0.1 Bundling

a form of price discrimination that works when a company sells multiple different "kinds" of things.

Willingness to Pay	Shirt	Pants	Both
Consumer 1	50	30	80
Consumer 2	10	80	90

Suppose you sell pants and shirts separately:

What is the ideal price for shirts?

If they **price at $10**, both people buy and the **profit is $20.**

If they **price at $50**, consumer 1 buys and **profit is $50.**

What is the ideal price for pants?

If they **price at $30,** both people buy and the **profit is $60**

If they **price at $80,** consumer 2 buys and the **profit is $80**

The total profit: $50+$80=$130.

What if we don't sell the separately, just a bundle (outfit):

If they price it at $80, both buy and the **profit is $160.**

If they price it at $90, consumer 2 buys and the **profit is $90.**

Notice, they can earn $30 more by forcing the consumer to buy a bundle (outfit).

0.2 Two-Part Tariff

A form of price discriminati that works when consumers are willing buy multiple units of something.

Coffee shop.

Marginal cost is 0 so that for each consumer, $c(y) = 0$.

Demand of cups of coffee in a month for each consumer: $y = 10 - p$.

Let's focus on the profit per consumer:

Inverse demand: $p = 10 - y$

$$\pi(y) = y(10 - y)$$

Maxmize this function to find the optimal number of cups to try and sell each consumer during a month:

$$\frac{\partial (y(10-y))}{\partial y} = \frac{\partial \left(10y - y^2\right)}{\partial y} = 10 - 2y$$

Profit is maximized where this is zero:

$$10 - 2y = 0$$

$$y = 5$$

How much should they charge. Plug this into the inverse demand:

$$p = 10 - 5 = 5$$

$$\pi(5) = 5 * 5 = 25$$

The optimal two-part tarrif here is to charge $0 for coffee (the shop's marginal cost) this creates $50 of consumer surplus, which you extract by charging a up-front fee of $50 for the right to get $0 coffee.

Theme park tickets, AMC movie mebership, Costco,

1 Cournot Oligopoly

This a model where we can study market power.

I am going to move from using y to represent quantity to using q.

With a monopolist it is clear how price is affected by quantity: $p(q)$ the inverse demand.

$$\pi(q) = qp(q) - c(q)$$

What about if there are multiple firms?

N firms named $\{1, 2, 3, ..., N\}$

q_i firm i's quantity.

Market quantity $Q = q_1 + q_2 + ... + q_N$

$N = 2$, $q_1 = 10, q_2 = 10$

Then $Q = 20$

What is firm i's profit?

$$\pi_i(q_i, Q) = q_i p(Q) - c(q_i)$$

1.1 Example with Two Firms

Suppose we have $N = 2$, the firms are $\{1, 2\}$

The cost function for each firm is $c(q_i) = 10q_i$

$Q = q_1 + q_2$

Inverse demand: $p(Q) = 100 - Q$

The profit function of firm 1:

$$\pi_1(q_1, q_2) = q_1(100 - (q_1 + q_2)) - 10q_1$$

$$\pi_2(q_2, q_1) = q_2(100 - (q_1 + q_2)) - 10q_2$$

1.2 Best Responses

A firm's **best response** is the optimal choice q_i given the choice of the other firms.

Firm 1's best response to $q_2 = 50$

$$\pi_1(q_1, 50) = q_1(100 - (q_1 + 50)) - 10q_1$$

$$= 100q_1 - q_1^2 - 50q_1 - 10q_1$$

$$= 40q_1 - q_1^2$$

Where is the marginal profit zero?

$$\frac{\partial\left(40q_1 - q_1^2\right)}{\partial q_1} = 40 - 2q_1$$

$$40 - 2q_1 = 0$$

$$q_1 = 20$$

Firm 1's best response to $q_2 = 50$ is $q_1 = 20$

Firm 1's best response to $q_2 = 10$

$$\pi_1 (q_1, 10) = q_1 (100 - (q_1 + 10)) - 10q_1$$

$$q_1 = 40$$

Firm 1's best response to $q_2 = 10$ is $q_1 = 40$.

1.3 What is a game:

Players,

Strategies (actions),

Payoffs (that depend on the strategies of all players).

1.3.1 Nash Equilibrium

Nash equilibrium requires that all strategies are mututal best respones.

Let's look at $q_1 = 20$,$q_2 = 50$

q_1 is a best response to $q_2 = 50$

Is $q_2 = 50$ a best response to $q_1 = 20$?

$$\{\{q_2 \to 35\}\}$$

Here, 50 was not a best resonse to 20. It is **not a nash equilibrium**

In fact, the only Nash equilibrium of this game is:

$$q_1 = 30, q_2 = 30$$