginal profit and total marginal costs is the factor that deters settlement. This is exactly the behavior predicted by the rent-maintenance hypothesis.

**Settlement Amounts under a Licensing Agreement**

Applying the same arguments used to identify equilibrium settlement amounts in the no-competition case to the licensing-agreement case when the plaintiff makes the initial offer yields a plaintiff payoff of

\[
O_p^0 = (m + n) \frac{P \delta}{1 + \pi \delta} + \frac{(1 - \pi) \left( qA(1 + \pi \delta) + \delta \pi \delta (1 - q)(m\pi \delta - n) \right) + \pi \delta (P - C_p) + C_d}{1 - \pi^2 \delta^2}
\]

(23)

and a defendant payoff of

\[
S = (m + n) \frac{\pi \delta \frac{P}{1 + \pi \delta} - \left( 1 - \pi \right) \left( qA(1 + \pi \delta) + \delta \pi \delta (1 - q)(m\pi \delta - n) \right) + \pi \delta (P - C_p) + C_d}{1 - \pi^2 \delta^2}
\]

(24)

The only difference between these payoffs and the respective no-competition agreement payoffs (16) and (17) is that the total duopoly profit \((m + n)P/(1 - \delta)\) replaces the exclusive-market profit \(P/(1 - \delta)\) in the first fraction of each equation. Hence, the only significant difference between the payoffs is that they are smaller when \(m + n < 1\). If \(m + n\) is sufficiently smaller than 1, settlement never occurs.

5 **Intermediate Settlement in Litigation With Profit Flows**

A major result of the previous section is that when a licensing agreement is the only settlement form settlement never occurs. Thus, settlement either occurs immediately
when settlement alternatives are unrestricted – as predicted by the prior literature – or not at all under the circumstances identified in Section 4.1. However, this never settle result under a licensing agreement is not absolute; there are circumstances under which settlement does not occur immediately but at an intermediate time in litigation.

To demonstrate this assertion, consider an extreme case in which marginal profits in periods 0 through \( T - 1 \) are \( P \) and in periods \( T \) on are zero and in which the parties can only settle their lawsuit by entering into a licensing agreement. In period \( T \) with \( P = 0 \) the Corollary 4.1 settlement condition reduces to \( 0 \geq -(C_p + C_d) \) – a condition that is always satisfied. Therefore, if litigation goes \( T \) periods without ending, the parties settle in period \( T \). The question then is whether settlement in period \( T \) implies settlement in period 0.

From Proposition 4 the parties settle if and only if the duopoly profit \( -(m+n)P^{1-\delta T} \) in this case – exceeds the sum of the parties’ continuation values. Or equivalently, settlement occurs if and only if

\[
(m + n)P^{\frac{1-\delta T}{1-\delta}} \geq V_p^0 + V_d^0. \tag{25}
\]

These continuation values are

\[
V_p^0 = (1 - \pi) \left( q(A + \delta P^{\frac{1-\delta T-1}{1-\delta}}) + (1 - q)m \delta P^{\frac{1-\delta T-1}{1-\delta}} \right) + P - C_p + \pi \delta V_p^1, \tag{26}
\]

and \( V_d^0 \) is

\[
V_d^0 = (1 - \pi) \left( qA - (1 - q)n \delta P^{\frac{1-\delta T-1}{1-\delta}} \right) + C_d + \pi \delta V_d^1. \tag{27}
\]

Now suppose that the parties settle in period 1 for a defendant to plaintiff payment of \( Q^* \). Then \( V_p^1 \) and \( V_d^1 \) are

\[
V_p^1 = Q^* + m P^{\frac{1-\delta T-1}{1-\delta}},
\]

and

\[
V_d^1 = -Q^* + m P^{\frac{1-\delta T-1}{1-\delta}}.
\]

Substituting for the continuation values in (25) implies that settlement occurs provided

\[
m + n \geq 1 - \frac{1-\delta}{1-\delta[1 - q(1 - \pi)(1 - \delta T^{-1})]} \left( \frac{C_p + C_d}{P} \right). \tag{28}
\]

24
To show that the parties may not settle in some period $t < T$ even though they definitely settle in period $T$ should the case last that long, consider the case in which the parties enter into a Cournot duopoly after settling with identical linear price and cost functions. This implies that $m + n = 8/9 = 0.889$. Let $(C_p + C_d)/P = 0.125$, $g = 0.8$, $\delta = 0.9$ and $\pi = 0.95$. When $T = 10$ the right side of (28) is 0.898, so the parties do not settle. In fact the parties do not settle immediately if the delay between the initial litigation period is greater than five periods.

