DETERMINATION OF EQUILIBRIUM LEVEL OF NI AND RATE OF INTEREST —— Hicksian Analysis

OR

Simultaneous Equilibrium in Goods and Money Markets

1. General Equilibrium in Goods Market in a Two-Sector Economy or IS curve (UAJK: 2010)

According to Hicks, IS curve represents general equilibrium in goods market. Hence, " IS curve in a Two–Sector Economy shows those pairs of rate of interest and level of income where savings are equal to investment". Moreover, here economy is in equilibrium where $Y = C + I$ while $C = Co + cY$, $I = Io - Vi$. Vi represents that induced investment which is influenced by rate of interest. V shows the slope of investment curve and negative sign shows the inverse relationship between rate of interest and investment. Thus, putting the values

$$Y = C + I \Rightarrow Y = Co + cY + Io - Vi$$

$$Y - cY = Co + Io - Vi \Rightarrow Y(1-c) = Co + Io - Vi$$

$$Y = \frac{Co + Io - Vi}{1-c}$$. This is NI determination equation according to Hicks.

Or $Y = \frac{1}{1-c}[Co + Io - Vi]$ which is IS mathematical equation or it is IS schedule.

If $Co = 102$, $c = 0.7$, $V = 100$, $Io = 150$, then $Y = \frac{102 + 150 - 100i}{1 - 0.7} = 840 - 333.33i$

2. GENERAL EQUILIBRIUM IN MONEY MARKET OR LM CURVE (UAJK: 2010)

According to Hicks, LM curve shows general equilibrium in money market. Therefore, "LM curve shows the combinations of rate of interest and level of NI where Md = Ms, or money market is in equilibrium". According to Hicks, Md has two parts : (1) The transactive demand for money (Mtd) which depends upon level of income (Y). Its general and standard forms are as :

$Mtd = f(Y)$ and $Mtd = kY$ where k = proportion of cash balance.

(2) Speculative demand for money (Msd) which depends upon the rate of interest. There exists an inverse relationship between Msd and rate of interest. Its general and standard forms are as :

$Msd = f(i)$ and $Msd = mo - mi$

where m is the slope of Msd curve and negative sign shows inverse relationship between interest rate and Msd. $Md = Mtd + Msd$

Ms is the supply of money which is fixed in short-run. It is as : $Ms = Mo$

$Md = Mtd + Msd$ (Summing two demands)

$Md = kY + mo - mi$. At equilibrium, $Md = Ms$

$kY + mo - mi = Ms \Rightarrow kY = Mo - mo + mi$

$$\Rightarrow \quad Y = \frac{Mo - mo + mi}{k} \quad \text{Or} \quad Y = \frac{1}{k}[Mo - mo + mi] \quad \text{LM – equation}$$

If $Msd = 124 - 200$, $Mtd = 0.25Y$, $Ms = Mo = 300$, $k = 0.25$.

Putting them we find the equation of LM as:

$$Y = \frac{1}{0.25}[300 - 124 + 200i] \quad \text{or} \quad Y = 704 + 800i$$

3. SIMULTANEOUS EQUILIBRIUM IN GOODS AND MONEY MARKETS

(UOPR: 2009)

We have already told that IS represents general equilibrium in goods market while LM shows general equilibrium in money market. Therefore, according to Hicks the simultaneous equilibrium in goods and money markets takes place where IS intersects LM curve. Now we explain them with examples. The same is available in general form in chapter 5 of the book "Macroeconomics" by Prof. A. Hamid Shahid.

Numerical Example. If the following information are given regarding goods and money markets, find equilibrium rate of interest and level of NI where goods and money markets are in equilibrium.

