

# Econ 476: Industrial Organization

## *Quality*

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Lecture 10

- ▶ What does quality even mean??
- ▶ <https://www.thebump.com/a/top-10-car-seats>

# Income and Quality

- ▶ Consider 2 firms producing a product that is only differentiated by “quality:” quality level  $k = H$  and quality level  $k = L$  where  $H > L > 0$ .
- ▶ There are 2 consumers ( $i = 1, 2$ ). Consumer 1 is the high-income consumer ( $I_1$ ) and consumer 2 is the low-income consumer ( $I_2$ ) such that  $I_1 > I_2 > 0$ .
- ▶ Each consumer only buys one unit and utility is given by

$$U_i \equiv \begin{cases} H(I_i - p_H) & \text{if he buys the high-quality brand} \\ L(I_i - p_L) & \text{if he buys the low-quality brand} \end{cases}$$

Proposition:

1. If the low-income consumer buys the high-quality brand, then the high-income consumer definitely buys the high-quality brand.
2. If the high-income consumer buys the low-quality brand, then the low-income consumer definitely buys the low-quality brand.

# Income and Quality

- ▶ Let's prove part 1!
- ▶ We want to show that  $U_1(H) > U_1(L)$ 
  - ▶ i.e. the high-income consumer prefers the high-quality brand to the low-quality brand

# Income and Quality

- ▶ prove part 2 in the homework(!)

# Durability

- ▶ Why produce a durable good instead of a disposable good?
- ▶ What might be some of the incentives to durable good producers?
- ▶ Does durability depend on market structure (i.e. monopoly, Cournot, etc.)?
  - ▶ Let's build a model!

# Durability

- ▶ Assume there is one consumer who lives for 2 periods. In each period the consumer values light services and is willing to pay  $\$V$  per period where  $V > 0$ .
- ▶ There are two types of light bulbs: a short-durability light bulb that lasts one period and a long-durability light bulb that lasts two periods. Assume the unit cost to produce light bulbs is  $c^S$  and  $c^L$  for the short-durability and long-durability light bulbs, respectively. Also assume that  $0 < c^S < V$ ,  $0 < c^L < 2V$ , and that  $c^S < c^L$ .



# Durability - monopoly

- ▶ Under what conditions would the monopolist produce the long-durability light bulbs?

# Durability - monopoly

Results:

- ▶  $p^S = V$
- ▶  $\pi^S = 2(V - c^S)$
- ▶  $\pi^L = 2V - c^L$
- ▶ produce long-durability bulbs if  $2c^S > c^L$

# Durability - competitive

- ▶ How do the results change if a perfectly competitive market produce light bulbs?
- ▶ Let's look at this through the consumer's viewpoint.

# Durability - competitive

Results:

- ▶  $p^S = c^S$  and  $p^L = c^L$
- ▶  $U^S = 2(V - p^S)$
- ▶  $U^L = 2V - p^L$
- ▶ produce long-durability bulbs if  $2p^S > p^L$

# Innovation - durability

- ▶ <http://www.bbc.com/future/story/20160612-heres-the-truth-about-the-planned-obsolence-of>
- ▶ <http://www.nytimes.com/2013/11/03/magazine/why-apple-wants-to-bust-your-iphone.html>

# Innovation - durability

- ▶ Is the iPhone too durable?
- ▶ How durable would a social planner make the iPhone?

Consider a 2 period model:

- ▶ In  $t = 1$ , there is only one consumer who seeks a computer for the two periods of his/her life. In period  $t = 2$ , one additional consumer enters the market seeking a computer.
- ▶ Let  $V$  be the per period gain from the quality of the technology embedded into the computer and let per period utility be defined by

$$U_t \equiv \begin{cases} V_t - p_t & \text{if purchasing the period } t \text{ technology product} \\ 0 & \text{if not purchasing} \end{cases}$$