The settlement condition differs from (20) by the presence of terms involving $\delta^{T-1}$ in the denominators of the fractions on the right side of each inequality. The fraction on the right side of each fraction is increasing in $T$ implying that settlement occurs at lower duopoly profit levels when $T$ is low than when $T$ is high. With high exclusive-market profits are large as well making the opportunity costs of settling high as well. As a result duopoly profits must be high as well in order to induce the incumbent to forgo his possibility of receiving an exclusive market. When $T$ is low exclusive-market profits are low as well because the benefit vanishes in a few periods. As a result, the cost to the parties of contesting the lawsuit are substantial relative to exclusive-market profits, so the parties settle at lower duopoly profit levels in order to avoid these high costs.

Because the game is structurally identical in all even periods, (28) with $T - t$ replacing $T$ is also the settlement condition for period $t$ as well. This implies that when the marginal profit declines the parties' incentives to settle increase over time. For example, in the above example although the parties do not settle in period 0, they are indifferent between settling and continuing in period 5 – the right side of (28) equals 0.889 – and they strictly prefer to settle in periods 6 on in which the right side of (28) is less than 0.889.

When the decline in marginal profits is far off, the expected benefit of winning the litigation lottery is high. Hence, only very high litigation costs or very high duopoly profits will induce the incumbent to settle. As litigation progresses, the expected payoff from litigation declines as well. As a result the parties settle at cost and duopoly profit levels that would have provided insufficient incentives earlier in litigation.
5.1 Application to the Apple v. Microsoft Case

The above results conform to the intuition developed in the preceding section about the rent-maintenance hypothesis. Under this hypothesis when $q = 0$ the difference between the marginal profit $P$ and total marginal costs $C_p + C_d$ deters settlement. As $P$ declines so does this difference. As a result the deterrence to settlement provided by this difference is reduced. For a sufficient reduction in $P$ the parties will settle. Thus, in a case driven by rent-maintenance behavior, a substantial reduction in the marginal profit may result in a settlement.

For example, consider the Apple v. Microsoft copyright infringement dispute. In this case, pending since April 1988, the court has rejected many of Apple's claim's concerning the alleged infringement of a Microsoft product (Windows) that allegedly operates and has a similar appearance to that of the Apple Macintosh. These rejections have led microcomputer industry analysts to urge Apple to settle its lawsuit.\textsuperscript{14} Yet Apple continues litigating with no indication of settling.

The theory developed here can be used to make several predictions relevant to this case. First, because the parties' have failed to settle it suggests a no-competition agreement, under which Apple stops producing Macintosh computer products or Microsoft ceases producing Windows products, is not an available settlement option. Antitrust considerations – Apple and Microsoft are the two biggest producers of microcomputer operating systems – as well as agency problems may impede consummation of such an agreement. In addition, contractual agreements between Microsoft and other computer producers, for example IBM, could also deter this type of settlement.

Because Apple and Microsoft can only settle their lawsuit by entering into a licensing agreement, the theory predicts that the profit flow that Apple receives while its lawsuit is pending less continuing litigation costs must exceed the duopoly profits available from a settlement. Apple is one of the most profitable companies in the microcomputer industry

\textsuperscript{14}"As Copyright Claims Narrow, Experts Say Apple Should Settle" \textit{InfoWorld}, p. 6, July 31, 1989.
due almost entirely to its proprietary Macintosh products.\textsuperscript{15} By contrast, the market for microcomputers that run under Microsoft operating systems – IBM clones – is extremely competitive and is characterized by low profit margins.\textsuperscript{16} If Microsoft's alleged "copycat" products allow IBM clones to attain a performance level close to that of Macintosh products, then it is possible that Apple products will come under the same competitive pressures that have burdened the IBM clone market. Thus, under this scenario, a rent-maintenance lawsuit may be a viable strategy for Apple even if its probability of obtaining a favorable court decision is low.

