1//

a) Endogenous variable $= P_x, Q^d, Q^s$

Exogenous variable $= P_y$

b) Equation 1 $=$ $P_x = 8 - bQ_x^d + CP_y$

Equation 2 $=$ $P_x = 20 + dQ_x^s$

Equation 1 = Equation 2

$$8 - bQ_x^d + CP_y = 20 + dQ_x^s$$

$$P_y = \frac{12 + dQ_x^s + bQ_x^d}{C}$$

$\therefore$ $C > 0$ is the restriction we need for the market equilibrium to exist.

c) $Q^*_x = Q_x^d = Q_x^s$

Equa 1 = Equa 2

$$8 - bQ^*_x + CP_y = 20 + dQ^*_x$$

$$-12 + CP_y = dQ_x^* + bQ_x^*$$

$$-12 + CP_y = Q_x^*(d+b)$$

$$Q_x^* = \frac{-12 - CP_y}{(d+b)}$$

Put value of Q_x^* in equation 2

$$P_x^* = 20 + d\left(\frac{-12 + CP_y}{d+b}\right)$$

$$P_x^* = \frac{20b + 8d + CdP_y}{d+b}$$

d) Magnitude $\Rightarrow$ $Q_x^* = \frac{-12 + CP_y}{(d+b)}$

$$\frac{\partial Q_x^*}{\partial P_y} = \frac{C}{d+b}$$

② a) $P = 10 + k_1 P_x + k_2 P_y - Q_j^d$

$Q_j^d = 10\ k_1 P_x + k_2 y - P$

$\dfrac{dQ_j^d}{dP_x} = k_1$

$\therefore\ k_1 > 0 \Rightarrow$ substitute product

b) $Q_{market} = 10Q$

$= 10(10 + k_1 P_x + k_2 y - P)$

c) $P = 5 + k_3 W + Q_1^s \Rightarrow Q_1^s = P - 5 - k_3 W$

$P = 20 + k_4 T + 2Q_2^s \Rightarrow Q_2^s = 0.5P - 0.5k_4 T - 10$

Market supply $= Q_1^s + Q_2^s$

$= (P - 5 - k_3 W) + (0.5P + 0.5k_4 T - 10)$

$Q_m^s = 1.5P - 15 - k_3 W - 0.5 k_4 T$

d) $Q^d = \begin{cases} 10(10 + k_1 P_x + k_2 Y - P) & , P < 10 + k_1 P_x + k_2 Y \\ 0 & , P \geq 10 + k_1 P_x + k_2 Y \end{cases}$

$Q^S = \begin{cases} 0 + 0 & , 0 \leq P \leq (20 + k_4 T) \\ \dfrac{P - (20 + k_4 T)}{2} & , (20 + k_4 T) < P \leq (5 + k_3 W) \\ Q_1^S + Q_2^S & , P > (5 + k_3 W) \end{cases}$

∴ Condition

Price is greater than $(20 + k_4 T)$

or

Price is less than and equal to $(5 + k_3 W)$

e) $Q_D = Q_S$

$10(10 + k_1 P_x + k_2 y - P) = 1.5P - 15 - k_3 W - 0.5 k_4 T - 10$

$100 + 10(2)(10) + 10(2)(5) - P = 1.5P - 15 - 3(10) - 0.5(5) - 10$

$400 - P = 1.5P - 57.5$

$2.5P = 457.5$

$P = 183$

$Q = 217$ #

f) $Q^D = 400 - P$	$Q_D = Q_S$
$Q^S = 1.5P - 57.5$	$395 - P = 1.5P - 57.5$
from Demand	$2.5P = 425.5$
$Q = 400 - P$	$P = 181$
$P = 400 - Q - 5$	$Q = 219$
$P = 395 - Q$	consumer's benefit $= 183 - 181 = 2$ per unit
$Q = 395 - P$	Producer's benefit $= 5 - 2 = 3$ per unit

3.

a) $Y = C + I + G + (X - M)$

$Y = (0.3Y_d - K_1 r) + (0.5Y - K_2 r) + G_0$

$Y = [0.3(Y - T) - K_1 r] + (0.5Y - k_2 r) + G_0$

$Y = 0.3Y - 0.3T_0 - k_1 r + 0.5Y - k_2 r + G_0$

$Y - 0.3Y - 0.5Y = 0.3T_0 - k_1 r - K_2 r + G_0$

$0.2Y = 0.3T_0 - k_1 r - K_2 r + G_0$

$Y = \frac{3}{2}T_0 - 5K_1 r - 5K_2 r + 5G_0$

$Y + (5k_1 + 5k_2)r = \frac{3}{2}T_0 + 5G_0$ —— 1

$M^d = M^s$

$K_3 Y - k_4 r = M_0$ —— 2

$$\begin{bmatrix} 1 & 5K_1 + 5K_2 \\ K_3 & K_4 \end{bmatrix} \begin{bmatrix} Y \\ r \end{bmatrix} = \begin{bmatrix} \frac{3}{2}T_0 + 5G_0 \\ M_0 \end{bmatrix}$$

