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# An Economic Model for Microrenting in Electronic Commerce

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## Abstract

This paper analyzes the possibility of a monopoly firm selling and renting a packaged software product. It employs a simple model to analyze the firm's pricing strategy. We observe that the introduction of the rental product leads to an increase in profits, an increase in selling and a decrease in rental prices as a function of the rate of change of the rental price with respect to the quantity sold.

## Introduction

Renting of cars, apartments, and other durable economic goods is common today. Computer hardware can also be rented but the same is not true for software. Software products have the characteristic that their marginal cost of production is zero, i.e. it is very easy to copy software. This causes enormous problems in enforcing copyright laws for software. The Business Software Alliance and the Software Publisher's Association estimate losses from software piracy to be about \$13 billion in 1995 [5]. This problem with IPR enforcement has affected the feasibility of renting software. However, software renting on a large scale has now become technically feasible. Microsoft's electronic distribution framework lets it implement new pricing and licensing paradigms including pay-per-view and software rental [2]. The Electronic Licensing and Security Initiative was formed in May 1996 [3] to build and operate a scaleable clearing house infrastructure that will make electronic distribution of software secure, accountable and quick.

Short-term rental of durable economic goods is a common everyday occurrence. The economic benefits of leasing have been well researched and there are numerous articles, mostly in finance journals. It is argued in various articles that renting is equivalent to buying, using for a period of time and then selling the good and that there is no additional value created by allowing renting. However, a paper by Flath [4] advances several reasons why short-term renting offers economic advantages. He shows that leasing reduces transactions costs, including the cost of identifying, assuring, maintaining quality and the costs of search. A commonly cited example is that of automobile renting. The cost of searching and then determining the quality of an automobile is significant, the same is true of the transactions costs in a buy or sell transaction. Consumers who need an automobile for a short duration can reduce these costs by renting.

We define microrenting as renting for a very short period of time. Typically, firms sell a license to use their software. This may be in the form of an end-user license or a site license. There are numerous restrictions on the sale and transfer of these licenses that reduce the viability of a used-software market [6]. The development of a rental market will fill the void caused by the absence of a used-software market. In recent years the development of the Internet and the World Wide Web has led to the development of electronic markets featuring dramatic reductions in transactions costs. This can aid a software rental market considerably, especially in view of the high costs of identifying and assuring the quality of used software products in a fast changing information world.

Since the software company observes increasing returns to investment as she keeps investing in technology, the emergence of short-term natural monopolies is possible. One dominant strategy for the software companies seems to be to establish a customer base for her product and then make a lot of profit from selling upgrades. The passage of the Computer Software Rental Act in 1990 made it illegal to rent software

without the copyright owner's specific permission. This legislation might also aid in the development of local monopolies in the software rental market.

We develop a simple model of a monopoly selling and renting a software product. We show various reasons why it should be economically attractive for the monopoly to sell and rent the software simultaneously. We also offer some intuition on how prices would behave in such circumstances.

## Model

We employ a simple monopoly model to analyze the gains from renting software.

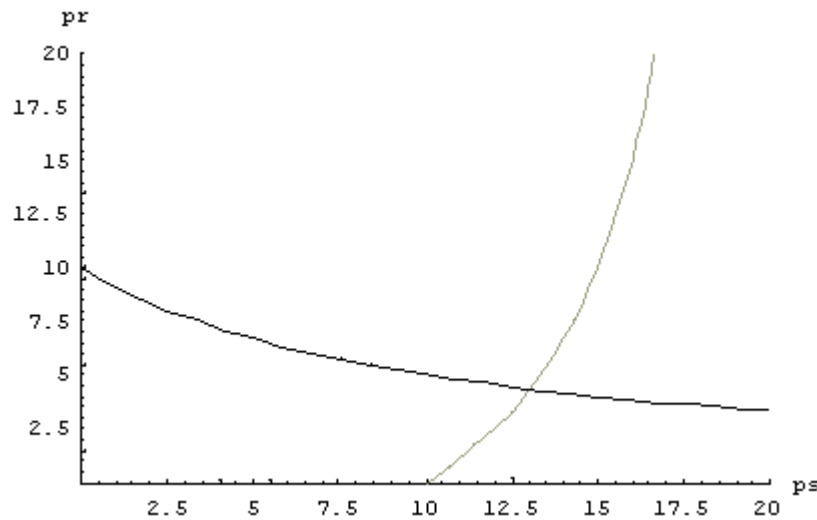


Figure 1:  $P_S$  and  $P_R$  as a function of the cross-elasticity parameter  $\gamma_R$ .  $P_S$  is represented by the lighter colored curve. The parameter values are  $\alpha = 20$ ,  $\beta_S = 2$ ,  $\beta_R = 2$

