The Coase Problem: A Transformation of the Usual Utility Function *

Paulo Maçãs **

Abstract

Given that demand for durable goods is not constant over time, we propose in this article a transformation of the utility function, which accounts for discrete time and for the effect of different levels of income in the utility of buying. With this, the original Coase paradox will collapse. The smaller the difference of the reservation prices between high income level and low income level consumers, the higher the probability of marginal cost pricing in the present.

Keywords: Utility Function, disutility, durable goods, monopoly.

JEL: D11, D42, D91.

1. Introduction

Coase (1972) verifies that even in case of monopoly, the price of the durable goods tends for the marginal cost, considering the time as a continuous variable. This result depends on instantaneous adjustments in the price, as the monopolist firm may be forced to set a marginal cost pricing in the present.

Considering the time as a discrete variable, without positive network externalities, without alterations of the economic conjuncture and without innovations of the product, the price of the durable goods can decrease for two fundamental reasons: 1) the consumers of larger income level are the first ones to buy the durable goods, being the residual demand composed by consumers of smaller income level and consequently with a smaller reservation price; and 2) the consumers expect a future price fall and postpone the decision of buying.

Considering the time as a discreet variable, the consumers of larger income level cannot be willing to wait a long time for acquiring the durable good, in spite of the possible future price falls. Then, when the demand vector is composed by consumers of high income level, the prices can be at a higher level, when compared with the prices charged when the demand vector is composed by consumers of smaller income level and consequently with smaller reservation prices.

2. The utility function

Several authors, such as Gul (1987), Ausubel and Deneckere (1989), Sobel (1991), Waldman (1996), Denicolò and Garella (1999) and Mason (2000), define the utility as being the difference between the consumers' reservation price and the market price, discounted by a factor that is usually equalized to the real interest rate. Then, the utility is given by:

$$UT_t = (V_t - P_t)d^t \qquad (1)$$

in which $d = \frac{1}{1+r}$, and r is the real interest rate. Most of the authors consider the interest tax as constant.

Considering this utility function, consumer's income level does not have any influence on the time they are willing to wait for the purchase of the durable good.

Considering that the level of consumer's income is a quite important variable in their decision of purchase in the present or in the future, we introduce a modified concept of the disutility for not buying the good in the present.

The proposed disutility will be dependent on the interest rate and on the consumer's available income. The higher is the consumer's available income, the higher will be the possibility to buy the durable good in the present. As the residual demand become of lower income level, the possibility of postponing the purchase of the durable good to the future is higher.

Besides the level of the consumer's income in the demand vector, the urgency in buying certain durable goods, as for example a freezer, also have a positive effect in the consumer's disutility of not buying in the present. Then the possibility of buying in the future increases.

For these reasons, the disutility for not buying durable goods in a certain moment is given for

$$r_t = r_{0t} + r_{1t} Y_t + r_t \qquad (2)$$

in which,

r_0 is the disutility related with the characteristics of the durable good. This will be possibly larger in the case of a freezer than in the case of a car,

r_1 is the consumer marginal disutility for each unit of increment of the available income,

r_t is the total disutility for not buying the durable good in time t,

Y_t is the consumers available income in time t,

r_t is the interest rate in time t.

Then, the new function is given by,

$$UT_t = (V_t - P_t) \sum_{z=0}^{n} (1 + r_{z-1})^{-1} \qquad (3)$$

with r_{-1} =0.

The utility in the present is,

$$UT_0 = (V_0 - P_0). \qquad (4)$$

The utility`s in the future moments are:

$$UT_1 = (V_1 - P_1)(1 + r_0)^{-1}, \quad (5)$$

$$UT_2 = (V_2 - P_2)(1 + r_0)^{-1}(1 + r_1)^{-1}, \quad (6)$$

$$UT_3 = (V_3 - P_3)(1 + r_0)^{-1}(1 + r_1)^{-1}(1 + r_2)^{-1}, \quad (7)$$

…

$$UT_t = (V_t - P_t)(1 + r_0)^{-1}(1 + r_1)^{-1}(1 + r_2)^{-1}....(1 + r_{t-1})^{-1}. \quad (8)$$

3. Application of the new Utility Function

Let us consider the existence of two moments, the present (0) and the future (1), in which the monopolist stops selling the durable good.

We admit that changes in the economic conjuncture, positive network externalities, and innovation of the product do not exist, in such a way that reservation prices do not change over time. Then, $V_0=V_1=V_2=V_3=\ldots=V_n=V$.

For simplification, we considered constant and zero marginal costs, as Bulow (1982), Gul (1987) and Denicolò and Garella (1999).

Lema 1: If the consumers expect a future fall in the price of the durable goods, then, the higher is the disutility of not buying a given durable good in the present and the higher the possibility of buying the good at the present.

Proof:

The consumer buys the durable good in the present if

$$UT_0 \geq UT_1, \quad (9)$$

Simplifying the terms,

$$V \geq P_0 + \frac{P_0 - P_1}{r_0}, \quad (10)$$

if the consumers expect a price fall, given r_0, $\frac{P_0 - P_1}{r_0}$ will be positive and then, the probability of buy in the present increases.

