울산대학교 사회과학 논집 제6권 2호 pp. 1~9, 1996.
Journal of Social Science Vol. 6, No. 2, pp. 1~9, 1996
University of Ulsan.

Liability, Court Cost and Product Quality

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<Abstract>

By using a simple model, I showed that strict liability rule can obtain the first best solution about quality level. Under negligence liability rule, the distribution of court cost is very important to the market performance. If the cost is imposed to the losing party, there is an increase of quality level and a decrease of lawsuit, compared to the case of consumer bearing the cost. Under negligence liability rule, imperfect information of the court cost is also welfare-decreasing. Finally, I showed the basic model can explain the wellknown result that monopolist produces higher quality goods than competitive firm does. In a generalized setup, however, this result can be overturned.

보상책임 및 법정비용과 상품의 질

이재기
경제학과

<요 약>

본 논문은 상품에 하자가 발생했을 경우의 보상원칙, 재판에 따르는 법정비용의 부담 등이 기업의 상품의 질의 선택에 미치는 영향을 분석한 것이다. 단순한 모형을 이용하여 본 논문에서 분석한 주요 결과는 다음과 같다. 첫째, 상품의 질에 관한 최선의 해는 하자 발생시 기업이 전적으로 보상하는 엄격한 보상원칙(strict liability rule)하에서 얻어진다. 둘째, 적정한 품질기준 미달시에만 기업이 보상하는 경우(negligence liability rule)에는 기업의 책임 여부를 결정하는 데 소요되는 법정비용의 배분이 시장성과에 중요한 영향을 미

친다. 원고인 소비자가 법정비용을 부담하는 경우보다 피소자가 이를 부담하는 경우에 상품의 질이 높아지고 소송건수도 감소한다. 그리고 불완전한 정보로 인해 기업의 책임여부에 대한 판정이 부정확할 가능성이 있을 때 사회후생은 감소한다. 마지막으로 본 논문의 기본모형은 완전경쟁기업보다 독점기업이 더 품질이 높은 상품을 생산한다는 잘 알려진 기존의 연구결과와 동일한 결과를 나타내고 있으나, 보다 일반화된 모형에서는 이러한 결과가 반전될 수 있음을 보인다.

I. Introduction

There have been a number of researches analyzing the economic effect of liability rules. These liability rules have an important function since liability through tort law is an alternative to administrative regulation of product quality or safety standard. The purpose of this paper is to examine the effects of various liability rules on market performance. In particular, related with negligence liability rule, effects of the distribution of court cost between two parties - consumer and firm - are analyzed. In addition, we examine the effects of liability rule in a monopoly market and the robustness of the idea that monopoly market produces higher quality products than competitive market does.

Liability rules related with tort law are studied in a large literature in law and economics which emphasizes perfect competition. The incentive effects of legal rules on product quality or care level are studied by Brown(1974), Diamond(1974), Shavell(1980) and Landes and Posner(1985). The effect of market power on the performance of product liability rule is studied by Epple and Raviv(1978).

We consider three legal rules; strict liability, negligence and no liability. Under strict liability rule, firm bears all costs of damages suffered by consumers. Under negligence liability rule, firm bears no cost as long as it meets a due quality standard. Consumers bear all product failure costs under no liability.[1)]

The paper is organized as follows. The basic model and the first-best solution are described in section II. Section III examines the market performances of different liability rules in a competitive market situation. Section IV shows the economic effects of the distribution of court cost and imperfect information under negligence liability rule. Section V examines the wellknown result that monopoly market is more likely to produce high quality good than competitive market is, and shows the result is not robust. Final section concludes the previous results and suggests some directions of future research.

1) This paper deals with a single moral hazard case of firm side. In a double moral hazard case conidering both firm and consumer, we can consider many different kinds of liability rules. For details, see Brown(1973).

