The Effect of Litigation on Intellectual Property and Welfare

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Abstract

Litigation is usually assumed to be wasteful. This paper shows that litigation about intellectual property may be welfare enhancing. After an innovation or a piece of work is created, the patent or copyright may be challenged in court. This litigation contest decreases the expected copyright rent, therefore reducing the incentive to be creative in the first place leading to a negative effect on social welfare. Yet the legal contest may have the positive welfare effect of breaking the copyright monopoly and allowing an entrant into the market, thus lowering prices and reducing the welfare loss of monopoly. If the welfare effect of increasing competition outweighs the first effect of reduced creative effort, a "wasteful" litigation contest is welfare increasing.

Keywords: Litigation, Creative Effort, Contests

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1 Introduction

Litigation is a fact difficult to explain from an economic perspective. Why do economic agents go to court, when they can settle the dispute at a lower (expected) cost? Although many cases are settled out of court, there are still many disputes that actually reach the courts.[1]

Asymmetric information and/or asymmetric beliefs about the merits of the legal case play an important role. In the legal praxis, a big part of the litigation costs belongs to the category of fact finding concerning the case. Even after considering possible asymmetries, which should diminish as the parties gather information about the case and update their success beliefs, many important cases are litigated in court. It seems plausible to assume that litigation involves some sort of strategic behaviour by the litigants. Intellectual property[2], which is by definition an intangible asset, is a right where information and beliefs may matter more than in other situations, leading to increased litigation, because every party believes in its own right.

There are few contributions in the literature on litigation about intellectual property. Lerner (1994) studies biotechnology patents and estimates that on average 2% of patents are litigated. Lanjouw and Schankerman (2001) combine data from the US Patent and Trademark Office with data from US courts to find that reputation plays an important role and litigation. They stress the heterogeneity of patent litigation, which varies by industry and size of the firm. Actual patent litigation is concentrated in high-value patents and occurs more often in industries with advanced technology. There are, to my knowledge, no similar studies about copyright litigation.

This paper focuses on the strategic effect of litigation on the creation or innovation

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[1]Statistics of the proportion of cases that are settled out of court are notoriously difficult to obtain, because by definition those cases do not reach the courts.

[2]Intellectual property embraces patent and copyright protection, trade secrets and other less important protection regimes for innovative and creative processes, see Scotchmer (2004), Chapter 3. Our analysis is more general and does not depend on a specific protection regime, although in the following we will use copyright protection as our example.

process itself.[3] It is known that the protection of intellectual property has several short-comings: it exists to provide the creator with an incentive to be creative in the first place. But ex-post and from an efficiency point of view, once the work has been created, its public good character requires that its dissemination is made possible for free. Since the creation's private copyright value is smaller than its social value, the copyright protection system and other creator's reward mechanisms[4] reduce the incentive to create, when compared to the socially efficient level of creative effort. Additionally, the copyright protection system results in a (temporary) monopoly which generates a deadweight welfare loss.

The aim of our analysis is to allow for the possibility that a copyright may be contested in court. A related paper by Waterson (1990) considers the effect of possible court action on an innovator's patenting decision and on a potential rival's entry decision, without modeling the litigation process explicitly. We concentrate on the litigation outcome and model the legal dispute as a contest following Farmer and Pecorino (1999).[5] We use a contest to model the legal dispute, and not to model the creation race as most of the (patent) literature does.[6] The creative process is modelled in a concise way to focus on its uncertain outcome where only the probability of creative success plays a role, and not the time path of creative effort.

It turns out that the legal dispute has two effects. In the first place, the contest reduces the potential creation (monopoly) rent of the creative firm, thus deviating further from the socially efficient creation effort level. This reduces social welfare. But the litigation, if the plaintiff prevails, breaks the creator's monopoly on the new work and allows a new entrant into the market. This lowers prices and increases quantities, thus increasing social welfare. There may be situations where the second, competition increasing effect dominates the effect of reduced creative effort expenditures. A litigation

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[3]Scotchmer (2004) surveys in her excellent book many different aspects of intellectual property: legal aspects, cumulative innovation, litigation, licensing, copyright values, etc.

