STRUCTURAL MODEL VS REDUCED FORM MODEL

We know that a model consists of set of equations, schedules or mathematical representations which describe functional relationships between variables. The economic model may be (1) partial equilibrium model as well as (2) general equilibrium model. The best example of partial equilibrium model is a one commodity demand and supply model where we find equilibrium level of price and quantity keeping the prices of other goods constant, incomes of consumers constant and number of consumers in the market constant. Such partial equilibrium model is concerned with microeconomic model. Again, we have a lot of partial equilibrium models which are concerned with macroeconomic models. As, we take a simple two sector Keynesian national income determination model. In this model, we have certain parameters or exogenous variables whose values are given or have to be kept constant, while there is one endogenous variable and the purpose of the model is to find its value. Thus the complete set of all the variables (exogenous as well as endogenous, or parameters as well as variables) is given the name of structural model. Whereas, the model where we find out the value of the endogenous variable in some set of exogenous variables or parameters is given the name of Reduced form model. Before we explain them, it is told that General equilibrium represents the simultaneous equilibrium. In case of microeconomics, the example may be of two commodity market model where there is equilibrium in both the markets at both the prices. First we present the structural of simple Keynesian and IS-LM models, and then using it we present the reduced form model:

The structural form of a two sector Keynesian model: $Y = C + I$, while $C = Co + cY$ and $I = Io$.

The reduced form model is obtained by putting the values:

$$Y = C + I \Rightarrow Y = Co + cY + Io \Rightarrow Y - cY = Co + Io \Rightarrow Y(1 - c) = Co + Io \Rightarrow Y = \frac{1}{1 - c}\,[Co + Io]$$

This is the reduced form of Keynesian model in terms of endogenous variable (Y). The reduced

The structural form model has following advantages:

1. It is easy to see and understand, 2. It gives a clear picture regarding endogenous and exogenous variables of the model. 3. It is neither understated nor over-stated.

The Reduced form model has following advantages:

1. It is a short-cut way to represent the value of endogenous variable into exogenous variables. 2. It provides a foundation for further development of the model, particularly when we have to move from Static to Comparative static and then to Dynamic analysis. 3. It is an exact model. 4. The reduced form equations represent' equilibrium level, i.e., equilibrium level of income and equilibrium level of consumption etc.

DETERMINATION OF EQUILIBRIUM LEVEL OF N. I. (UAJK: 2012)

The theory of NI determination is attributed to Prof. Keynes. Accordingly, NI is determined where

1. Savings are equal to investment   2. Aggregate demand is equal to Aggregate supply

1. NI DETERMINATION — Saving and Investment Method

First we present equilibrium in general form: As $S = -So + sY$

while $I = Io$ (autonomous investment)

At equilibrium : $S = I$ Putting the values of S and I

$$-So + sY = Io \Rightarrow sY = Io + So \Rightarrow \overline{Y} = \frac{Io + So}{s} \Rightarrow \overline{Y} = \frac{1}{s}(Io + So)$$

where $\overline{Y}$ is given the name of equilibrium level of national income (NI).

Thus the last equation shows the equilibrium level of NI in two sector economy.

While investment multiplier (K) will be as: $K = \frac{1}{MPS} = \frac{1}{s} = \frac{1}{0.4} = 2.5$

2. NI DETERMINATION — Aggregate Demand and Aggregate Supply Method— OR — Consumption and Investment Method

We suppose that investment is autonomous ($I = Io$) while consumption equation is as : $C = Co + cY$. Putting the values of C and I in NI equation, i.e., $Y = C + I$

$$Y = C + I$$
$$Y = Co + cY + I$$
$$Y - cY = Co + Io$$
$$Y(1 - c) = Co + Io$$
$$\overline{Y} = \frac{Co + Io}{1 - c}$$
$$\overline{Y} = \frac{1}{1 - c}(Co + Io)$$

$$C = Co + cY$$
$$\overline{C} = Co + c\overline{Y}$$
$$\overline{C} = Co + c\left(\frac{Co + Io}{1 - c}\right)$$
$$\overline{C} = \frac{Co(1 - c) + c(Co + Io)}{1 - c}$$
$$\overline{C} = \frac{Co - cCo + cCo + cIo}{1 - c}$$
$$\overline{C} = \frac{Co + cIo}{1 - c}$$

EXAMPLE 1. **If $C = 25 + 6Y^{\frac{1}{2}}$, Io = 16, G = 14. Or $I_o + G_o = 30$ We find**

