Determination of Equilibrium National Income in a 2 Sector Closed Economy: Simple Keynesian Model

GDP or the value of output produced in a country is a part of national income because the value of goods and services produced gets distributed among households and producers through wages, salaries, rents and profits. GDP is measured at market prices. National income on the other hand is the Net National Product (NNP) at factor cost. To arrive at NNP at factor cost, we deduct depreciation (reduction in value of an asset, like plants, machineries, over time) and net indirect taxes (indirect taxes imposed less subsidies given) from GDP, and add to it net factor incomes from abroad. Hence ideally GDP and National Income are not the same. However, we build here a very simple model by making the following simplifying assumptions:

(1) The economy is closed, so there are no factor incomes from abroad.
(2) There is no depreciation.
(3) There are no indirect taxes.
(4) Disposable income is equal to GDP.
(5) The price level is fixed.

Given the assumptions (1) - (4), GDP is equal to National Income. Henceforth, GDP/ output/ National Income/ income will be used interchangeably in our model. These simplifications have no serious consequences and are made only for convenience.

Considering a closed economy without government, the different components of aggregate demand (AD), or the different purposes for which GDP gets demanded can be expressed as:

$AD = C + I$

We need to find out the equilibrium output/ income so that AD, which is the amount that people want to buy, is equal to the output produced.

OR

Output produced (Y) = AD

So that there is no unplanned inventory (unsold stock of goods) accumulation or dissipation.

Defining Consumption Function:

$C = C_0 + bY$

C_0 is the autonomous consumption, independent of income Y.

b is the increase in C for every unit increase in Y. Also known as Marginal Propensity to Consume (MPC).

$$MPC = \frac{\Delta C}{\Delta Y} = b, the\ slope\ of\ consumption\ function$$

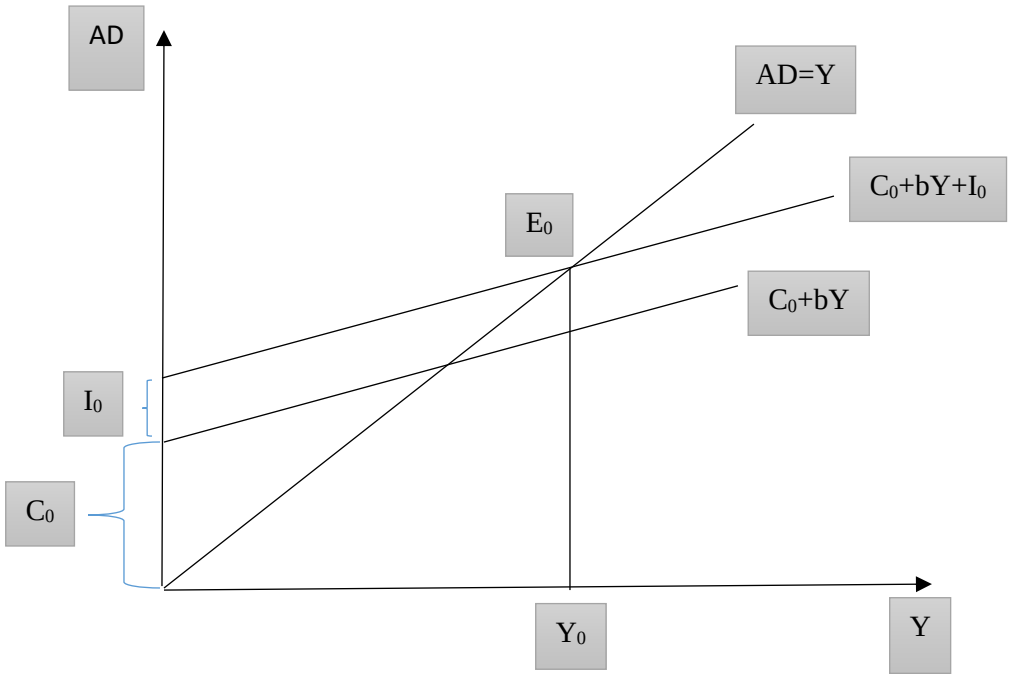
$$0 < MPC < 1$$

Investment Function:

$I = I_0$, investment is autonomous, or independent of Y.

We now diagrammatically derive the equilibrium national income/ output in Figure 1.

Figure 1



At every point on the 45^o line, AD=Y, or the horizontal distance of the line from Y axis is equal to the vertical distance of the line from X axis. The line can also be considered as the Aggregate Supply curve. Aggregate supply is the same thing as national product (Y), as both represent the value of output of final goods and services produced. With the assumption that price level is fixed (assumption no. 5), any amount of output can be supplied at the given price level. If marginal cost of production (additions to total cost of production due to a unit increase in output) is further assumed to be constant, output can be increased at a constant rate in response to an increase in aggregate demand. That is why the aggregate supply curve is a 45^o line.

The equilibrium national income/ output is Y_0 determined by the intersection of AD and 45^o line at E_0.

At any $Y > Y_o$, $Y > AD$ so that there would be unplanned inventory accumulation and therefore $Y \downarrow$ through reduction in production by firms.

At any $Y < Y_o$, $Y < AD$ so that there would be unplanned inventory dissipation and therefore $Y \uparrow$ through increase in production by firms.