[4]Shavell and van Ypersele (2001) compare the incentive effects of rewards vs. property rights.

[5]Cooter and Rubinfeld (1989) survey the economics of legal disputes.

[6]See Reinganum (1989) for a survey on patent race models.

contest where resources are "wasted" in principle may turn out to be welfare enhancing. This effect is counterintuitive to most of the contest literature, where contest effort is usually associated with waste.[7] There are some other examples in the literature where contests have a positive effect on social welfare. Kolmar and Wagener (2005) combine a contest with a game of private provision of public goods to achieve under certain conditions an efficient equilibrium with no underprovision of the public good.

Consider as an example the case of copyrighted software. In the 1990s, Lotus spreadsheet application 1-2-3 was the market leader. Borland's Quattro application entered the market and in order to make the users' application switch more comfortable, copied Lotus 1-2-3's menu commands, menu structure, etc. This prompted Lotus to sue Borland for copyright infringement in 1990. The Supreme Court ruled 5 years later in Borland's favor. Ironically, by the mid-1990s, the outcome of the litigation battle no longer mattered. While Lotus and Borland were busy with each each at the courts, Microsoft conquered the Windows spreadsheet market with its Excel application.

We proceed as follows. The next section sketches the time structure of our game. Section 3 presents the concise model of the creative process. The litigation contest is presented in Section 4. Section 5 analyzes the welfare effects of creation and litigation. A numerical example is presented in Section 6. Section 7 concludes.

2 The structure of the game

Our game has the following structure with 4 stages:

1. In the first stage, a firm invests in creative effort and possibly creates a new work for which there is a (net) positive willingness to pay. If the creative process is not successful, the game ends here.

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[7]Actually, Tullock (1980), considered one of the seminal contributions on contests, was concerned with the rate of "dissipation", that is the rate of which the value of the contest prize is wiped out by the sum of the efforts of all contestants.

2. If the firm comes out with a new and valuable work, the successful creator will enjoy copyright protection to recover his costs from the resulting monopoly rent.

3. Once the work is out and copyrighted, the creation is common knowledge. A second firm challenges the validity of the copyright in court and both firms, creator and challenger, engage in a litigation contest.

4. Depending on the outcome of the litigation dispute, the new product is produced by the creative monopolist or by both firms as Cournot duopolists in quantities.

When solving this game, we will concentrate on Stage 1, the "creative process", and Stage 3, the "litigation contest". The outcomes of the monopoly and duopoly situations in Stage 4 are well known from the literature.

3   The creative process

Analysis of intellectual property races often assume a Poisson creation process, early works are Loury (1979), Lee and Wilde (1980) and Dasgupta and Stiglitz (1980). Since our interest is the creative expenditure level and not the time path of the such creative effort, we assume that all creation costs are incurred at time zero with no subsequent costs. They generate a positive creation success probability, as in Gilbert and Newbery (1984) and Shavell and van Ypersele (2001).

Suppose there is a risk neutral firm spending an amount k on effort to create a new work. The probability of the firm's creative success is given by $p(k)$, where we plausibly assume that $p'(k) > 0$ and $p''(k) < 0$, e. g., the more the firm invests in creative effort, the higher the probability of creating a worthy new work, but with diminishing increases. Once a work is created, it can be (re)produced with constant returns to scale at a unit cost of production given by c.

