5.7.3 Elasticity

If $y = f(x)$

$$\epsilon_x = \frac{\Delta y * 100}{y} / \frac{\Delta x * 100}{x}$$

$$= \frac{\Delta y}{\Delta x} * \frac{x}{y}$$

Demand elasticity:

$$Q_d = f(P)$$

$$\epsilon_d = \frac{\Delta Qd}{\Delta P} * \frac{P}{Qd}$$

$$\epsilon_d = \frac{dQd}{dP} * \frac{P}{Qd} \quad \rightarrow \quad \text{point elasticity}$$

Supply elasticity:

$$Q_s = f(P)$$

$$\epsilon_s = \frac{\Delta Qs}{\Delta P} * \frac{P}{Qs}$$

$$\epsilon_s = \frac{dQs}{dP} * \frac{P}{Qs}$$

Cross price elasticity:

$$Q_{dx} = f(P_y)$$

$$\epsilon_z = \frac{\Delta Qdx}{\Delta Py} * \frac{Py}{Qdx}$$

$$\epsilon_s = \frac{dQdx}{dPy} * \frac{Py}{Qdx}$$

If $\epsilon_z > 0 \rightarrow$ X and Y are substitute goods.

If $\epsilon_z < 0 \rightarrow$ X and Y are complementary goods.

Income elasticity:

$$Q_d = f(Y)$$

Y is consumer's income.

$$\epsilon_y = \frac{\triangle Qd}{\triangle Y} * \frac{Y}{Qd}$$

If $\epsilon_y \leq 0$ → X is an inferior goods.

If $\epsilon_y > 0$ → X is a normal goods.

If $\epsilon_y > 1$ → X is a luxury goods.

If $0 < \epsilon_y \leq 1$ → X is a necessity goods.

Output elasticity:

$$TP = f(L)$$

$$\epsilon_L = f'(L) * \frac{L}{f(L)} = MP_L/AP_L$$

5.7.4 Total Revenue (TR) and Marginal Revenue (MR)

$$TR = P * Q$$

$$AR = \frac{TR}{Q}$$

$$MR = \frac{dTR}{dQ}$$

AR & MR:

$$TR = P*Q = f(Q)*Q$$

$$\frac{dTR}{dQ} = MR = AR + Q\frac{dP}{dQ}$$

$$MR = AR\left(1 + \frac{1}{\epsilon d}\right)$$

If $|\epsilon d| > 1$ (elastic) → MR > 0

If $|\epsilon d| < 1$ (inelastic) → MR < 0

If $|\epsilon d| = 1$ (unitary) → MR = 0

$$\epsilon_d = \frac{AR}{MR - AR}$$

$$|\epsilon d| = \frac{AR}{AR-MR}$$

If MR < 0, $\frac{AR}{AR-MR} < 1$ → inelasticity

MR > 0, $\frac{AR}{AR-MR} > 1$ → elasticity

MR = 0, $\frac{AR}{AR} = 1$ → unitary

5.7.5 Total Product (TP), Average Product (AP) and Marginal Product (MP)

S-R production function: Q = g(L)

Total revenue: TR = f(Q)*Q

Marginal revenue product: MRP = $\frac{dTR}{dL}$

= MP*MR

Perfectly competitive market: MRP = MP*P

= VMP

5.7.6 Total Cost (TC) and Marginal Cost (MC)

VC = f(Q)

MC = $\frac{dVC}{dQ}$ = f'(Q)

TC = FC + VC

= a + f(Q)

$$\frac{dTC}{dQ} = \frac{dVC}{dQ}$$

From Q = g(L)

TC = f(Q) = f(g(L))

$$\frac{dTC}{dL} = f'(Q)*g'(L)$$

Factor market: Perfectly competitive market

$$VC = wL$$

$$\frac{dVC}{dL} = w$$

$$w = f'(Q)\, g'(L)$$

$$= MC*MP$$

$$MC = \frac{w}{MP}$$

Factor market: Imperfectly competitive market

$$\frac{dVC}{dL} = w\frac{dL}{dL} + L\frac{dw}{dL}$$

$$= w\left(1 + \frac{L}{w}\frac{dw}{dL}\right)$$

$$= w\left(1 + \frac{1}{\epsilon}\right)$$

$$= MFC$$

$$w\left(1 + \frac{1}{\epsilon}\right) = f'(Q)\, g'(Q)$$

$$= MC*MP$$

$$MC = \frac{MFC}{MP}$$

5.7.7 Macroeconomic variables

Consumption function: $C = f(Y)$

$$\frac{dC}{dY} = f'(Y) = MPC$$

Import function: $M = m_0 + m_1 Y$

$$\frac{dM}{dY} = m_1$$