Renting or Selling – A Strategic Choice in a Durable Good Market

Manas Paul
Indira Gandhi Institute of Development Research
Gen. Vaidya Marg
Goregaon (East)
Bombay 400 065.

Sougata Poddar
Department of Economics
National University of Singapore
10 Kent Ridge Crescent
Singapore 119260

E-mail: ecssp@nus.edu.sg
mpaul@igidr.ac.in

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Abstract

We study the strategic impact on the choice between two commercial transactions, namely, renting and selling, by the competing firms in a durable good market. In the literature, it has been generally shown that given a choice between renting and selling, a monopoly firm will choose renting in order to maximize its profits. This is also what Coase (1972) conjectured while studying the behaviour of a durable good monopolist. We prove that under a strategic environment, this is not any more true. First, when we considered a simultaneous move game between two symmetric durable good firms, who have the option to choose between renting and selling before competing in the product market, selling turns out to be the unique dominant behaviour of the firms. We also studied a sequential move game between an incumbent durable good firm and a potential entrant and found that under the threat of entry, incumbent firm would choose to sell instead of renting in the pre-entry stage. Thus, we establish the fact that the market structure as well as the nature of competition plays an important role in determining the optimal behaviour of the firms operating in a durable good market.

Keywords: Durable good, Renting, Selling, Market Structure.

JEL Classification: L13, L68, D43
1. Introduction

Coase (1972) first pointed out that a monopoly selling a durable good will behave differently from the monopoly selling a perishable good. Given a choice between renting and selling, a monopoly firm would like to rent the durable good, rather than selling it, in order to maximize its profit. The intuition behind this is that rational consumers are able to calculate that a selling-durable-good monopolist would lower future prices due to the future fall in the demand resulting from having some consumers purchasing the durable product in earlier periods. This calculation reduces the willingness of consumers to pay high prices in the first period when the monopoly offers the product for sale. Hence, the current demand facing the monopoly falls, implying that the monopoly will charge a lower price than what a monopoly selling a perishable good would charge. Realizing this, later, Bulow (1982, 1986) studied that in case the monopoly firm is unable to make a binding contract with the consumers with regard to renting, or unable to make binding promises about restricting his future production plan of the durable good in order to keep the future prices high, the selling monopolist will produce a good of lesser durability than those produced by either competitive firms or renting monopolists. This way of production of goods with uneconomically short useful lives so that the consumers will have to make repeat purchases is what is called “Planned Obsolescence”. Now most of the studies in the literature related to this, are mainly focused on a monopolistic market structure (see also Stokey (1981), Gul, Sonnenschein, and Wilson (1986), Shy (1995), Waldman (1997), Fudenberg and Tirole (1998)). Hence a natural question arises what happens to the choice between renting and selling of a durable good where more than one firm competes in the same market. More specifically, if we consider an oligopoly market structure or a sequential entry of firms in the same durable good market, what would be the optimal action (between renting and selling) of the competing firms. In other words, we are interested to see, what would be the strategic impact on the choice of action between renting and selling in a durable good market. In this analysis, we consider a perfectly durable good and thus the level of durability is not a choice variable of the competing firms. The only strategic choice variables of the firms are to rent or sell and supply the quantities appropriately in order to maximize profits. In this strategic environment, first we considered a simultaneous move game between two symmetric
durable goods firms, who have the option to choose between renting and selling before competing in quantities in the product market, and found that unlike the optimum behaviour of renting by a durable goods monopolist, selling turns out to be the unique dominant behaviour of the firms. We also studied a sequential move game between an incumbent durable goods firm and a potential entrant and found that under the threat of entry, incumbent firm would choose to sell instead of renting in the pre-entry stage.\(^1\) Thus, our result stands in sharp contrast with the result obtained under a monopoly market structure. Hence, we establish that the market structure as well as the nature of competition has an important impact on Coase conjecture\(^2\) and on the optimal choice of action (between renting or selling) by the firm(s) in a durable good market.