Let q and p_q be the quantity and the price of the new product, respectively. The

inverse demand curve is $d(q)$ with $d'(q) < 0$. The social surplus $S(q)$ is then given by

$$S(q) = \int_0^q (d(\tilde{q}) - c)d\tilde{q} \qquad (1)$$

Let $S^* = S(q^*)$ be the maximum social surplus for the first best quantity q^*. Social welfare W is the expected value of the work minus production costs (as given by the expected social surplus) minus creative effort:

$$W = p(k)S^* - k \qquad (2)$$

To avoid the trivial case where the created work is not worthwhile, assume further that the unit cost is low enough (alternatively, that demand is high enough) such that at $q = 0$, producing a unit of q increases social welfare. The first best creative effort level k^* is the creative effort level that maximizes the social welfare (2) and is implicitly defined by the condition

$$p'(k)S^* = 1. \qquad (3)$$

The left hand side gives the marginal increase in social welfare from an additional unit of creative effort, while the right hand side reflects the marginal cost of this additional unit of creative effort. Equation (3) defines a creative effort level depending on the social surplus S: $k(S)$. Implicit differentiation of (3) leads to

$$k'(S) = \frac{-p'(k)}{S \cdot p''(k)} > 0. \qquad (4)$$

Thus, research creative effort k is increasing in social surplus: the greater the surplus S, the higher k. For the first best social surplus S^* and creative effort level k^*, we obtain the first best social welfare W^*

$$W^* = p(k(S^*))S^* - k(S^*). \qquad (5)$$

Suppose now that the firm has a copyright for the creation. The firm enjoys a legal (although temporary) monopoly on the creation. Let d_m denote the quantity chosen by the profit maximizing monopolist firm and Π_m the resulting monopoly profit. The

creator chooses his creative effort level to maximize his expected payoff

$$p(k)\Pi_m - k \tag{6}$$

which leads to the first order condition

$$p'(k_m)\Pi_m = 1, \tag{7}$$

where k_m denotes the profit maximizing research expenditures implicitly defined by condition (7). Since $\Pi_m < S^*$, by comparing the first order conditions (3) and (7) we obtain $p'(k_m) > p'(k^*)$. Thus, by the diminishing marginal probability returns of research, under a copyright regime the firm invests too little in creative effort from a social perspective:

$$k_m < k^*. \tag{8}$$

The monopolist restricts quantity, $q_m < q^*$, and this leads to the well known monopoly deadweight welfare loss DWL_m:

$$DWL_m = \int_{q_m}^{q^*} (d(\tilde{q}) - c)d\tilde{q} > 0. \tag{9}$$

The social welfare under the copyright regime is

$$W_m = p(k(\Pi_m))[S^* - DWL_m] - k(\Pi_m). \tag{10}$$

Since the monopolistic firm both produces and researches too little from an efficiency perspective, social welfare under the copyright regime is lower than the first best social welfare:

$$\begin{aligned} W^* - W_m &= p(k^*)S^* - k^* - p(k_m)[S^* - DWL_m] - k_m \\ &= [(p(k^*)S^* - k^*) - (p(k_m)S^* - k_m)] + [p(k_m)DWL_m] > 0. \end{aligned} \tag{11}$$

The first bracketed term in (8) is the welfare loss due to suboptimal research activity of the firm, whereas the second bracketed term is the welfare loss commonly associated with a monopoly situation.

4 The litigation contest

Once the creative firm is awarded a copyright, it enjoys a monopoly for the new product. But rival firms have several ways to circumvent the copyright and thus endanger the monopoly rent. They may produce a similar good which is a good substitute for the creator's good but is still beyond the scope of the copyright. A copyright may be challenged in court in order to show that the creation is not really an "original work of authorship".

As an example, consider again the litigation suit of Lotus vs. Borland. Lotus wanted to prevent Borland from entering the spreadsheet market and argued that Borland had infringed its copyright. Borland argued successfully (respect to the legal outcome), that the "feel" and "look" of the software application was not covered by Lotus copyright. Thus Borland was free to enter the market, which by that time was already dominated by Microsoft.

Litigation is very expensive. Related data concerning patent litigation, the median litigation per patent claim has been estimated at \$1.5 million (Barton, 2000), which may be more than the average value of the intellectual property in itself. According to Scherer and Harhoff (2000), the distribution of patent value is very skewed: very few, high value patents concentrate most of the value. The cost of enforcing and defending the intellectual copyright may be even greater than the creative effort itself.