b) Solve for equilibrium Y^*, r^*

$$\det = \begin{vmatrix} 1 & 5k_1+5k_2 \\ k_3 & -k_4 \end{vmatrix} = -k_4 - (5k_1k_3 + 5k_2k_3)$$

$$\text{Inverse} = \frac{1}{-k_4 - (5k_1k_3 + 5k_2k_3)} \begin{bmatrix} -k_4 & -5k_1 - 5k_2 \\ -k_3 & 1 \end{bmatrix}$$

$$\frac{1}{-k_4 - (5k_1k_3 + 5k_2k_3)} \begin{bmatrix} -k_4 & -5k_1 - 5k_2 \\ -k_3 & 1 \end{bmatrix} \begin{bmatrix} 1 & 5k_1+5k_2 \\ k_3 & -k_4 \end{bmatrix} \begin{bmatrix} Y \\ r \end{bmatrix} = \frac{1}{-k_4 - (5k_1k_3 + 5k_2k_3)} \begin{bmatrix} -k_4 & -5k_1 - 5k_2 \\ -k_3 & 1 \end{bmatrix} \begin{bmatrix} \frac{3}{2}T_0 + 5G_0 \\ M_0 \end{bmatrix}$$

$$\begin{bmatrix} Y^* \\ r^* \end{bmatrix} = \frac{1}{-k_4 - (5k_1k_3 + 5k_2k_3)} \begin{bmatrix} -k_4\left(\frac{3}{2}T_0 + 5G_0\right) + M_0(-5k_1 - 5k_2) \\ -k_3\left(\frac{3}{2}T_0 + 5G_0\right) + M_0 \end{bmatrix}$$

$$\begin{bmatrix} Y^* \\ r^* \end{bmatrix} = \frac{1}{-k_4 - (5k_1k_3 + 5k_2k_3)} \begin{bmatrix} -\frac{3}{2}T_0k_4 - 5G_0k_4 - 5M_0k_1 - 5M_0k_2 \\ -\frac{3}{2}T_0k_3 - 5G_0k_3 + M_0 \end{bmatrix}$$

$$Y^* = \frac{-\frac{3}{2}T_0k_4 - 5G_0k_4 - 5M_0k_1 - 5M_0k_2}{-k_4 - 5k_1k_3 - 5k_2k_3}$$

$$r^* = \frac{-\frac{3}{2}T_0k_3 - 5G_0k_3 + M_0}{-k_4 - 5k_1k_3 - 5k_2k_3}$$

c)

$$Y = -(5k_1 + 5k_2)r + (\tfrac{3}{2}T_0 + 5G_0)$$

$$\frac{dY}{dr} = -5k_1 + 5k_2$$

$$5k_1 = 5k_2$$

$$k_1 = k_2$$

from $$Y^* = \frac{-\frac{3}{2}T_0 k_4 - 5G_0 k_4 - 5M_0 k_1 - 5M_0 k_2}{-k_4 - 5k_1 k_3 - 5k_2 k_3}$$

when k_1 and k_2 are bigger, interest rate will be reduced and this can motivimate Investment and consumption. Hence, By this cause, this circumstance does not an impact of fiscal policy while it is a principle of monetary policy and it is not effective on government spending.

when k_1, k_2 are bigger this causes Y^* to reduce and as a result, GDP falls, so this is not effective for fiscal policy.

from $$r^* = \frac{-\frac{3}{2}T_0 k_3 - 5G_0 k_3 + M_0}{-k_4 - 5k_1 k_3 - 5k_2 k_3}$$

$$r^* = \frac{\frac{3}{2}T_0 k_3 + 5G_0 k_3 - M_0}{k_4 + 5k_1 k_3 + 5k_2 k_3}$$

(4) Let the demand fn. be $P = 14 - 3Q$ and supply fn. be $P = 4 + 2Q$. Suppose that the government imposes tax by \$1 per unit of output. This tax is assumed to impose on consumer. Answer the following question

(a) Find the ~~equation~~ equilibrium under pre-tax situation. That is, when "t" is set to equal to zero

Sol.