II. Basic Model and the First-Best Solution

Consider a competitive market in which product failure imposes an expected monetary loss on the representative consumer. There are a large number of consumers and each consumer has an identical inelastic demand for one unit of product.[2] Each firm chooses to produce a good of quality x and charges a price r which is an equilibrium price in a competitive market. The following terms will be used in subsequent analysis.[3]

l: damage award from product failure
p(x): probability of product failure
x: firm's quality choice [x is H(high) or L(low)]
C(x): production cost of quality x good [C(H) > C(H)]
α: probability that firm chooses x=L
d_x: firm's share of liability

In a competitive market the equilibrium price will be

(1) $r = \alpha C(L) + (1-\alpha)C(H) + d_x l p(x)$

from zero profit condition. In this case, firm will maximize $r-[\alpha C(L)+(1-\alpha)C(H)]-d_x l p(x)$ and consumer will maximize $-r - l[\alpha p(L)+(1-\alpha)p(H)]+d_x l p(x)$. Therefore, the first best solution can be obtained from the following problem:

$$\text{Max}_{\alpha} \; -\alpha C(L) - (1-\alpha)C(H) - l[\alpha p(L)+(1-\alpha)p(H)]$$

The solution is

(2) $\alpha = 0$ (1) if $p(H)l + C(H) < (>)\; p(L)l + C(L)$.

That is, firm chooses high quality (low quality) if the cost of producing high quality good plus expected damage is less (more) than those of producing low quality good.

III. Liability Rules and Market Performance

It is evident that firm chooses different quality level according to the legal

2) The basic model implicitly assumes production function is constant return to scale in quantity.
3) We assume that damage award is independent of both quantity and quality. Production costs depend only on quality. These assumptions are for simplification and will be relaxed in section V.

restrictions on liability. Under strict liability rule, $d_x = 1$, firm's optimization problem is

$$\text{Max}_{\alpha}\ r - \alpha C(L) - (1-\alpha)C(H) - l[\alpha p(L)+(1-\alpha)p(H)].$$

The solution for this problem is equal to the first best solution and social optimum is obtained under strict liability rule.

Under negligence liability rule, $d_x = 1$ if $x = L$ and $d_x = 0$ if $x = H$. Then firm's optimization problem is

$$\text{Max}_{\alpha}\ r - \alpha C(L) - (1-\alpha)C(H) - \alpha lp(L)$$

The solution for this problem is

(3) $\alpha = 0\ (1)$ if $C(H) < (>)\ p(L)l + C(L)$.

This result implies quality level under negligence liability rule is likely to be higher than that under strict liability rule. If there is no liability rule, firm will maximize $r-\alpha C(L)-(1-\alpha)C(H)$. Then the optimal choice of firm is to produce only low quality good. If consumer recognizes this fact, the situation of market is similar with Akerlof's lemon problem. From the previous arguments we can derive the following proposition.[4]

Proposition 1: Quality level is socially optimal only under strict liability rule.

The above proposition comes from our assumption that only the firm has an incentive to choose low quality level. If we admit the existence of consumer's effect on product failure, the above result can be inappropriate.

IV. Negligence Liability Rule with Court Cost

It is usual that under negligence liability rule, a third party (usually it is a "court") is needed to determine product quality. In this case, there arises substantial costs for court decision and who bears the cost is very important to market performance. In this section, we will consider two cases, plaintiff (consumer) bearing case and losing party bearing case. The other problem we analyze is the effect of imperfect information in court decision. If there is some probability e ($0<e<0.5$) of wrong decision by court, this will influence market performance.

At first, consider the case in which consumer bears the court cost F ($F<l$) and court has perfect information. Consumer chooses the probability θ to file a court suit

4) This proposition may not hold in double moral hazard case.

under given value of α, the probability that firm chooses low quality. Consumer's problem is

$$\text{Max}_{\theta} \ \theta(\alpha l - F)$$

Then, consumer's optimal strategies are $\theta = 0$ (1) if $\alpha <$ (>) F/l, and $\theta \in [0,1]$ if $\alpha = F/l$. Firm's problem is to choose optimal quality under given probability of consumer's suit when product fails.

$$\text{Max}_{\alpha} \ r - \alpha[C(L) + \theta p(L)l] - (1-\alpha)C(H)$$

Firm's optimal strategies are $\alpha = 0$ (1) if $\theta >$ (<) $[C(H)-C(L)] / p(L)l$, and $\alpha \in [0,1]$ if $\theta = [C(H)-C(L)] / p(L)l$. From these results, we can get proposition 2. Consumer's and firm's optimal responses and equlibrium are represnted in Figure 1.

Proposition 2: There is a mixed strategy Nash equilibrium when $\alpha^* = F/l$ and $\theta^* = [C(H)-C(L)] / p(L)l$.

An interesting point in this case is that pure strategy Nash equilibrium does not exist. Moreover, the mixed strategy Nash equilibrium is not the first best solution.