We model this copyright enforcement as an imperfectly discriminating litigation, asymmetric contest (Farmer and Pecorino, 1999). For the sake of simplicity, we assume that there is only one risk neutral challenger C litigating against a creative monopolist M who owns a copyright for the good. Let x_c and x_m denote, respectively, their spending effort to prevail in the litigation dispute. The probability that the contestant $i = c, m$ wins the prize is

$$\frac{x_i^\alpha}{\sum_{j=c,m} x_j^\alpha},\tag{12}$$

where $\alpha \in (0,1)$. This contest success function was given an axiomatic foundation by Skaperdas (1996). For the sake of analytical tractability, we will assume $\alpha = 1$.

This contest success function has been widely used in the literature.[8] The restriction $\alpha = 1$ amounts to assuming constant returns to scale in the litigation effort producing technology, which we believe to be a reasonable assumption for labor intensive law producing technology.

The litigation contest in Farmer and Pecorino (1999) is asymmetric because they also consider objective merits of the litigation suit favoring the plaintiff or the defendant. It turns out that these objective merits do not play a role in our setting. Thus we assume them to be zero. The asymmetry of our model is caused by the asymmetric valuation of the prize (Hillman and Riley, 1989). If the creative monopolist successfully defends its position, it earns a monopoly profit Π_m. If the challenging firm prevails, then both firms share the market and are duopolists earning a profit Π_c, with $\Pi_c < \Pi_m$. Thus the prize is different for each contestant. The expected payoffs of challenger and monopolist V_c and V_m are given by:

$$V_c = \frac{x_c}{x_m + x_c}\Pi_c - x_c, \tag{13}$$

$$V_m = \frac{x_m}{x_m + x_c}\Pi_m + \frac{x_c}{x_m + x_c}\Pi_c - x_m = \frac{x_m}{x_m + x_c}(\Pi_m - \Pi_c) + \Pi_c - x_m. \tag{14}$$

The expected payoff of the creative monopolist firm contains the duopoly profit as a fixed part, because if the plaintiff wins the case and the copyright is declared void, the creator is still able to enter the market as a duopolist. If we disregard the fixed payoff Π_c from the creator's payoff, the direction of the asymmetry is not a priori clear, as the Cournot profit Π_c may be greater or smaller than the difference between the monopoly and the Cournot profit $\Pi_m - \Pi_c$. Both players maximize their expected payoff (13) and (14) with respect to their own effort for given rival's effort (Nash behavior). The first order conditions (FOC) are:

$$\text{FOC challenger:} \quad 0 = x_m\Pi_c - (x_m + x_c)^2 \tag{15}$$

$$\text{FOC monopolist:} \quad 0 = x_c(\Pi_m - \Pi_c) - (x_m + x_c)^2 \tag{16}$$

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[8]See Nitzan (1994) for a general survey on contests.

In this imperfectly discriminating contest there exists an interior Nash equilibrium in pure strategies (see Hillman and Riley, 1989) and the participation constraint for both contestants is satisfied, e. g., both creator and challenger prefer to litigate rather than choose a corner solution with zero litigation effort (Farmer and Pecorino, 1999). The pay-off maximizing choices of the contestants are found by finding the effort couple (x_c, x_m) that simultaneously solve conditions (15) and (16):

$$x_c = \frac{\Pi_c}{\Pi_m^2}(\Pi_m - \Pi_c) \cdot \Pi_c \tag{17}$$

$$x_m = \frac{\Pi_c}{\Pi_m^2}(\Pi_m - \Pi_c) \cdot (\Pi_m - \Pi_c) \tag{18}$$

Notice that the direction of the valuation asymmetry depends on the relative size of $\Pi_m - \Pi_c$ and Π_c. Depending on this relationship, it is the creator or the challenger who has a higher incentive to invest a higher effort in litigation. Further, both contestants invest less than their valuation of the contest prize:

$$\frac{\Pi_c}{\Pi_m^2}(\Pi_m - \Pi_c) < 1$$

$$\Longleftrightarrow \quad \Pi_c\Pi_m - \Pi_c^2 < \Pi_m^2$$

$$\Longleftrightarrow \quad \Pi_c\Pi_m < \Pi_m^2 + \Pi_c^2$$

The rent dissipation lost in the litigation contest is given by

$$x_c + x_m = \frac{\Pi_c}{\Pi_m}(\Pi_m - \Pi_c). \tag{19}$$

Since this expression is smaller than either $\Pi_m - \Pi_c$ (the creative monopolist's valuation of the litigation prize) and Π_c (the challenger's valuation of the litigation prize), the prize is not fully dissipated. The maximal expected payoffs of challenger and monopolist are

$$V_c = \frac{\frac{\Pi_c}{\Pi_m^2}(\Pi_m - \Pi_c)\Pi_c}{\frac{\Pi_c}{\Pi_m}(\Pi_m - \Pi_c)}\Pi_c - \frac{\Pi_c}{\Pi_m^2}(\Pi_m - \Pi_c)\Pi_c = \frac{\Pi_c^3}{\Pi_m^2}, \tag{20}$$

$$V_m = \frac{\frac{\Pi_c}{\Pi_m^2}(\Pi_m - \Pi_c)^2}{\frac{\Pi_c}{\Pi_m}(\Pi_m - \Pi_c)}(\Pi_m - \Pi_c) - \frac{\Pi_c}{\Pi_m^2}(\Pi_m - \Pi_c)^2 + \Pi_c = \frac{(\Pi_m - \Pi_c)^3}{\Pi_m^2} + \Pi_c. \tag{21}$$

The difference in expected payoff between defendant and plaintiff is positive:

$$V_m - V_c \;\; = \;\; \frac{(\Pi_m - \Pi_c)^3 - \Pi_c^3}{\Pi_m^2} + \Pi_c \tag{22}$$

$$= \;\; \frac{(\Pi_m - \Pi_c)(\Pi_m^2 - \Pi_m P i_c + 2\Pi_c^2)}{\Pi_m^2} > 0, \tag{23}$$

but this depends crucially on the certain rent Π_c accruing to the original creator. If we disregard this duopoly rent and consider only the expected payoff of the litigation contest in a narrow sense, (22) shows that this payoff difference again depends on the relative size of $\Pi_m - \Pi_c$ and Π_c.

We summarize the main characteristics of the legal dispute in the following proposition:

Proposition 1 (Litigation contest)

Assume a litigation contest with linear contribution technologies and asymmetric prizes $\Pi_m - \Pi_c$ and Π_c. Both the plaintiff and the defendant choose a litigation effort level greater than zero and less than their valuation. The rent is not fully dissipated. The relative size of both the optimal effort choices and the maximal expected payoff depend on the relative size of the prizes.

5   Welfare Effects

The litigation dispute influences a rational profit maximizing firm doing creative activities in the first place. The firm will choose its creative effort level takes to maximize

$$p(k)V_m - k, \tag{24}$$

resulting in the first order condition

$$p'(k_l)V_m = 1, \tag{25}$$

where k_l denotes the profit maximizing research expenditures with subsequent litigation implicitly defined by condition (25). From Section 4 we know that $V_m < \Pi_m < S^*$. Thus,

analogously to Section 3, we obtain by the diminishing marginal probability returns of research:

$$p'(k_l) > p'(k_m) > p'(k^*) \iff k_l < k_m < k^*. \tag{26}$$

The litigation contest increases the deviation from the first best research level, reducing social welfare when compared to the situation of a copyright monopoly without litigation.

But the legal dispute has also a positive effect on social welfare. With a positive and possibly significant probability, the copyright is successfully challenged in court and the monopoly changes into a duopoly. Prices drop and quantities increase, resulting in a smaller deadweight welfare loss DWL_l under litigation:

$$DWL_l = \int_{q_l}^{q^*} (d(\tilde{q}) - c)d\tilde{q} < DWL_m, \tag{27}$$

where q_l is the duopoly output, $q_l > q_m$.