Demand function : $P = 14 - 3Q$

$$Q^D = \frac{14 - P}{3}$$

Supply function : $P = 4 + 2Q$

$$Q^S = \frac{P - 4}{2}$$

$$Q^D = Q^S$$

$$\frac{14 - P}{3} = \frac{P - 4}{2}$$

$$28 - 2P = 3P - 12$$

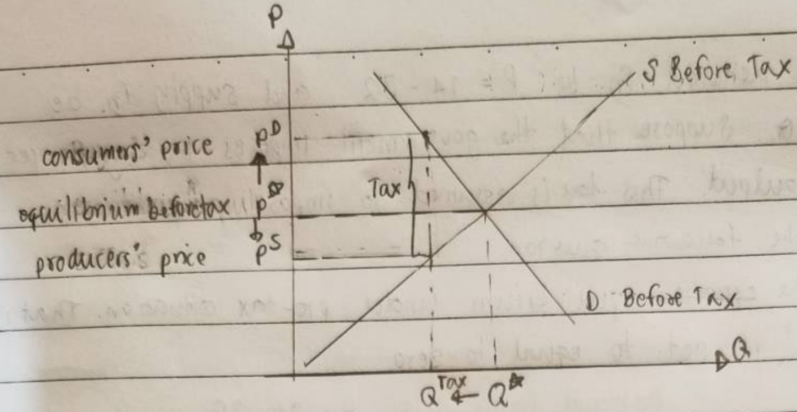
$$40 = 5P$$

$$P^* = 8$$

$$Q^* = \frac{8 - 4}{2} = 2$$

(b) State the condition that links between consumer's and producer's price

Sol: The quantity traded before a tax was imposed at $Q^* = 2$.
When Tax is imposed on consumers, the price that buyers pay will
exceed the price that sellers receive by the amount of tax.



(6) Find the equilibrium after tax

$$t = P^D - P^S$$

Demand function ; $P^D = 14 - 3Q$

$$P^S + t = 14 - 3Q$$

$$Q^D = \frac{14 - P^S - t}{3}$$

Supply function ; $P^S = 4 + 2Q$

$$Q^S = \frac{P^S - 4}{2}$$

at equilibrium ; $Q^D = Q^S$

$$\frac{14 - P^S - t}{3} = \frac{P^S - 4}{2}$$

$$28 - 2P^S - 2t = 3P^S - 12$$

$$40 - 2t = 5P^S$$

$$P^S = \frac{40 - 2t}{5} = 8 - \frac{2}{5}t$$

$$P^D = P^S + t$$

$$P^D = 8 - \frac{2}{5}t + t$$

$$P^D = 8 + \frac{3}{5}t$$

$$Q^*_{after\ tax} = \frac{8 - \frac{2}{5}t - 4}{2}$$

Q^*_{after}

$$Q^*_{\text{after tax}} = \frac{4 - \frac{2}{5}t}{2}$$

$$= 2 - \frac{1}{5}t$$

(d) Calculate the consumers' and producers'. Which group is paying more for the tax under the equilibrium.

Sol: Consumers' burden $= (P^D - P^*) \times Q^*_{\text{After tax}}$

$$= (8 + \frac{3}{5}t - 8) \times (2 - \frac{1}{5}t)$$

$$= (\frac{3}{5}t)(2 - \frac{1}{5}t)$$

$$= \frac{6}{5}t - \frac{3}{25}t^2$$

Producers' burden $= (P^* - P^S) \times Q^*_{\text{after tax}}$

$$= (8 - (8 - \frac{2}{5}t)) \times (2 - \frac{1}{5}t)$$

$$= (\frac{2}{5}t)(2 - \frac{1}{5}t)$$

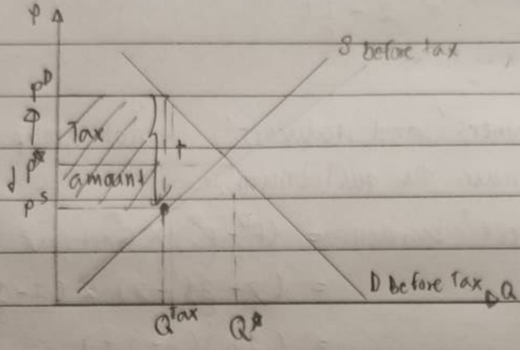
$$= \frac{4}{5}t - \frac{2}{25}t^2$$

Hence, Consumers' burden is higher than producers' burden

$$(\frac{3}{5}t)(2 - \frac{1}{5}t) > (\frac{2}{5}t)(2 - \frac{1}{5}t)$$

and consumers pay more for the taxes.

e. Find the expression of the revenue that government can collect from the market under the equilibrium



Tax Revenue that government earns is the value of tax times the quantity traded, which is shaded area of ~~reg~~ rectangle

$$\text{Tax Revenue} = t \times Q_{\text{after tax}}$$
$$= t\left(2 - \frac{1}{5}t\right)$$
$$= 2t - \frac{1}{5}t^2$$

f If the government were to collect tax so that revenue is maximized, what is the appropriate level of unit tax "t" that it should impose to the market.

$$\text{Tax Revenue} = T \times Q$$
$$TR = 2t - \frac{1}{5}t^2$$
$$\frac{dTR}{dt} = 2 - \frac{2}{5}t$$
$$2 - \frac{2}{5}t = 0$$
$$t = 5$$

$5 per unit of output is the appropriate level of unit tax that should be imposed to provide revenue maximizing