We also show that the resulting market outcome in the strategic environment of the simultaneous move game gives rise to a prisoner’s dilemma situation, i.e. even if selling turns out to be the unique dominant strategy of the competing firms, in the equilibrium each firm ends up with a lower profit compared to a situation where they both opt for renting. We also find that the market outcome under the strategic environment is socially sub-optimal, which essentially leaves a place for policy intervention in order to improve society’s welfare. Another striking feature, we find is that a policy intervention could not only improve upon a market outcome from social point of view but a particular policy prescription also depends on the type market structure of the durable goods market. For example, under a monopoly market structure advocating a “selling policy” to the firms would improve the overall welfare, whereas under a strategic environment a “renting policy” would have a similar effect.

In the literature, Bucovetsky and Chilton (1986) considered a similar issue and studied the behaviour of a durable goods monopolist facing a threat of entry. In the absence of such a threat, the monopolist would prefer to rent, whereas in the presence of it an optimal pre-entry contract is a mix of renting and selling. Their model differs from our model in a number of ways. First, they considered only a sequential move game.

\(^1\) A parallel result regarding the choice of selling or renting has also been proved by Bagnoli, Salant and Swierzbinski (1989) under a monopoly market structure, where they showed that selling dominates renting if and only if the demand is discrete.

\(^2\) In another study, Kuhn and Padilla (1996) also showed that the Coase conjecture does not hold when a durable goods monopolist also sells non-durable goods that are demand related to the durable good.
(incumbent-entrant type), whereas our model allows for a *simultaneous* move between two symmetric durable goods firm. In that model, the incumbent gets a cost advantage (on the previous rented units) over the entrant when it competes with the entrant, which essentially shifts the reaction function of the incumbent outward and gives the incumbent a limited Stackelberg leadership (analogous to Dixit, 1980, in the investment entry deterrence game). In contrast, we assume zero cost of production for both the firms in both sequential and simultaneous move games and derive our results from a pure strategic play.

The rest of the paper is organized as follows. Section 2 introduces the model. Section 3 discusses the existing results of a durable good monopolist. This forms the benchmark of the subsequent analysis done afterwards. Section 4 takes up the simultaneous duopoly game between the durable good manufacturers. Section 5 analyzes the sequential entry game in the durable good market. Section 6 considers the welfare analysis with policy implications and finally, section 7 collects some concluding remarks.

### 2. The Model

Consider a continuum of consumers having different valuations for a certain durable good. Suppose that consumers live for two periods denoted by $t, t = 1, 2$. The good is perfectly durable. For simplicity, we assume no time discounting in the model for the firms and consumers. $^3$ There is no secondhand market.

If a consumer ever purchases the product, she will have it for her entire life and she will not have to replace it ever again. $^4$ The different valuations for the good are summarized by the familiar downward sloping demand curve. More precisely, at period $t = 1$, the aggregate inverse demand for one period of service is given by $p(Q) = a - Q$, where $p$ is the price and $Q$ is the aggregate supply.

We consider two types of commercial transactions: *renting* and *selling*. By renting a product to a consumer for a certain price, the renter maintains ownership of the product, but contracts with the consumer to allow the consumer to derive services from the

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$^3$ It can be verified that all the results obtained in this paper remain unaffected if we allow time discounting for the firms and consumers. A brief argument is provided in the conclusion.

$^4$ In our model, this means if she buys a good in time period one, she will not have to buy it in time period two.
product for a given period specified in the contract. Whereas by selling a product to a consumer for a certain price, the seller transfers all rights of ownership for using the product and never gets back the product. Thus, selling means charging a single price for an indefinite period for using the product whereas renting means charging a price for using the product for a specific limited time period. In our model, we essentially distinguish between renting and selling in the first period only, in the following way. If a consumer rents a good in time period one, she has to give it back to the renter at the end of period one whereas if a consumer buys a good in time period one, she gets to keep it till the end of time period two. Since period two is the last period (end of time) renting or buying a product in period two is equivalent.