The probabilities that the plaintiff (challenger) and the defendant (monopolist) prevail in the litigation contest are given by $p_c = \Pi_c/\Pi_m$ and $p_m = (\Pi_m - \Pi_c)/\Pi_m$. The social welfare under the copyright regime with subsequent litigation is then given by

$$
\begin{aligned}
W_l &= p(k(V_m))[S^* - p_c \cdot DWL_l - p_m \cdot DWL_m - x_m - x_c] - k(V_m) \\
&= p(k_l)[S^* - \frac{\Pi_c}{\Pi_m}DWL_l - \frac{\Pi_m - \Pi_c}{\Pi_m}DWL_m - \frac{\Pi_c}{\Pi_m}(\Pi_m - \Pi_c)] - k_l.
\end{aligned} \tag{28}
$$

Consider now the welfare difference between the situations with and without litigation:

$$
\begin{aligned}
W_l - W_m &= \underbrace{[(p(k_l)S^* - k_l) - (p(k_m)S^* - k_m)]}_{<0} \\
&\quad + p(k_l)\underbrace{[-\frac{\Pi_c}{\Pi_m}DWL_l - \frac{\Pi_m - \Pi_c}{\Pi_m}DWL_m - \frac{\Pi_c}{\Pi_m}(\Pi_m - \Pi_c)]}_{<0} \\
&\quad + p(k_m)\underbrace{DWL_m}_{>0}
\end{aligned} \tag{29}
$$

The first term in (29) is negative because litigation acts as a disincentive for research. The second term reflects the (expected) welfare loss in the litigation situation and the

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litigation effort expenses. Last, the third term is the welfare loss under monopoly with no legal challenge. The sign of expression (29) depends on the specification of demand and on the specific probability function of the firm's creative success. For certain specifications, we may obtain the following result

Proposition 2 (Welfare increase due to litigation)

If the effect of increased competition outweighs the effect of reduced creative effort plus litigation effort, then the legal dispute may lead to a welfare increase.

6   A numerical example

In the following we present an example to show that the situation described in Proposition 2 can arise assuming commonly used utility and distribution functions. Suppose the inverse market demand is given by $p_q(q) = a - bq$ and the marginal cost is constant at c, where a, b and c are positive with $a > c$. Table 1 briefly presents the outcome of the different market situations: monopoly, duopoly and perfect competition.

The monopoly profit Π_m, the profit of one duopolist firm Π_c, the monopoly deadweight loss DWL_m, and the duopoly deadweight loss after (successful) litigation DWL_l can all be expressed in terms of the efficient social surplus $S^* = \dfrac{(a-c)^2}{2b}$. Thus, we obtain

$$
\begin{aligned}
\Pi_m &= \frac{(a-c)^2}{4b} = \frac{1}{2}S^* \\
\Pi_c &= \frac{(a-c)^2}{9b} = \frac{2}{9}S^* \\
DWL_m &= \frac{(a-c)^2}{8b} = \frac{1}{4}S^* \\
DWL_l &= \frac{(a-c)^2}{18b} = \frac{1}{9}S^*
\end{aligned}
$$

Table 1: Market outcomes

	Monopoly	Duopoly	Competition
Quantity	$\dfrac{a-c}{2b}$	$\dfrac{2(a-c)}{3b}$	$\dfrac{a-c}{b}$
Price	$\dfrac{a+c}{2}$	$\dfrac{a+2c}{3}$	c
PS	$\dfrac{(a-c)^2}{4b}$	$\dfrac{2(a-c)^2}{9b}$	0
CS	$\dfrac{(a-c)^2}{8b}$	$\dfrac{2(a-c)^2}{9b}$	$\dfrac{(a-c)^2}{2b}$
S	$\dfrac{3(a-c)^2}{8b}$	$\dfrac{4(a-c)^2}{9b}$	$\dfrac{(a-c)^2}{2b}$
DWL	$\dfrac{(a-c)^2}{8b}$	$\dfrac{(a-c)^2}{18b}$	0

Notes: PS = producers's surplus, which in absence of fixed costs equals the profit of the firm(s), CS = consumers' surplus, S = social surplus, $DWL = S - (PS + CS)$ deadweight loss.