(1) Equilibrium level of NI ($\overline{Y}$), (2) Equilibrium level of C ($\overline{C}$), (3) Prove Y = C + I + G, (4) How many endogenous and exogenous variables are there. [(UAJK: 2010), (BZU: 2011), (UOPR: 2004), (UOH: 2009)]

$Y = C + I + G \Rightarrow Y = 25 + 6Y^{\frac{1}{2}} + 16 + 14$ (Putting the values)

$Y = 55 + 6Y^{\frac{1}{2}} \quad \Rightarrow \quad Y - 6Y^{\frac{1}{2}} - 55 = 0$

Supposing that $Y^{\frac{1}{2}} = X$, then $Y = X^2$

$X^2 - 6X - 55 = 0 \quad \Rightarrow \quad X^2 - 11X + 5X - 55 = 0$

$X(X - 11) + 5(X - 11) = 0 \quad \Rightarrow \quad (X + 5)(X - 11) = 0$

$X - 11 = 0$, so $X = 11$ | $X + 5 = 0$, so $X = -5$

As $X = Y^{\frac{1}{2}}$, then $Y^{\frac{1}{2}} = 11$ while $X^2 = Y = 121$.

Thus $Y^{\frac{1}{2}} = 11$ and $\overline{Y} = Y^* = 121$ Putting the value of $Y^{\frac{1}{2}} = 11$ in consumption, $C = 25 + 6Y^{\frac{1}{2}}$

$\overline{C} = C^* = 25 + 6(11) = 25 + 66$ i.e., $\overline{C} = 91$

This is equilibrium level of consumption. Putting the values of Y, C, I and G ,

$\overline{Y} = \overline{C} + Io + Go \Rightarrow 121 = 91 + 16 + 14 \Rightarrow 121 = 121$ This is equilibrium level of NI. The Endogenous variables are Y and C while exogenous variables are I_o and G_o.

EXAMPLE 2. **If $C = 20 + 5Y^{\frac{1}{2}}$, Io =14, Go = 16. We find (1) Equilibrium level of NI ($\overline{Y}$), (2) Equilibrium level of C ($\overline{C}$), (3) Prove S + T = Io + Go. [(BPSC 2012) (UOH: 2009)]**

$Y = C + I + G \qquad Y = 20 + 5Y^{\frac{1}{2}} + 14 + 16$ (Putting the values)

$Y = 50 + 5Y^{\frac{1}{2}} \Rightarrow Y - 5Y^{\frac{1}{2}} - 50 = 0$. Supposing that $Y^{\frac{1}{2}} = X$, then $Y = X^2$

$X^2 - 5X - 50 = 0 \Rightarrow X^2 - 10X + 5X - 50 = 0$

$X(X - 10) + 5(X - 10) = 0 \Rightarrow (X + 5)(X - 10) = 0$

$X - 10 = 0$ so $X = 10$. | $X + 5 = 0$ so $X = -5$

As $X = Y^{\frac{1}{2}}$, then $Y^{\frac{1}{2}} = 10$ while $X^2 = Y = 100$. Thus $Y^{\frac{1}{2}} = 10$and $\overline{Y} = 100$

Putting the value of $Y^{\frac{1}{2}} = 10$ in consumption, $C = 20 + 5Y^{\frac{1}{2}}$. Putting the values of Y, C, I and G,

$\overline{C} = 20 + 5(10) = 20 + 50 \Rightarrow \overline{C} = 70$ This is equilibrium level of consumption.

$\overline{Y} = \overline{C} + Io + Go \Rightarrow 100 = 70 + 14 + 16 \Rightarrow 100 = 100$ This is equilibrium level of NI.

$S = Y - C - T = 100 - 70 - 0 = 30$. $S + T = I + G = 30 + 0 = 14 + 16 \Rightarrow 30 = 30$

EXAMPLE 3: Given the following model: $Y = C + I_o + G_o$, $C = 25 + 20Y^{½} I_o + G_o = 100$.

(i) How many endogenous and exogenous variables are there?

(ii) Find Y* and C* (BZU: 2011)

PROBLEMS with SOLUTIONS

Problem 1. Given the following model: $Y = C + Io + Go$,

$C = a + b\,(Y - T), T = d + tY$ $(a > 0, 0 < b < 1)$, (T = taxes),

$(d > 0, \quad 0 < t < 1)$. t = income tax rate.

(a) How many endogeneous variables are there?

(b) Find $\overline{Y}$, $\overline{T}$ and $\overline{C}$