3. Monopoly and Durable Goods

In this section we briefly report the main existing results in the literature of a durable good monopolist (Bulow (1982), Shy (1995)). These results will form a benchmark of the forthcoming analysis that we do in the subsequent sections 4 and 5. As we have said earlier, we are mainly interested to see the strategic effect on the choice of a particular action (namely, between renting or selling) of the durable good manufacturer when more than one firm operates in the same market. Thus, the comparison between the existing results in a monopoly market structure along with our new results under an oligopolistic market structure will allow us to see the impact of strategic behaviour in a durable good market.

Consider a monopoly providing a durable good. In the subsequent analysis, for simplicity, we will assume no cost of production for the durable good.6

3.1 A Renting Monopoly

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5 It should be emphasized that by selling, the manufacturer does not always transfers all rights on the product sold. For example even when a product is sold (rather than rented) the new owner does not have the rights to produce identical or similar products if the product is under patent protection.

6 The same analysis could be carried out with a cost of production of the durable good. But since our main aim in the paper is to see the effect of market structure on the choice of two types of commercial transactions, (namely, between renting or selling) by the firm(s) in a durable good market, the present representation is sufficient.
Assume that each period the monopoly rents a durable product for one period only. Suppose that in each of the two periods the monopoly faces the demand $p(Q) = a - Q$.

Naturally, in each period the monopoly behaves like a usual profit maximizer and maximizes the sum of two period profits.

In each period the monopoly charges a price $p_t^R = \frac{a}{2}$ and earns a profit $\pi_t^R = \frac{a^2}{4}$, $t = 1,2$. Hence in two period the monopoly earns a total profit of $\pi^R = \frac{a^2}{2}$.

### 3.2 A Selling Monopoly

A seller monopoly knows that those consumers who purchase the durable good in $t = 1$ will not repurchase in period $t = 2$. That is, in $t = 2$ the monopoly will face a demand for its product that is lower than the period 1 demand by exactly the amount its sold in $t = 1$. Therefore, in period 2 the monopoly will have to sell at a lower price resulting from a lower demand, caused by its own earlier sales.

Formally, we define this two period game as follows. The payoff to the monopoly is the total revenue generated by period 1 and period 2 sales. The strategies of the seller are the price set in period 1, $p_1^S$; and the price set in period 2 as a function of the amount purchased in period 1, $p_2^S(q_1)$; where $q_1$ is period one sales. The strategies of the buyer are to buy or not to buy (in the first period) depending on the net utility she gets in consuming the good for two periods as opposed to one period (second period) consumption only. We look for a subgame perfect equilibrium.

The equilibrium price, quantity and profit of the selling monopoly in period one are:

$$p_1^S = \left[ \frac{9a}{10} \right] ; \quad q_1^S = \left[ \frac{2a}{5} \right] ; \quad \pi_1^S = \left[ \frac{9}{25} \right] a^2 ; \quad \text{and in period 2 are:}$$

$$p_2^S = \left[ \frac{3a}{10} \right] ; \quad q_2^S = \left[ \frac{3a}{10} \right] ; \quad \pi_2^S = \left[ \frac{9}{100} \right] a^2 .$$

Hence total profit of a seller monopoly is: $\pi^S = \left[ \frac{9}{20} \right] a^2$

It is straight forward to compare and see that renting monopoly earns a higher profit than a seller monopoly. Hence, we have the following result.
**Proposition 1**

*Given a choice between renting and selling, a durable good monopolist will always choose renting.*

Now the question is: Does this result continue to hold when there is another firm operating in the same durable good market? In other words, we are interested to see how the strategic interaction will affect the choice of renting or selling by a firm when it faces another firm in the same durable good market?

### 4. Duopoly and Durable Goods

Suppose two firms 1,2 are producing the same durable good and they compete with each other in quantities in period 1 and 2. The game between the firms is as follows. Before choosing the quantities for the respective periods, they decide simultaneously whether to rent or sell the good. This can be thought of as a pre-play stage. Once they make their decision on renting and selling they commit to it and choose appropriate quantities in period 1 and 2 in order to maximize total individual profits.\(^7\) We look for a subgame perfect equilibrium of this game. We start solving the game by the usual method of backward induction. In this game, in the first period three scenarios may arise where (i) both the firms rent (ii) one firm rents and the other sells (iii) both the firms sell. We will take up each of these cases separately while solving the game.

