**5 Numerical Exercises with Keynes**

**Government Fiscal Policy**

**Exercise 1.**

**Government purchases and lump sum taxes are $500 and $400, respectively. Investment equals $200. The autonomous part of consumption is $100. The marginal propensity to consume is 0.9.**

**AD = C + I + G + NX**

**C = 100 + 0.9 • YD   
YD = Y - 400   
I = 200   
G = 500   
NX = 0**

**What is the level of GDP?**

*Answer:* Only trick is to recognize that GDP is equivalent to national income

**Step 1.** Substitute the equations for the four spending components into the aggregate expenditure equation:

AD = C + I + G + NX   
      = 100 + 0.9 • YD + 200 + 500 + 0   
      = 100 + 0.9 • (Y - 400) + 200 + 500   
      = 800 + 0.9 • Y - 0.9 • 400   
      = 440 + 0.9 • Y

**Step 2.** Apply the equilibrium condition, equation (2):

Y = AD

**Step 3.** Substitute AD from Step 1 into the equilibrium condition in Step 2:

Y = 440 + 0.9 • Y

**Step 4.** Collect the Y terms on the left hand side and solve for national income, Y.

Y - 0.9 • Y = 440   
(1 - 0.9) • Y = 440   
Y = 440 / 0.1   
Y = $4,400 = the level of GDP

**Exercise 2.**

**Consider an economy similar to Problem 1, but with an income tax that is one-third of income.**

**AD = C + I + G + NX**

**C = 100 + 0.9 • YD   
YD = Y - 0.33 • Y - 400   
I = 200   
G = 500   
NX = 0**

**The government decides to increase spending in order to increase GDP by $750. How much should government spending increase?**

*Answer:* The solution method is the same as the previous problem. The only difference is that we have added an income tax, 0.33 • Y, to the model.

**Step 1.** Substitute the equations for the four spending components into the aggregate expenditure equation:

AD = C + I + G + NX   
      = 100 + 0.9 • YD + 200 + 500 + 0   
      = 800 + 0.9 • (Y - 0.33 • Y - 400)   
      = 440 + 0.9 • (Y - 0.33 • Y)   
      = 440 + 0.9 • (0.67 • Y)

AD= 440 + 0.6 • Y

**Step 2.** Apply the equilibrium condition, equation (2):

Y = AD

**Step 3.** Substitute AD from Step 1 into the equilibrium condition in Step 2:

Y = 440 + 0.6 • Y

**Step 4.** Collect the Y terms on the left hand side and solve for national income, Y.

Y - 0.6 • Y = 440   
(1 - 0.6) • Y = 440   
Y = (1 / 0.4) • 440   
    = 2.5 • 440

Here the trick is to recognize that all that is required is the multiplier. The multiplier is 2.5.

If desired change in Y = $750

$750 = multiplier • change in G   
change in G = $750 / 2.5 = $300

**Exercise 3.**

**Suppose we expand our model to take account of the fact that transfer payments, TR, do depend on the level of income, Y. When income is high, transfer payments such as unemployment benefits will fall. Conversely, when income is low, unemployment is high and so are unemployment benefits. We can incorporate this into our model by writing transfer payments as:**

**TR = TR0 - b • Y   
b > 0**

**Consider the economy is further defined as:**

**AD = C + I + G + NX   
C = C0 + c • YD   
I = I0   
G = G0   
NX = 0**

**YD = Y + TR - TA   
TA (lump sum taxes) = TA0**

**A. Derive the expression for national income, Y.**

*Answer:*

**Step 1.** Substitute the equations for the four spending components into the aggregate expenditure equation:

AD = C + I + G + NX   
      = C0 + c • YD + I0 + G0   
      = C0 + c • (Y + TR - TA) + I0 + G0   
      = C0 + c • (Y + TR0 - b • Y - TA0) + I0 + G0

**Step 2.** Apply the equilibrium condition, equation (2):

Y = AD

**Step 3.** Substitute AD from Step 1 into the equilibrium condition in Step 2:

Y = C0 + I0 + G0 + c • TR0 - c • TA0 + c • (Y - b • Y)   
     = (C0 + I0 + G0 + c • TR0 - c • TA0) + c • (1 - b) • Y

**Step 4.** Collect the Y terms on the left hand side and solve for national income, Y.

Y - c • (1 - b) • Y = C0 + I0 + G0 + c • TR0 - c • TA0

Y =          1          • (C0 + I0 + G0 + c TR0 - c • TA0)   
       [1 - c (1 - b)]

**B. What is the new multiplier?**

*Answer:*

Multiplier = 1 / [1 - c (1 - b)]

**C. Why is the new multiplier less than the standard one?**

*Answer:* Transfer payments act as automatic stabilizers. As income declines (e.g., economy goes into a recession), transfer payments increase.

**Exercise 4.**

**Let us introduce a foreign sector into the national economy. The following equations describe the economy:**

**AD = C + I + G + NX   
C = 20 + 0.75 • (1 - t) • Y   
I = 25   
G = 15   
NX = exports - imports = 20 - 0.1 • Y**

**YD = Y + TR - TA   
TA (lump sum taxes) = TA0**

**If the government seeks to maintain a zero trade balance (NX = 0), what proportional income tax rate, t, should be set?**

*Answer:*

**Step 1.** Substitute the equations for the four spending components into the aggregate expenditure equation:

AD = 20 + 0.75 • (1 - t) • Y + 25 + 15 + 20 - 0.1 • Y   
      = 80 + 0.75 • (1 - t) • Y - 0.1 • Y

**Step 2.** Apply the equilibrium condition, equation (2):

Y = AD

**Step 3.** Substitute AD from Step 1 into the equilibrium condition in Step 2:

Y = 80 + 0.75 • (1 - t) • Y - 0.1 • Y

**Step 4.** Collect the Y terms on the left hand side and solve for national income, Y. Seems we have a problem since we were asked to solve for the income tax rate, t, but we don't know the value of national income, Y. The trick is to recognize we can obtain a value for Y from restriction that NX = 0. Where it was given:

NX = 20 - 0.1 • Y   
0 = 20 - 0.1 • Y   
Y = 200

Substitute the value for Y ( = 200) into the equation from Step 3:

200 = 80 + 0.75 • (1 - t ) • 200 - 0.1 • 200   
200 = 80 + 150 - 150 • t - 20   
10 = - 150 • t   
t = 1/15 = 6.67 percent

**Automatic Stabilizers**

**Exercise 5.**

**Which of the following represent an example of an automatic stabilizer?**

**a. unemployment compensation   
b. public works designed to get the economy out of a depression   
c. local property taxes   
d. inheritance taxes   
e. the personal income tax   
f. temporary tax increases passed by congress to fight inflation   
g. income tax**

*Answer:* A, E and G. When the economy moves into a recession, national income declines and unemployment increases. Total income tax revenue automatically declines and total unemployment benefit payments automatically increase without Congress taking any action. Answers B and F represent discretionary rather than automatic fiscal policies. With discretionary fiscal policy parliament and the government must take some action before the spending or tax revenues can change. Answers C and D are neither discretionary nor automatic. During recessions these tax rates usually don't change.