This strategy could change if the profitability of Macintosh computer products declines. This could occur by technological changes in the IBM clone market that meet or surpass the Macintosh's performance level without using Microsoft's Windows products, or if an alternative microcomputer system, such as Next Corporation's microcomputer, successfully provides superior performance to Macintosh microcomputers. In such an event the profit flow obtained by continuing litigation will be sufficiently reduced in comparison to the costs of continuing litigation that Apple could obtain a greater payoff by settling the case. Thus, it is still possible that the case may be resolved through settlement.

6 Conclusions

The analysis has shown that rent-maintenance behavior can exist under certain conditions. When the parties can only settle their lawsuit by entering into a licensing agreement, settlement may be delayed or never occur – a characteristic that is uncommon in full-information sequential-bargaining models. This inability to settle occurs when total post-settlement profits under a licensing agreement are substantially less than profits available in an exclusive market and when the marginal profit is significantly larger than marginal litigation costs. Because a court judgment can provide the incumbent firm with an exclusive market, the incumbent may prefer to "have its day in court" than to settle


for the very low profits available in a duopoly. That is, with relatively low profits under a licensing agreement, the competitor may be unwilling to make a settlement offer large enough to induce the incumbent to forgo his right to a court judgment. As a result, litigation continues indefinitely. Even when the plaintiff has no chance at winning the case, the marginal profit may be sufficiently larger than litigation costs so that the plaintiff’s payoff from continued litigation exceeds any payoff he can receive from settling under a licensing agreement. In contrast, the exclusive-market profit is an available option under a no-competition agreement, so payoffs received pursuant to such an agreement exceed all payoffs that either party can receive by prolonging litigation.

Thus when settlement options are restricted one can expect to see rent-maintenance behavior as one party finds prolonging a litigated dispute to be more profitable than resolving it. This result indicates that society has an interesting tradeoff in attempting to reduce inefficiencies associated with litigation. The most effective means of eliminating rent-maintenance behavior is to eliminate deterrents to settlement by removing barriers to the making of no-competition agreements. This may be a satisfactory solution in industries where there are advantages to scale or when it is desirable to encourage research and development through patents (or copyright protection) or by awarding exclusive franchises. However, in other industries such advantages of exclusivity may not be present, and encouraging competition can be socially-beneficial. In such industries it will be necessary to weigh the gains to society from encouraging settlement through no-competition agreements versus the losses from the reduction in competition.

Although rent-maintenance behavior is consistent with a profit-maximization objective, the existence of such behavior is less clear-cut. Although Apple’s failure to settle its lawsuit against Microsoft is consistent with rent-maintenance behavior, the lawsuit has not chilled demand for Microsoft products as the theory postulates. This may indicate that instead of destroying demand for Microsoft Windows, Apple’s objective is to prevent Windows from duplicating the essential functionality of the Macintosh computer that makes it unique.\(^1\) Thus, as long as Windows is an inferior product, Apple can still

\(^1\)The Windows interface is considered to be significantly inferior to the Macintosh interface. Windows’
charge monopoly prices for its Macintosh products.

This paper has also identified conditions under which nuisance lawsuits occur. In a full-information setting nuisance lawsuits cannot occur unless the plaintiff’s threat to continue the lawsuit an additional period is credible. Hence in order for a plaintiff to file a nuisance lawsuit – a lawsuit in which the expected payoff is negative – the marginal expected payoff – the value of continuing the lawsuit one period – must be positive. Thus the prototypical lawsuit in which the plaintiff drops the case if the defendant rejects his settlement demand can only occur when the defendant is uncertain about the plaintiff’s commitment to continue the lawsuit.

problems range from a difficult configuration process to an aesthetically unpleasing and unintuitive screen. See “The (Un)aesthetics of Windows,” PC Magazine, October 31, 1989, p. 73.
7 References