#### 4.1 Both Firms Rent

In this case both the firms are faced with the same demand curve in each period. Hence, we get the standard duopoly outcomes in each period. The price, quantity and profits of each firm in each period are:

\[
p^{R}_t = \left[ \frac{a}{3} \right]; \quad q^{R}_t = \left[ \frac{a}{3} \right]; \quad \pi^{R}_t = \left[ \frac{a}{3} \right]^2;
\]

where \(R\) denotes renting; \(t=1,2\).

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\(^7\) Here since our focus is on comparing between renting and selling, we assume that firms cannot mix renting with selling. In other words, either they opt for renting or selling.
Hence, sum of the two period profits for each firm is:  
\[ \pi_i^{RR} = 2 \left[ \frac{a}{3} \right]^2 ; \quad i=1, 2 \]

4.2 One Firm Rents and the Other Sells

The second period

Without loss of generality, suppose firm 1 sells and firm 2 rents in the first period. That means in the second period a group of consumers (those who bought) will not buy in the second period. Let firm 1 sold \( q_i^s \) units of the good in the first period. Thus, the residual demand faced by the firms in period two is \( p (Q) = a - q_i^s - Q \), where \( Q \) is the aggregate supply in period two. Hence each firm will maximize its profit given this demand in period two. This gives quantity, price and profits, respectively in the second period as

\[ q_2^s = q_2^r = \frac{a - q_1^s}{3} ; \quad p_2 = \frac{a - q_1^s}{3} ; \quad \text{and} \quad \pi_2^s = \pi_2^r = \frac{1}{9} \left[ a - q_1^s \right] ; \]

where \( S \) and \( R \) refers to seller and renter respectively.

The first period

Here we have to find the effective demand faced by the seller and the renter in period one. First notice that for both the seller and the renter to co-exist in the market, we must have: \( p_1^s = p_1^r + p_2 \). Otherwise, if \( p_1^s > p_1^r + p_2 \), then any consumer who plans to enjoy the good for two periods would only rent it in the first period and buy it in the second period instead buying the good in first period from the seller. Similarly, \( p_1^s < p_1^r + p_2 \), then the reverse will happen.

Now, to find the effective demand of the seller we have to identify the marginal consumer who is indifferent between enjoying the service of the good in both periods as oppose to second period only. More precisely, suppose the seller sells \( q_i^s \) units of the good and the renter rents \( q_i^r \) units of the good in the first period to the consumers with the highest reservation prices. Then, the marginal consumer (who is buying from the seller) with a reservation price \( \left[ a - q_i^s - q_i^r \right] \) will be indifferent between buying in the first period (gaining utility of \( 2 \left[ a - q_i^s - q_i^r \right] - p_i^s \)) and buying in the second period.

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8 We used the following convention in the notation. In the superscript of all the profit expressions \( \pi \), the first component denotes firm 1’s action, while the second component denotes firm 2’s action.
(gaining utility of \( [a - q_i^S - q_i^R] - p_2 \)) if and only if
\[
2(a - q_i^S - q_i^R) - p_i^S = (a - q_i^S - q_i^R) - p_2.
\]
Substituting the value of \( p_2 \) in the above equation, we get effective demand curve for the seller in period one, \( \text{viz}; \quad p_i^S = \left[ 4 \left( a - q_i^S \right) - q_i^R \right] \)

Substituting the value of \( p_i^S \) and \( p_2 \) in \( p_i^S = p_i^R + p_2 \), we get the effective demand of the renter in period one, \( \text{viz}; \quad p_i^R = (a - q_i^S - q_i^R) \)

Now the first order condition of maximizing the sum of the profits in period 1 and in period 2 each for the the renter and the seller gives us two equations with the first stage variables \( q_i^S \) and \( q_i^R \).