The welfare difference given by expression (29) simplifies to

$$
\begin{aligned}
W_l - W_m &= [(p(k_l)S^* - k_l) - (p(k_m)S^* - k_m)] \\
&\quad + p(k_l)[-\frac{\frac{2}{9}S^*}{\frac{1}{2}S^*}\frac{1}{9}S^* - \frac{\frac{1}{2}S^* - \frac{2}{9}S^*}{\frac{1}{2}S^*}\frac{1}{4}S^* - \frac{\frac{2}{9}S^*}{\frac{1}{2}S^*}(\frac{1}{2}S^* - \frac{2}{9}S^*)] \qquad (30) \\
&\quad + p(k_m)\frac{1}{4}S^* \\
&= [(p(k_l)S^* - k_l) - (p(k_m)S^* - k_m)] - p(k_l)[\frac{101}{324}S^*] + p(k_m)\frac{1}{4}S^* \quad (31) \\
&= [k_m - k_l] + [p(k_l)(1 - \frac{101}{324}) - p(k_m)(1 - \frac{1}{4})]S^* \qquad (32) \\
&= [k_m - k_l] + [p(k_l)(\frac{223}{324}) - p(k_m)(\frac{3}{4})]S^* \qquad (33)
\end{aligned}
$$

The stochastic relationship between the rate of research and the creative success is often assumed to follow a Poisson process, see the creative race models by Loury (1979), Lee and Wilde (1980) and Dasgupta and Stiglitz (1980). Let k be the rate of research. The probability of a successful creative work is then given by

$$
p(k) = 1 - e^{-\lambda k}, \qquad (34)
$$

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where the λ is the hazard rate and the expected creation success is given by $1/\lambda$. This exponential distribution is "memoryless" in the sense that the random success of the creator does not depend on the past creative effort rate.

Remember that k_m and k_l are the profit maximizing choices of an unrestricted monopolist and of a monopolist facing litigation, respectively, and are implicitly defined by the FOCs (7) and (25):

$$p'(k_m)\Pi_m \;=\; 1 \quad \Longrightarrow \quad e^{-\lambda k_m}(\frac{1}{2}S^*) = 1 \quad \Longleftrightarrow \quad k_m = \frac{1}{\lambda}\ln\frac{S^*}{2} \tag{35}$$

$$p'(k_l)V_m \;=\; 1 \quad \Longrightarrow \quad e^{-\lambda k_l}(\frac{2}{9}S^*) = 1 \quad \Longleftrightarrow \quad k_l = \frac{1}{\lambda}\ln\frac{2S^*}{9} \tag{36}$$

Computing the corresponding probabilities $p(k_m) = p(\frac{1}{\lambda}\ln\frac{S^*}{2}) = 1 - \frac{2}{S^*}$ and $p(k_l) = p(\frac{1}{\lambda}\ln\frac{2S^*}{9}) = 1 - \frac{9}{2S^*}$ and replacing k_m, k_l, $p(k_m)$ and $p(k_l)$ with their values, we obtain the following expression for the welfare difference $W_l - W_m$:[9]