The previous case where consumer solely bears court cost is not desirable in social welfare sense. We can show this by considering the case where losing party bears the cost. Here we also assume that court has perfect information. Consumer determines to sue or not to sue by considering the following problem:

$$\text{Max}_{\theta} \ \theta[\alpha l - (1-\alpha)F]$$

Consumer's optimal strategies are $\theta = 0$ (1) if $\alpha <$ (>) $F/(F+l)$, and $\theta \in [0,1]$ if $\alpha = F/(F+l)$. Firm's reaction can be derived from the following problem:

$$\text{Max}_{\alpha} \ r - \alpha[C(L) + \theta p(L)l + \theta p(L)F] - (1-\alpha)C(H)$$

Then firm will choose $\alpha = 0$ (1) if $\theta >$ (<) $[C(H)-C(L)]/p(L)(F+l)$, and $\alpha \in [0,1]$ if $\theta = [C(H)-C(L)]/p(L)(F+l)$. Similar with the previous case, there does not exist pure strategy Nash equilibrium.

Proposition 3: There exists a mixed strategy Nash equilbrium when $\alpha^{**} = F/(F+l)$ and $\theta^{**} = [C(H)-C(L)]/p(L)(F+l)$.

Proposition 4: Product quality in the case where losing party bears the court cost is higher than that in the case where consumer solely bears the cost. The number of

lawsuit in the first case is less than that in the latter case.

Proof: It is obvious form the results that $\alpha^* > \alpha^{**}$ and $\theta^* > \theta^{**}$

The proposition 4 means that in a civil suit, the legal system in which losing party pays the court cost is more desirable than that in which plaintiff who is consumer in this paper pays the cost. An interesting point is that if consumer can make a commitment to file a suit whenever product fails and if the commitment is credible, there will be an improvement of product quality. In this sense, tradition of society that lawsuit is popular or not can be a partial element to determine product quality.

We now need to consider the case in which court has imperfect information and makes wrong decision with probability e. In this case, consumer's problem is

$$\text{Max}_\theta \quad \theta[\alpha l(1-e)+(1-\alpha)el-\alpha cF-(1-\alpha)(1-e)F]$$

The optimal strategies of consumer are $\theta=0$ (1) if α < (>) $[(1-e)F-el]/[(1-2e)(F+l)]$, and $\theta \in [0,1]$ if $\alpha = [(1-e)F-cl]/[(1-2e)(F+l)]$.

Firm's optimal strategy can be obtained from the following maximization problem:

$$\text{Max}_\alpha \quad r - \alpha[C(L)+\theta p(L)(1-e)l+\theta p(L)(1-e)F] - (1-\alpha)[C(H)+\theta p(H)cl+p(H)eF]$$

Firm's best strategies are $\alpha = 0$ (1) if θ > (<) $[C(H)-C(L)+\theta p(H)e(F+l)] / [p(L)(1-e)(F+l)]$, and $\alpha \in ([0,1]$ if the equality holds in θ. Similary with the previous cases, there exists only a mixed strategy Nash equilibrium.[5] At this equilibrium there arise decrease of product quality and increase of the number of suits compared to the perfect information case. This result can be interpreted as a kind of information cost of the society.

V. Generalization of Basic Model and Monopoly Market

It is an established result that monopoly market produces a good which is as safe as that produced by a competitive firm. Furthermore, by making the producer liable, safety of the good will be diminished.(Epple and Raviv, 1978) This result can be checked by using the basic model. This result is, however, very restrictive and depends on our assumption about cost function. In the basic model, production cost depends on quality and it is constant return to scale in quantity. Also damage l is assumed to be independent of both quantity and quality. By relaxing several restictive assumptions in the basic model, we can check that Epple and Raviv's result is not

5) We can easily find that this imperfect information case is a general case of the previous perfect information case.

robust. At first, consider our basic model and apply it to monopoly case. Then we can find Epple and Raviv's result holds in the basic model.

1. Application of Basic Model to Monopoly Case

Assume that the maximum price consumers willing to pay for a high quality product is r_H and for a low quality product is r_L. ($r_H > r_L$). Also assume that monopolist can not make commitments about the quality of his product. Then the maximum price that monopolist can make is $\alpha r_L+(1-\alpha)r_H$. Since monopolist usually can rip-off all consumer's surplus, we can assume $\alpha r_L+(1-\alpha) r_H > r$.