Solving these two equations we get, \( q_i^S = \left[ \frac{11a}{35} \right] \), \( q_i^R = \left[ \frac{12a}{35} \right] \); \( p_i^S = \left[ \frac{4a}{7} \right], \quad p_i^R = \left[ \frac{12a}{35} \right] \);

Hence, \( p_2 = \left[ \frac{8a}{35} \right] \) and \( q_i^{S,R} = \left[ \frac{8a}{35} \right] \).

We find that the price of the seller in the first period exceeds that of the renter which can be easily explained by the fact that the seller is selling the good for two period of consumption while the renter is allowing for one period of consumption only.

The total profit of the seller and the renter respectively are:
\[
\pi_i^{SR} = \left[ \frac{284}{1225} \right] a^2, \quad \pi_i^{SR} = \left[ \frac{208}{1225} \right] a^2
\]

Hence, we observe the following.

**Lemma 1**

*In a durable good market with a seller and a renter, the seller earns a higher profit than the renter.*

The intuition behind this is the following. In the second period, both the seller and the renter share the market equally and earn equal profits. So the only difference in the profits comes in the first period. In the first period, the seller charges a significantly

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9 We assume valuation for the good of the consumers does not change over time.
higher price than the renter since it sells the good for two-period of consumption as oppose to the renter, who rents the good only for one-period of consumption. The high price of the good enables the seller to earn higher revenue (even if it sells a lesser unit of goods compared to the renter) than the renter in the first period.

4.3 Both Firms Sell

When both the firms opt for selling in period one, then in period two the demand they face is restricted by their previous period sales. If \( q_1^1 \) and \( q_2^1 \) are the sales of each of the firms in period one, then the effective demand in period two is,

\[
p = \left[ \frac{a - q_1^1 - q_2^1}{3} \right] - q_2^1 - q_2^2.
\]

The profit maximising levels of quantity, price and profits for each firm in period 2 are:

\[
q_{i=1,2}^2 = \frac{a - q_1^1 - q_2^1}{3}; \quad p_2 = \frac{a - q_1^1 - q_2^1}{3}; \quad \pi_{i=1,2} = \frac{a - q_1^1 - q_2^1}{9}.
\]

We derive the effective demand curve for the sellers in period 1 from the indifference condition of the marginal consumer between her purchase in period 1 and period 2. This condition implies: \( 2(a - q_1^1 - q_2^1) - p_1^s = (a - q_1^1 - q_2^1) - p_2 \).

Substituting \( p_2 \) above we get the effective demand curve for each seller in period one, \( \text{viz}, \ p_1^s = \frac{4(a - q_1^1 - q_2^1)}{3} \).

As previously, from the first order condition of maximising the sum of period 1 and period 2 profits for each firm with respect to their respective quantity in period 1, we get two equations with the variables \( q_1^1 \) and \( q_2^1 \). Solving them simultaneously we get,

\[
q_1^1 = q_2^1 = \frac{5a}{16}; \quad p_1^s = \frac{a}{2}; \quad \pi_1^1 = \pi_1^2 = \left( \frac{5}{32} \right) a^2; \quad \text{and for the second period}
\]

\[
q_2^1 = q_2^2 = \frac{a}{8}; \quad p_2^s = \frac{a}{8}; \quad \pi_2^1 = \pi_2^2 = \left( \frac{a^2}{64} \right).
\]

Hence the sum of the two periods profit for each firm is:

\[
\pi_i^{ss} = \left( \frac{11}{64} \right) a^2, \quad i=1, 2
\]
4.4 The Extended Game

The following table summarizes the two period game.