$$W_l - W_m = \left(\frac{1}{\lambda}\ln\frac{S^*}{2} - \frac{1}{\lambda}\ln\frac{2S^*}{9}\right) + \left(\frac{2S^*-9}{2S^*}\cdot\frac{223}{324} - \frac{S^*-2}{S^*}\cdot\frac{3}{4}\right) \tag{37}$$
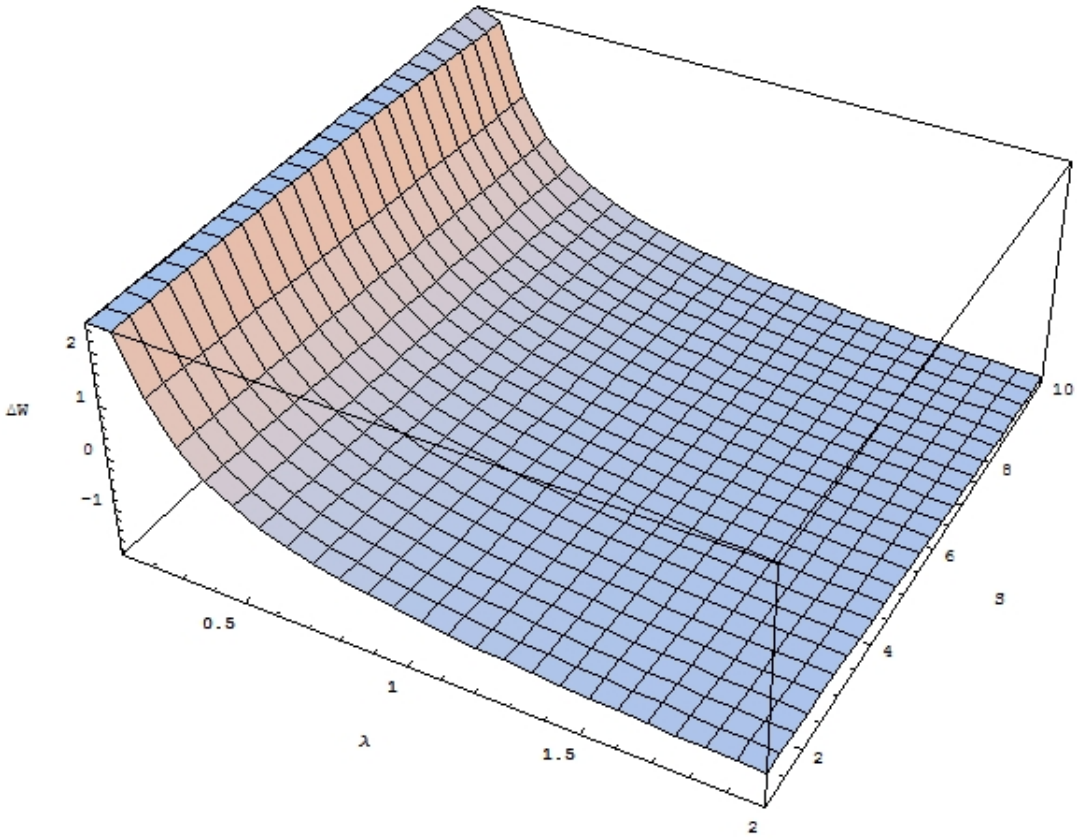
If expression (37) is positive, then welfare under litigation is greater than welfare under the copyright monopoly. Figure 6 shows the plot of (37) for given (λ, S^*). For any given S^* there exists a λ leading to this welfare improvement. If λ is small enough, litigation is welfare improving, although the litigation contest effort is "wasted". A small λ is equivalent to a high mean of the distribution, e. g. creative processes where successful works are relatively seldom.

7 Conclusions

Contests are usually assumed to waste resources and to dissipate the contest prize. Our paper presents a situation where a litigation contest may turn out to be welfare improving. In our model, legal disputes have the positive welfare effect to break the monopoly of the creator and so to reduce the associated deadweight welfare loss.

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[9]We assume implicitly and without loss of generality that S^* is large "enough" to generate positive probabilities smaller or equal than 1.

Figure 1: The welfare difference as a function of the exponential parameter λ and the social surplus S^*

Still, this result is only valid within the framework of the existing intellectual property protection system. We take the laws protecting intellectual property as given. There are mechanisms inducing the creation of novel works other than copyright monopolies that do not result in a monopoly, e.g. a creation award. If such a reward is contested in court, the litigation efforts of the contestants are really wasted and do not enhance social welfare.

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