Under strict liability rule, monopolist solves:

$$\text{Max}_{\alpha} \ \alpha r_L + (1-\alpha)r_H - \alpha[C(L)+lp(L)] - (1-\alpha)[C(H)+lp(H)]$$

Monopolist will choose high quality ($\alpha = 0$) if the following holds:

(4) $\quad r_L - [C(L)+p(L)l] < r_H - [C(H)+p(H)l]$

The above condition (4) is less restrictive than the condition (2) in competitive madket. That is, if condition (2) holds, then condition (4) is satisfied, but the reverse is not true. Therefore, we can say that the quality level in monopoly market is at least as high as that in competitive market. This result will hold under different liability rules.

2. Does Monopolist Always Produce Higher Quality?

A representative consumer's utility is u(q) where q is the amount of purchase and $u(\cdot)$ is increasing and stricly concave. Damage award $l = l(q,x)$ and $l(\cdot)$ is increasing and convex in q and decreasing and convex in x. Firm's cost function, C(q,x), is assumed to be increasing and convex both in q and x. Consumer's net utility is $u(q) - l(q,x)$. The first best solution which is assumed to be equal to competitive one is obtained from the following problem:

$$\text{Max}_{q,x} \ u(q) - l(q,x) - C(q,x)$$

The first-order conditions are as follow and the second order conditions for a global maximum are assumed to be satisfied.

(5) $\quad u'(q^0) - l_q(q^0,x^0) - C_q(q^0,x^0) = 0$

(6) $\quad - l_x(q^0,x^0) - C_x(q^0,x^0) = 0$

Condition (5) means the marginal utility of consuming the product net of marginal expected damages equals to marginal production costs. Condition (6) implies marginal reduction in damages from the increase of quality must be equal to the marginal cost of increasing quality. It is evident that monopoly equilibrium can be different from the above competitive results. Under strict liability rule,[6] the monopolist chooses q and x to maximize profit $r(q)q-l(q,x)-C(q,x)$ where $r(q)$ is an inverse demand function. The first order conditions are

(7) $r(q^m) + q^m r'(q^m) - l_q(q^m,x^m) - C_q(q^m,x^m) = 0,$

(8) $- l_x(q^m,x^m) - C_x(q^m,x^m) = 0,$

where $r(q) = u'(q)$ is the monopoly price. The quality level chosen by monopolist depends on the cross effect of quality and quantity on mpnopolist's cost $l(q,x)+C(q,x)$. Similar to the analysis of Sheshinski(1976) for product quality without liability rule, quantity and quality are said to be cost substitutes(complements) if $\partial^2 [l(q,x)+C(q,x)] / \partial x \partial q > (<) 0$.

Proposition 5 : Under strict liability rule,

i) output level in monopoly market is less than that in competitive market ($q^m < q^o$);

ii) if l_x/C_x is constant over q, $q^m = q^o$;

iii) if quantity and quality are cost substitutes (complements), $x^m > (<) x^0$.

Proof: i) From equation (5) and (7), since $u'(q) = r(q)$ and $r'(q) < 0$, $q^m < q^o$.

ii) If l_x/C_x is constant over q, then $l_x(q,x) = q l_x(x)$ and $C_x(q,x) = qC_x(x)$. From (6) and (8), $x^m = x^0$.

iii) Since $q^m < q^0$, the condition (8) holds when $x^m > x^0$ if $\partial^2 [l(q,x)+C(q,x)] / \partial x \partial q > 0$ and $x^m < x^0$ if $\partial^2 [l(q,x)+C(q,x)] / \partial x \partial q < 0$. Q.E.D.

The above proposition shows that monopolist can produce lower quality product in cost complements case and the results of Epple and Raviv(1978) and the basic model of this paper are not robust.

VI. Concluding Remarks

By using a simple model, we showed that strict liability rule can bring the first best solution for product quality. Under negligence liability rule, the distribution of court cost is very important to social welfare. If the cost is imposed to the losing

6) Only strict liability rule is analyzed in the generalized setup. The other cases can also be applied and the results seem to be similar.

party, there is an increase of quality and decrease of lawsuit compared to the case of consumer bearing the cost. Imperfect information of court is also welfare-decreasing under negligence liability. Finally, we showed the basic model can explain the wellknown result that monopolist produces higher quality good than competitive firm does. In a more generalized setup, however, this result can be overturned.

The model analyzed in the paper used many simplifying assumptions and missed some important points we need to consider. Future researches need to include the case where consumer has risk-averseness and moral hazard problem.

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