<table>
<thead>
<tr>
<th>FIRM 1</th>
<th>RENTING</th>
<th>SELLING</th>
</tr>
</thead>
<tbody>
<tr>
<td>RENTING</td>
<td>$\pi_1^{RR} : \pi_2^{RR}$</td>
<td>$\pi_1^{RS} : \pi_2^{RS}$</td>
</tr>
<tr>
<td>SELLING</td>
<td>$\pi_1^{SR} : \pi_2^{SR}$</td>
<td>$\pi_1^{SS} : \pi_2^{SS}$</td>
</tr>
</tbody>
</table>

Now, it is easy to verify that $\pi_i^{SR} > \pi_i^{RR}$ and $\pi_i^{SS} > \pi_i^{RS}$, thus making selling a dominant strategy for firm 1. The same holds for firm 2 as well. Hence, $(\text{selling}, \text{selling})$ turns out to be the unique dominant strategy equilibrium of this two period game. Interestingly, it is also easy to verify that $\pi_i^{RR} > \pi_i^{SS}$; $i=1,2$. Thus, we arrive at a situation of prisoners dilemma.

**Proposition 2**

*In a duopoly durable good market where firms are allowed to rent or sell; $(\text{selling}, \text{selling})$ turns out to be the unique dominant strategy equilibrium. Moreover, since $(\text{renting}, \text{renting})$ payoff dominates $(\text{selling}, \text{selling})$, we arrive at a situation of prisoner’s dilemma.*

This is in sharp contrast with the existing results of a durable good monopolist (see proposition 1) where the monopolist will always find it profitable to rent rather than sell. Thus, a durable good monopolist who was renting its good will switch to selling when it faces a competition of a rival firm in the same market. So the important thing to notice here is the switch in optimal strategy of a durable good manufacturer under competition.
Thus, strategic interaction does play an important role in determining the optimal behaviour of a durable good producer.

5. Sequential Entry

In this section, we take up a sequential entry game in the same durable good market. Assume firm 1 is a durable good monopoly in the first period. In the second period, firm 1 (incumbent) faces a potential entrant, firm 2, who offers the same durable good. We assume that the entrant has the same cost structure as of the incumbent. Thus, these two firms are a priori symmetric. Now firm 1 has the option to accommodate or deter the entrant in period two. We will thus address the issue of entry accommodation and deterrence seperately. We are interested to see the strategic choice of the incumbent firm between renting and selling under the threat of entry. In other words, when the incumbent decides to accommodate (deter) the entrant what would be the profitable action in the first period (between renting and selling) that maximizes the sum of its two period profits. We will first consider the case of entry accommodation.

5.1 Entry Accommodation

In the second period, we will consider two cases seperately: (i) When the monopoly acts as a seller in the first period, and (ii) as a renter in the first period. Given the first period action in each of these cases we solve the second period game.

(i) Incumbent Seller

The demand curve faced by the incumbent and the entrant in period two is restricted by the amount of the previous period sales. First, we calculate the second period duopoly profits of the two firms on the restricted demand. As previously, the first period effective demand for the monopolist is generated from the indifference condition of the marginal consumer from her purchase in period one and two. Then we solve for the equilibrium value of the first period sales by maximising the sum of the first period and the second period profits. We get the equilibrium quantity, price and profits of the incumbent in period one as:

\[ q_i^s = \left[ \frac{5a}{11} \right]; \quad p_i^s = \left[ \frac{8a}{11} \right]; \quad \pi_i^s = \left[ \left( \frac{40}{121} \right) a^2 \right]; \quad \text{and in period two as:} \]

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\[ q_2^s = \left[\frac{2a}{11}\right]; \quad p_2^s = \left[\frac{2a}{11}\right]; \quad \pi_2^s = \left[\frac{2a^2}{11}\right]. \]

Thus the sum of two period profits for the incumbent seller under entry accommodation is:

\[ \pi^{SA} = \left[\left(\frac{4}{11}\right)a^2\right]. \]

(ii) Incumbent Renter

In the case of renting by the incumbent in the first period, the second period demand remains unaffected and thus in period two we have a usual duopoly situation with the original demand curve.

In this case the equilibrium quantity, price and profits of the incumbent in first period are:

\[ q_1^r = \left[\frac{a}{2}\right]; \quad p_1^r = \left[\frac{a}{2}\right]; \quad \pi_1^r = \left[\frac{a^2}{2}\right] \]

and in the second period are:

\[ q_2^r = \left[\frac{a}{3}\right]; \quad p_2^r = \left[\frac{a}{3}\right]; \quad \pi_2^r = \left[\frac{a^2}{3}\right]. \]

Hence the sum of two period profits for the incumbent renter under entry accommodation is:

\[ \pi^{RA} = \left[\left(\frac{13}{36}\right)a^2\right]. \]

A straightforward comparison between the above two cases (i) and (ii) yields the following result.