### Case 1: No Renting

For a monopoly, given the market demand function

$$Q_S = \alpha - \beta_S P_S$$

where  $\alpha$  is the intercept and  $-\beta_S$  is the slope of the demand function,  $Q_S$  is the quantity demanded and  $P_S$  is the selling price, the profit function is given by

$$\Pi = P_S Q_S$$

We know from microeconomics textbooks [7] that the firm's optimal selling price is given by

$$P_S^* = \frac{\alpha}{2\beta_S}$$

and the profit by

$$\Pi^* = \frac{\alpha^2}{4\beta_S}$$

## Case 2: Renting

The monopoly firm produces a software product and either sells it or rents it. Since she faces two different demand functions, we represent the market with two demand functions. Information goods are characterized by having marginal cost of zero, hence the profit function only includes the total revenues.

Let  $Q_1$  be the software product sold,  $Q_2$  be the product rented. We model the demand for  $Q_2$  as a function of  $Q_1$ . The two demand functions, with  $P_S, P_R, Q_S, Q_R$  representing selling and rental prices, quantity sold and rented respectively, are given by:

$$\begin{aligned} P_S &= \alpha - \beta_S Q_S \\ P_R &= \alpha - \beta_R Q_R - \gamma_R Q_S \end{aligned}$$

where  $\alpha$  is the intercept of the demand functions,  $-\beta_S$  is the slope of the demand function for  $Q_1$ ,  $-\beta_R$  is the slope of the demand function for  $Q_2$  and  $\gamma_R$  is the cross-elasticity parameter of  $Q_2$  with respect to  $Q_1$ .

The profit function is given by

$$\begin{aligned} \Pi &= P_S Q_S + P_R Q_R \\ &= (\alpha(Q_S + Q_R) - \beta_S Q_S^2 - \beta_R Q_R^2 - \gamma_R Q_S Q_R) \end{aligned}$$

From the first order condition to the profit maximization problem, we get

Optimal prices:

$$\begin{aligned} P_S^* &= \frac{\alpha(\beta_S \gamma_R + 2\beta_R \beta_S - \gamma_R^2)}{(4\beta_R \beta_S - \gamma_R^2)} \\ P_R^* &= \frac{\alpha\beta_S(-\gamma_R) + 2\beta_R \beta_S}{(4\beta_R \beta_S - \gamma_R^2)} \end{aligned}$$

And the optimal profit:

$$\Pi^* = \frac{\alpha^2(\beta_R + \beta_S - \gamma_R)}{4\beta_R \beta_S - \gamma_R^2}$$

## Results

In this section, we compare the optimal solutions we have found above. We find that the profits in case 2 are greater than in case 1 when

$$(\gamma_R - 2\beta_S)^2 \geq 0$$

which is always true.

We also observe that the selling price is higher than the rental price if

$$4\beta_R\beta_S > \gamma_R^2 > 1$$

$$\alpha > 1$$

which implies that the demand intercepts and  $\partial P_R / \partial Q_S$  has to be large enough.

Further, using comparative statics, we find that

1.  $P_S^*$  is increasing with respect to  $\gamma_R$  if  $\alpha > 2$  and  $2\gamma_R < \beta_S$ .
2.  $P_R^*$  is decreasing with respect to  $\gamma_R$  if  $\alpha > 2\beta_R$ .

## Conclusion

By introducing the rental software product, the monopolist increases her profits. In other words if the monopolist starts renting her software product, she will observe higher profits.

An interesting result is that the monopolist's optimal selling price increases if the quantity demanded for  $\gamma_1$  is more sensitive to changes in rental price than to changes in selling price.

## Future Directions for Research

This paper attempts to develop a simplified model as a first step to address an interesting question. A more realistic model should capture properties of software products such as network externalities, and upgrades.

A more complete model of software microrenting is developed by Choudhary et al. [1]. They examine a two period model of a monopoly selling and renting a software product that exhibits delayed network externalities.

An extension of their model includes pre-emptive pricing by the monopolist which rents software. They also look at the behavior of the firms under the assumption of monopolistic competition.

Another research direction that could be followed is to look at different market structures which can represent software market more realistically. One such market can be modeled as a duopoly and another as perfect competition.

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