Let us suppose that a monopolist and two consumers exist: one of high income level (*h*), and another of smaller income level (*l*). The consumer *h*, of larger income level has a reservation price V_h in the two moments, and a disutility for not buying the durable good in the present, which is r_{0h}. The consumer of smaller income level (*l*) has a reservation price V_l in the two moments and a disutility for not buying the durable good

in the present is r_{0l}. Then, $V_h > Vl$ and $r_{0h} > r_{0l}$. For normalization proposes, each consumer only buys a unit of the good.

The monopolist has two units to sell and three different optimal pricing choices: 1) to set the price V_h in the present, selling a unit of the durable good to the consumer of high income level, and the other in the future; 2) to set the price V_l in the actual moment, buying the two consumers the durable good in the present; and 3) to charge a price so that the consumer of larger income level buys the durable good in the present, setting V_l in the future, so that the consumer of smaller income level buys the durable good.

Let us admit that, in equality of the intertemporal profits, the monopolist prefers to sell more units of the durable good and that she prefers to sell in the present than to sell in the future.

Then, if

$$V_h > V_l(1+d(1+r_0)), \tag{11}$$

$$V_h > 2V_l, \tag{12}$$

the monopolist charges

$$P_0 = V_h. \tag{13}$$

If

$$V_l((1-d)+r_h(2-d)) \geq V_h r_{0h}, \tag{14}$$

$$V_h \leq 2V_l, \tag{15}$$

the monopolist charges

$$P_0 = V_l. \tag{16}$$

Finally, if

$$V_h \leq V_l(1+d(1+r_{0h})), \tag{17}$$

$$V_l((1-d)+r_{0h}(2-d)) < V_h r_{0h}, \tag{18}$$

the monopolist charges

$$P_0 = \frac{V_h r_{0h} + V_l}{1+r_{0h}}, \tag{19}$$

$$P_1 = V_l. \tag{20}$$

Lema 2: If the monopolist proceeds a Intertemporal discrimination of prices, then, the higher is the disutility, the higher will be the price in the present, and slower will be the tendency to a marginal cost pricing.

Proof:

Solving (19) in order to the disutility for not buying the durable good in the actual moment, it comes

$$\frac{\partial P_0}{\partial r_{0h}} = \frac{V_h(1+r_{0h}) - (V_h r_{0h} + V_l)}{(1+r_{0h})^2}, \tag{21}$$

then,

$$\frac{\partial P_0}{\partial r_{0h}} = \frac{V_h - V_l}{(1+r_{0h})^2}. \tag{22}$$

As $V_h > V_l$, $\frac{\partial P_0}{\partial r_{0h}} > 0$. Then, with a residual demand of small income level, the disutility will be high and the tendency to set prices close to marginal cost in the present will be higher.

In the case of a very low income demand, the disutility for not buying the durable good in the present can approach zero, and (19) will be transformed in $P_0 = V_l$, then the monopolist will sell two units of the durable good in the present and will not discriminate prices.

4. Conclusion

The introduction of a new disutility concept for not buying durable goods in the present in a discreet time environment allows for another reason to a collapse of the original Coase paradox. It also allows for a relationship between pricing schemes and income distribution in demand.

As consumers of high income level are the first ones to buy the durable goods and have high disutility because they are not very willing to wait for the acquisition of the durable goods, the monopolist can practice higher prices. As the residual demand is composed by consumers of smaller income level, with smaller disutility (because they give more importance to the expected future prices fall), the monopolist will have to decrease prices in the present, and to get faster to a marginal cost pricing.

---

* This article is part of my Ph.D. dissertation in the Business and Economics Department of Universidade da Beira Interior, Covilhã, Portugal.

** I grateful acknowledge António Mendonça (ISEG), Ricardo Chaves Lima (UFR), Carlos Osório (UBI) and Tiago Sequeira (UNL and UBI) for their helpful comments on previous versions of this article. E-mail: pnunes@alpha2.ubi.pt; phone +351275319619.

References

Ausubel L., Deneckere, R. (1987). One is Almost enough for Monopoly. Rand Journal of Economics, 18, 255-274.

Bulow, J. (1982). Durable Goods Monopolists. Journal of Political Economy, 90, 314--332.

Coase, R. (1972). Durability and Monopoly. Journal of Law and Economics, 15, 143—149.

Denicolò, V., Garella, P. (1999). Rationing in a Durable Goods Monopoly. Rand Journal of Economics, 26, 331-342.

Gul, F. (1987). Noncooperativ e collusion in Durable Goods Oligopoly. Journal of Economics, 18, 248-254.

Maçãs, P. (2002) Demand for Durable Goods Monopoly. Phd Thesis in Economics, UBI, Portugal.

Mason, R. (2000). Network Externalities and the Coase Conjecture. European Economic Review, 44, 181-192.

Sobel, J. (1991). Durable Goods Monopoly with entry of new consumers. Econometrica, 59, 1455-1485.

Waldman, M. (1996). Planned Obsolescence and the R&D decision. Rand Journal of Economics, 27, 583-595.