**Lemma 2**

*In a durable good market, an incumbent seller earns a higher profit than an incumbent renter when there is an entry.*

This implies when an incumbent firm anticipates entry in its durable good market, it will operate as a seller rather than a renter.
5.2 Entry Deterrence

Here we assume a fixed cost of entry $F > 0$ which has to be incurred by the entrant if it enters the market. As before, we will consider two cases namely, (i) monopoly seller and (ii) monopoly renter in the first period.

(i) Incumbent Seller

The equilibrium quantity, price and profits of the incumbent in period one are:

\[
q_i^s = \left[ \frac{a}{2} \right]; \quad p_i^s = \left[ \frac{a}{2} + 2\sqrt{F} \right]; \quad \pi_i^s = \frac{a}{2} \left[ \frac{a}{2} + 2\sqrt{F} \right]
\]

and in the second period the entry deterrent level of quantity, price and profits are:

\[
q_2^s = \left[ \frac{a}{2} - 2\sqrt{F} \right]; \quad p_2^s = 2\sqrt{F}; \quad \pi_2^s = 2\sqrt{F} \left[ \frac{a}{2} - 2\sqrt{F} \right].
\]

Hence, the sum of two period profits for the incumbent seller under entry deterrence is:

\[
\pi^{SD} = \left[ \frac{a^2}{4} + 2\sqrt{F} (a - 2\sqrt{F}) \right].
\]

(ii) Incumbent Renter

For the renting monopolist the equilibrium quantity, price and profit in period one are:

\[
q_i^r = \left[ \frac{a}{2} \right]; \quad p_i^r = \left[ \frac{a}{2} \right]; \quad \pi_i^r = \left[ \frac{a}{2} \right]^2 \quad \text{and}
\]

the entry deterrent level of quantity, price and profits in the second period are:

\[
p_2^r = 2\sqrt{F}; \quad q_2^r = [a - 2\sqrt{F}]; \quad \pi_2^r = 2\sqrt{F} [a - 2\sqrt{F}].
\]

Hence, the sum of two period profits for the incumbent renter under entry deterrence is:

\[
\pi^{RD} = \left[ \frac{a^2}{4} + 2\sqrt{F} (a - 2\sqrt{F}) \right].
\]

A straight forward comparison between the above two cases (i) and (ii) yeilds the following interesting result.

**Lemma 3**

In a durable good market, the entry deterring profit earned by an incumbent seller is same as that of an incumbent renter.
This implies the entry deterring profit of an incumbent firm in a durable good market is independent of its marketing action.

Table 2  
Profits of the Incumbent Firm under Entry Accommodation and Entry Deterrence

<table>
<thead>
<tr>
<th></th>
<th>Accommodation</th>
<th>Deterrence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Renting</td>
<td>$\pi^{RA}$</td>
<td>$\pi^{RD}$</td>
</tr>
<tr>
<td>Selling</td>
<td>$\pi^{SA}$</td>
<td>$\pi^{SD}$</td>
</tr>
</tbody>
</table>

We have just verified that $\pi^{SA} > \pi^{RA}$ and $\pi^{SD} = \pi^{RD}$, thus making selling a weakly dominant action for the incumbent firm.

Proposition 3  
*In a sequential entry game in a durable good market, selling is a (weakly) dominant action of the incumbent firm.*

*Proof:* Follows from Lemma 2 and 3.

