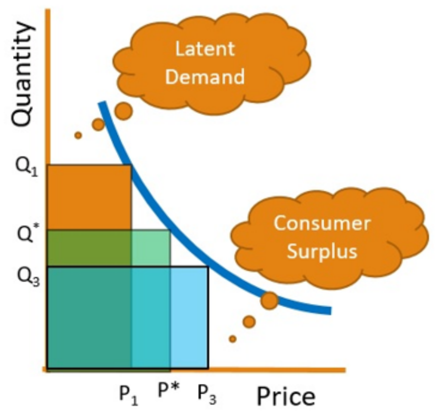
W4 Formulae

Sunday, 13 November 2022 15:16

Basic economics



Demand Response Curve

A function that describes how demand $D(p)$ of a product varies as a function of its price (p).

- **Latent Demand:** By reducing the price, we can capture more demand.
- **Consumer Surplus:** when the price that consumers pay for a product or service is less than the price they're willing to pay.
- As P↑ ⇒ Q↓
- 4 properties:
  1. Non-negative
  2. Continuous
  3. Differentiable
  4. Downward sloping

2 ways to decided optimal price:

1. Revenue Maximizing Price
2. Profit maximizing Price

2 ways to calculate Price Sensitivity:

1. Slope
2. Elasticity

Slope $= \frac{change\ in\ demand}{change\ in\ price}$

- ∂ is always negative.

$$\boldsymbol{\partial} = \frac{D(p_2) - D(p_1)}{p_2 - p_1}$$

Demand elasticity,

$$\varepsilon = \frac{\%\ change\ in\ demand}{\%\ change\ in\ price}$$

$$\varepsilon = \left| \frac{\frac{D(p_2) - D(p_1)}{D(p_1)}}{\frac{p_2 - p_1}{p_1}} \right|$$

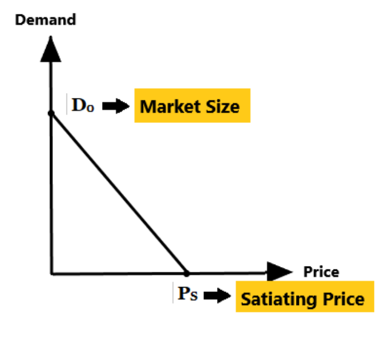
Elasticity:

- If **<u>high</u>**, means, **<u>alternatives are available</u>**.
- If **<u>low</u>**, means, there is an **<u>urgency and no alternative</u>**.

- Short term: in the short term period
- Long term: in the long term period

<u>Linear Response Curve</u>

$$\mathbf{D\,(p) = D\,(0) - m\,.\,p}$$



$\mathbf{D\,(0)}$: **Market Size** → Demand at price $= 0$

$P_S = \frac{\mathbf{D(0)}}{\mathbf{m}}$: **Satiating Price** ⟶ Price at which demand $= 0$

Elasticity of this curve

$$\boldsymbol{\varepsilon} = \frac{\mathbf{m.\,p}}{\mathbf{D(p)}} = \frac{\mathbf{m.\,p}}{\mathbf{D\,(0) - m\,.\,p}}$$

- $\varepsilon = 0$ when $p = 0$
- As $p \longrightarrow P_S,\ \varepsilon \longrightarrow \infty$

Constant Elasticity Curve

$$\mathbf{D}(\mathbf{p}) = \mathbf{D}(\mathbf{1})\ \boldsymbol{p}^{-\varepsilon}$$

Revenue

$$\mathbf{R} = \mathbf{p} \times \mathbf{D}\left(\mathbf{p}\right) = \mathbf{D}(\mathbf{1})\ \boldsymbol{p}^{(\mathbf{1}-\varepsilon)}$$

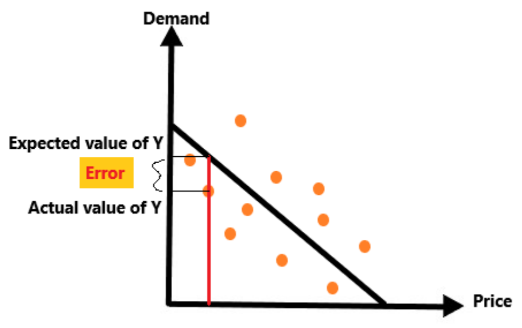
- As $p \longrightarrow 0,\ D \longrightarrow \infty$
- $D \neq 0$ for any p

- To increase revenue for products with
  - Inelastic demand: Increase the price
  - Elastic demand: Set the price close to zero
    - Huge demand ⇒ Increased revenue

Simple Linear Regression Model

The equation of SRM describes how the conditional mean of Y depends on X.

$$\mu_{Y|X} = E(Y \mid X = x) = \beta_0 + \beta_1 x$$



- Regression line is also called Mean Squared Error line.
- $E(\epsilon) = 0$
- We makes 3 assumptions about the error term:
  1. Independent
  2. Equal variance, $Var(\epsilon) = \sigma_\epsilon^2$
  3. Normal. $\epsilon \sim \mathcal{N}(0, \sigma_\epsilon^2)$

- Observed values of Y are linearly related to the explanatory variable X:

$$\boldsymbol{y} = \boldsymbol{\beta_0} + \boldsymbol{\beta_1 x} + \boldsymbol{\epsilon},$$

where, $\boldsymbol{\epsilon} \sim \boldsymbol{\mathcal{N}}(\mathbf{0}, \boldsymbol{\sigma_\epsilon^2})$