$Y = C + I$

$C = 102 + 0.7\,Y$

$I = 150 - 100i$

$Mtd = 0.25\,Y$

$Msd = 124 - 200i$

$Ms = Mo = 300$

$$Y = 102 + 0.7Y + 150 - 100i$$

$$Y - 0.7\,Y = 252 - 100i$$

$$Y(1 - 0.7) = 252 - 100i$$

$$Y(0.3) = 252 - 100i \Rightarrow Y = \frac{252 - 100i}{0.3}$$

$$Y = 840 - 333.33i \quad \ldots (1)$$

(1) is the IS Equation

$Md = Mtd + Msd$

$Md = 0.25Y + 124 - 200i$

$Md = Ms$

$0.25Y + 124 - 200i = 300$

$0.25Y = 300 - 124 + 200i$

$0.25Y = 176 + 200i$

$$Y = \frac{176 + 200i}{0.25}$$

Subtracting (2) from (1)

$$Y = 840 - 333.33i$$
$$\pm Y = \pm 704 \pm 800i$$
$$0 = 136 - 1133.33i$$

$1133.33\,i = 136$

$$i = \frac{136}{1133.33} = 0.12 = 12\%$$

Putting the value of i in (1)) and (2)

$Y = 840 - 333.33\,(0.12) = 800$

$Y = 704 + 800(0.12) = 800$

$Y = 704 + 800i \quad \ldots (2) \Rightarrow$ (2) is the LM equation

Putting the value of Y in Mtd $Mtd = 0.25Y = 0.25(800) = 200$

Putting the value of *i* in Msd

$Msd = 124 - 200i = 124 - 200(0.12) = 100$

$Md = Mtd + Msd = 200 + 100 = 300$

$C = 102 + 0.7\,Y = 102 + 0.7(800) = 662$

$S = Y - C = 800 - 662 = 138$

$I = 150 - 100i = 150 - 100(0.12) = 138$

Thus equilibrium rate of interest i =12% and equilibrium level of NI=800 where S=I and Md=Ms.

i	Y	S	I	Md=Mtd+Msd	Ms
12%	800	138	138	300=200+100	300

[Note: For more examples of IS, LM and IS and LM equilibrium see my book MacroEconomics].

Example 2. With the following equations, find simultaneous equilibrium in goods and money markets:

Goods Market Equilibrium

$Y = C + I + G$

$Y = 10 + 0.8\ Yd + 100 - 200i + 15$

$Y = 10 + 0.8\ [\ Y - T\ ] + 100 - 200i + 15$

$Y = 10 + 0.8\ [\ Y - 30\ ] + 100 - 200i + 15$

$Y = 10 + 0.8Y - 24 + 100 - 200i + 15$

$Y - 0.8Y = 101 - 200i$

$Y(1 - 0.8) = 101 - 200i$

$Y(0.2) = 101 - 200i$

$$Y = \frac{101 - 200i}{0.2} \quad \text{OR} \quad Y = 505 - 1000i \quad \ldots (1)$$

$C = 10 + 0.8Yd$

$Yd = Y - T,\ T = 30$

$G = Go = 15$

$I = 100 - 200i$

$Md = 0.25Y - 40i,\ Mo = 100$

Money Market Equilibrium

$Md = Ms$

$0.25\ Y - 40i = 100$

$0.25Y = 100 + 40i$

$$Y = \frac{100 + 40i}{0.25}$$

$Y = 400 + 160\ i \quad \ldots (2)$

Subtracting (2) from (1)

$Y = 505 - 1000i$

$\pm Y = \pm 400 \pm 160\ i$

$0 = 105 - 1160\ i$

$1160\ i = 105$

$$i = \frac{105}{1160} = 0.0905172$$

Putting the value of i in (1) and (2)

$Y = 505 - 1000i = 505 - 1000(0.0905172)$

Q: If $C = 48 + 0.8Y$
$I = 98 - 75i$
$M = 250$
$L = L_T + L_S \Rightarrow$
$0.3Y + 52 - 150i$
(i) find IS and LM equations
(ii) find equilibrium level of income and rate of interest. (UAJK: 2013)
Goods, market equilibrium
$Y = C + I$
$Y = 48 + 0.8Y + 98 - 75i$
Money market equilibrium
$L = M \Rightarrow L_T + L_S = M$
$0.3Y + 52 - 150i = 250$
For further solution, see Example 1