Thus once again, we find that a monopolist who will operate as renter in a durable good market under no threat of entry will switch to selling under any possible threat of entry. (compare with Proposition 1)

Summary  
Thus, we can generally conclude that under any kind of strategic environment (be it a simultaneous oligopoly game or a sequential entry game) *selling* (as oppose to *renting*) turns out to be the dominant behaviour of the competing firm(s). This is in sharp contrast with the dominant behaviour of the firm under a monopolistic market structure where *renting* is the optimal behaviour.
6. Welfare Analysis and Policy Implications

6.1 Strategic Environment

Under this situation, in the simultaneous duopoly game, we find that \((\text{selling, selling})\) is the unique dominant strategy equilibrium and also in the case of sequential entry game the incumbent firm finds it profitable to sell rather than rent when it anticipates a new entrant in its future market. In other words, the market outcome of a strategic game for a durable good is dominated by selling. On the other hand, we also find that the social welfare (consumer surplus plus industry profit) of the society is strictly higher when the market outcome is characterized by renting. Thus, the market outcome under a strategic environment leads to a socially suboptimal outcome. Hence, there is a place for a policy intervention in an oligopolistic durable good market. Any policy, which encourages the firm to rent (as oppose to sell) its durable good, would be welfare improving. The intuition behind this is the following. In the simultaneous duopoly game, under a pure selling regime, because of the very high price of the good in the first period, many people postpone to buy it in the second period only (when the price falls), resulting a heavy loss in consumer surplus as well as a loss of revenue earned by the firms. On the other hand, under a pure renting regime, the price is uniform (across two periods) and lower (compared to the first period selling price under a pure selling regime), resulting a higher purchase for the good over the two periods. This in turn increases the total consumer surplus as well as the revenue of the competing firms, which leads to an overall improvement in society’s welfare. A similar intuition also holds for the case of sequential entry.

6.2 Monopoly versus Strategic Environment

In the pure monopoly case (section 3), it could be easily seen that the market outcome (renting) is socially sub-optimal since the welfare under a selling arrangement is higher. So any policy should give appropriate incentives to encourage the monopolist to sell in order to improve society’s overall welfare. This is again, in some contrast with the policy prescription under the strategic case, where a policy maker would like to advocate for a renting policy to the competing firms as we have just seen that under a (renting, renting) regime, overall social welfare is higher than a (selling, selling) regime. This shows that a
policy prescription could not only improve upon a market outcome from social point of view but also very much depends on the particular type market structure in a durable goods market.

7. Conclusion
In this analysis, we focused on the strategic effect and the resulting outcome in a durable good market with more than one firm. Our results sharply differ from the existing results that are obtained in a one-firm industry or under a monopolistic market structure. Given a choice between renting and selling a durable good monopolist will choose renting in order to maximize its profit; while under any kind of strategic environment (be it simultaneous or sequential), selling turned out to be the unique dominant behaviour of the competing firms operating in the same market. This helps us to establish the underlying strategic impact under a particular kind of market structure on the resulting outcomes in a durable goods market.

We also emphasize the fact that the results we obtained here are robust to time discounting. The reason for this is the following. If we allow discounting, the second period profits for the firms will be lower in both the cases of renting and selling. Moreover, in a selling arrangement the seller can recover more revenue from the first period only (by adjusting its first period sales) if the second period is heavily discounted, whereas under the same situation in a renting regime the renter is unable to do that due to the very nature of renting contract, thus making selling a even more profitable option for the firm.

As a future work to this analysis, we believe the following extension could be fruitful. Consider a three period model, where consumers live for two periods. First generation is born in period one and die at the end of period two and the second generation is born in period two and die at the end of period three. So there is an overlapping generation at period two with an old and new generation. Consider a perfectly durable good which lasts for two periods. One firm (say firm 1) sells or rents the durable good in period one and two; and ceases to exist after period two. A new firm (say firm 2) arrives in period two with the same product and stays till the end of time (i.e. period three) before it ceases to exist. Hence there is an overlap of firm 1 and firm 2 in period two. Under this structure, it
would be interesting to see the equilibrium market outcomes. This analysis would not only capture the type of strategic interaction between the firms but also capture the impact of overlapping generation, which would significantly change the market demand in each period. A study in this direction has been done by Fishman, Gandal and Shy (1993) in a competitive environment. A similar analysis under an oligopolistic market would also be interesting.

References