Derivation of Multiplier

The equilibrium condition in the goods market:

Y=AD

Incorporating the components of AD, the equilibrium condition can be stated as:

$Y = C_0 + bY + I_0$

Since we have Y on both sides of the equilibrium condition, we can collect terms and solve the equilibrium level of income and output, denoted by Y_0:

$$Y_0 = \frac{1}{1-b}\bar{A} \qquad (1)$$

$\bar{A}$ stands for the autonomous component of AD i.e., C_0+I_0.

The position of the AD schedule is characterized by its slope, b (the marginal propensity to consume), and intercept $\bar{A}$ (autonomous expenditure). Given the intercept, a steeper AD function – as would be implied by a higher MPC – implies higher level of equilibrium income. Similarly for a given MPC, a higher level of autonomous expenditure (parallel upward shift of the AD curve) implies higher equilibrium level of income.

The multiple $\frac{1}{1-b}$ is called the multiplier. The multiplier is the amount by which equilibrium output changes when autonomous components of AD increases by one unit. We can arrive at the multiplier from expression (1) by considering the variation in Y with respect to $\bar{A}$, so that:

$$\Delta Y_0 = \frac{1}{1-b}\Delta\bar{A}$$

Hence, from the value of the multiplier we will be able to infer by how much a given dollar/ rupee increase in autonomous spending raise the equilibrium level of income.

Larger the MPC, larger the multiplier. A higher MPC implies that a larger fraction of an additional dollar/ rupee of income will be consumed, thereby causing a larger induced increase in AD. Hence, larger the MPC, steeper the AD schedule, and therefore larger the income change (**SHOW DIAGRAMATICALLY**).

The larger the increase in autonomous expenditure (represented by parallel upward shift of the AD schedule), the larger the income change (**SHOW DIAGRAMATICALLY**).

Introduction of Government Expenditure

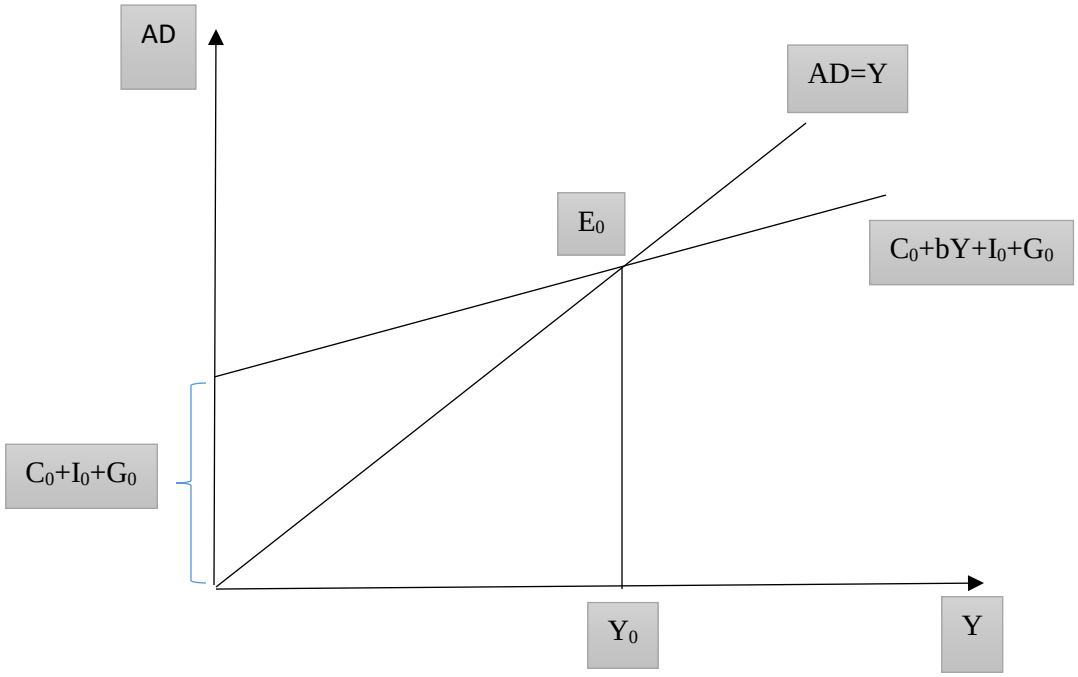
We introduce government expenditure into the above model and consider a 3 sector closed economy.

Government Expenditure Function:

$G = G_0$, government expenditure is autonomous, or independent of Y.

The determination of equilibrium national income can be represented by the following diagram.

Figure 2



The equilibrium national income/ output is Y_0 determined by the intersection of AD and 45° line at E_0.

At any $Y > Y_o$, $Y > AD$ so that there would be unplanned inventory accumulation and $Y \downarrow$ through reduction in production by firms.

At any $Y < Y_o$, $Y < AD$ so that there would be unplanned inventory dissipation and $Y \uparrow$ through increase in production by firms.

Derivation of Marginal Propensity to Save

Marginal Propensity to Save (MPS) is the increase in savings due to a given unit increase in income.

We have:

$$Y = C + S \qquad (2)$$

In expression (2) considering variations in C and S with respect to Y:

$$1 = \frac{\Delta C}{\Delta Y} + \frac{\Delta S}{\Delta Y}$$

Therefore,

$$MPC + MPS = 1$$

$$0 < MPS < 1$$