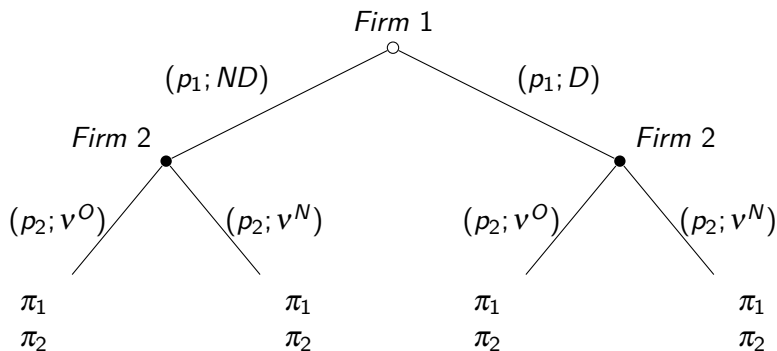
# Innovation - firms

There are 2 firms:

- ▶ Firm 1 only operates in the first period and is endowed with an old technology that provides a per period quality level of  $v^O$  to consumers.
- ▶ Firm 2 may enter in period 2 and can produce the old technology computer ( $v^O$ ), or upgrade the computer to a new technology level of  $v^N$  for an innovation cost of  $I > 0$ , where  $v^N > v^O$ .
- ▶ Assume that production cost is independent of the technology level but only depends on the durability of the computer. A durable computer lasts for 2 periods and a nondurable good lasts for 1 period. Let the production cost of the durable and nondurable good be  $c^D$  and  $c^{ND}$ , respectively, where  $c^D > c^{ND}$ . Assume that  $c^{ND} = 0$  for simplicity.

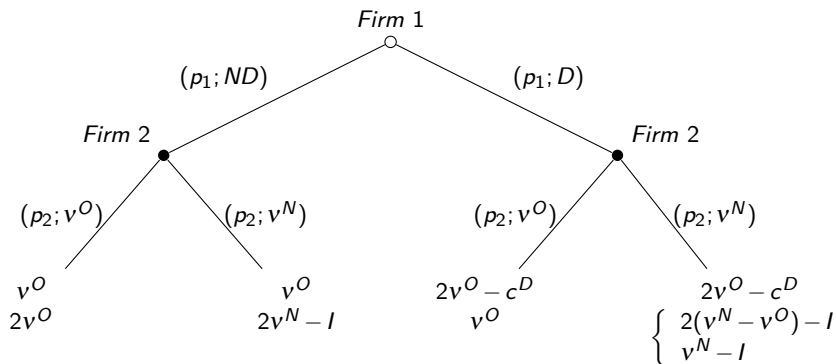


# Innovation - the game



Let's solve for the profits of each firm (outcomes).

# Innovation - results



- ▶ Under what conditions would Firm 1 choose the durable good?
- ▶ Assume that Firm 1 produced a durable good. Under what conditions would Firm 2 set its price such that only the new consumer would purchase the computer with the new technology (the old consumer would not upgrade)?

# Warranties

Consider a microwave whose value to a consumer is  $V$  if the microwave works and 0 if the microwave is defective, where  $V > 0$ . Suppose that it is commonly known that microwaves have a probability  $\rho$  of being functional, where  $0 < \rho < 1$ . The firm producing the microwaves have 2 options: sell microwaves with a full replacement warranty (i.e. keep replacing until functional microwave is delivered), or sell microwaves without a warranty. Let  $p$  be the price and  $c > 0$  denote the unit production cost of each microwave. The utility to the consumer is

$$U \equiv \begin{cases} V - p & \text{purchase with a full replacement warranty} \\ \rho V - p & \text{purchase without any warranty} \\ 0 & \text{does not purchase} \end{cases}$$

# Warranties

- ▶ What is the profit function of the firm (monopoly) if no warranty is offered?
- ▶ What is the profit function of the firm (monopoly) if a full replacement warranty is offered?

# Warranties

▶ Remember that  $1 + \delta + \delta^2 + \dots = \sum_{t=0}^{\infty} \delta^t = \frac{1}{1-\delta}$

▶ Similarly,

$$c + c(1-\rho) + c(1-\rho)^2 + \dots = \sum_{t=0}^{\infty} c(1-\rho)^t = \frac{c}{1-(1-\rho)} = \frac{c}{\rho}$$

# Warranties - results

- ▶  $\pi^{NW} = \rho V - c$
- ▶  $\pi^W = V - \frac{c}{\rho}$
- ▶ Under what condition would the monopolist offer a full replacement warranty?