$Y = 505 - 90.5172 = 414.48275$

$Y = 400 + 160i = 400 + 160(0.0905172) = 414.48275$

$Md = 0.25Y - 40i = 0.25(441.48275) - 40(0.0905172) = 100$

$C = 10 + 0.8Y = 10 + 0.8\,[Y - T]$

$C = 10 + 0.8\,[414.48275 - 30] = 317.58624$

$Yd = Y - T = 414.4828 - 30 = 384.4828$

$S = Yd - C = 384.4828 - 317.58624 = 66.89656$

$I = 100 - 200i = 100 - 200(0.0905172)$

$I = 100 - 18.10344 = 81.89$

Thus at 9% rate of interest the equilibrium level of NI is 414.48, where

$Md = Ms = 100$ and $I + G = S + T = 96.90$

i	Y	Md	Ms	S + T	I + G
9%	414.48	100	100	66.89+30=96.90	81.89+15=96.90

Numerical Example 3. With the following equations, find equilibrium level of interest and equilibrium level of NI.

$C = 130 + 0.5\,Yd$, $Yd = Y - T$, $T = 20 + 0.2Y$, $G = Go = 112$,

$I = 200 - 600i$, $Ms = 300$, $Mtd = 0.5Y$, $Msd = 50 - 600i$

Solution. *Goods market equilibrium.* Putting the values

$Y = C + I + G$

$Y = 130 + 0.5Yd + 200 - 600i + 112$

$Y = 130 + 0.5\,[Y - T] + 200 - 600i + 112$

$Y = 130 + 0.5\,[Y - (20 + 0.2Y)] + 200 - 600i + 112$

$Y = 130 + 0.5\,[Y - (20 + 0.2Y)] + 200 - 600i + 112$

$Y = 130 + 0.5\,[Y - 20 - 0.2Y] + 200 - 600i + 112$

$Y = 130 + 0.5\,Y - 10 - 0.1Y + 200 - 600i + 112$

$Y - 0.5Y + 0.1Y = 130 + 200 - 600i + 112 - 10$

$Y(1 - 0.5 + 0.1) = 432 - 600i$

$$Y(0.6) = 432 - 600i \Rightarrow Y = \frac{432 - 600i}{0.6}$$

$$Y = 720 - 1000i \quad \ldots (1)$$

Money Market Equilibrium

$Md = Ms$

$Mtd + Msd = Ms$

$0.5\,Y + 50 - 600i = 300$

$0.5Y = 300 - 50 + 600i$

$0.5Y = 250 + 600i$

$$Y = \frac{250 + 600i}{0.5}$$

The equation of IS

Subtracting (2) from (1)

$Y = 720 - 1000i$

$\pm Y = \pm 500 \pm 1200\,i$

$0 = 220 - 2200\,i$

$2200\,i = 220$

$$i = \frac{220}{2200} = 0.1 = 10\%$$

$Y = 500 + 1200\,i$ ... (2) The equation of LM

Putting the value of i in IS and LM equations

$Y = 720 - 1000(0.1) = 720 - 100 = 620$

$Y = 500 + 1200(0.1) = 500 + 120 = 620$

Putting the value of Y and i in different variables

$T = 20 + 0.2Y = 20 + 0.2(620) = 20 + 124 = 144$

$Yd = Y - T = 620 - 144 = 476$

$C = 130 + 0.5Yd = 130 + 0.5(476) = 130 + 238 = 368$

$S = Yd - C = 476 - 368 = 108$

$I = 200 - 600i = 200 - 600(0.1) = 200 - 60 = 140$

$Md = 50 + 0.5Y - 600 = 50 + 0.5(620) - 600(0.1) = 50 + 310 - 60 = 300$

$S + T = 108 + 144 = 252, \quad I + G = 140 + 112 = 252$

Thus, 10% is the equilibrium rate of interest and 620 is the equilibrium level of NI where both goods and money markets are in equilibrium.

i	Y	Md	Ms	S + T	I + G
10%	620	300	300	252	252