Macroeconomics

Cheng Wang
Department of Economics
Iowa State University

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1 Equilibrium in the more general setting

Suppose $Y = 100$ is fixed. Suppose the consumption function is $C(Y - T) = 20 + M(Y - T)$, where $M$ is a constant that is between 0 and 1. Suppose the investment function is $I(r) = 30 - 50r$. Suppose we leave $G$ and $T$ as unspecified constants.

Remember the equilibrium condition for the economy is

$$Y - C(Y - T) - G = I(r)$$

Substitute $Y = 100$ and $C = 20 + M(Y - T)$ and $I(r) = 30 - 50r$ into the equilibrium condition to get

$$100 - [20 + M(100 - T)] - G = 30 - 50r$$

solve this equation for the equilibrium interest rate

$$r^* = \frac{50 - M(100 - T) - G}{-50}$$

or

$$r^* = \frac{-50 + M(100 - T) + G}{50}$$

We can make several predictions based on the above equation.

(1) When $G$ rises, $r^*$ rises and so $I(r^*)$ falls. This is what we called the “crowding-out effect”.
(2) When $T$ increases, $r^*$ decreases and $I(r^*)$ increases. What happens here is, as $T$ goes up, disposable income $Y - T$ falls, so consumption falls, and saving goes up, and this induces the supply of loanable funds to go up. What happens next is competition among banks (who all want to find borrowers for their loanable funds) will bid down the price for the use of funds or the interest rate.

(3) When $M$ increases, $r^*$ increases.

Note given the form of the consumption function, $M$ is equal to the marginal propensity to consume (MPC). Can you show this?

Suppose we have two countries. Country 1 (Japan) has a lower $M$ than country 2 (US). According to our model, Which country has a lower interest rate?
Chapter 5
The IS-LM Analysis

2 The Equilibrium GDP (Mankiw Chapter 10-1)

Let $\bar{Y}$ denote the economy’s potential GDP. $\bar{Y}$ is the maximum amount of goods and services that the economy can produce if all the economy’s available resources are fully utilized.

As before, let $Y^*$ be the economy’s equilibrium GDP. Assume

$$Y^* < \bar{Y}.$$ 

That is, the economy is operating at a level that is strictly below its potential. Imagine the economy is in a recession where many workers are unemployed and factories are closed.

Question: That can be done to raise the equilibrium GDP?

Remember the equilibrium condition for the economy is:

$$Y = C(Y - T) + I(r) + G$$
Note that so far we have always treated $Y$ (together with $G$ and $T$) as the model’s exogenous variable. This time we want to use the model to determine $Y$, that is, we now want to assume $Y$ is the model’s endogenous variable.

To make our life easy, as a first step let’s assume interest $r$ is fixed (by the Federal Reserve Bank which, we assume, has full control over the financial market) That is treat $r$, $G$ and $T$ as the model’s exogenous variables. Then the equation $Y = C(Y - T) + I(r) + G$ can be used to determine the only unknown variable: $Y$.

One interpretation (Keynes’ interpretation) of the equation $Y = C(Y - T) + I + G$ is that the right hand side of the equation represents the aggregate PLANNED EXPENDITURE and left hand side the ACTUAL EXPENDITURE.

Actual expenditure is the amount households, firms, and the government actually spend on goods and services, and as we know, it equals the economy’s GDP. Planned expenditure is the amount households, firms, and the government would like to spend on goods and services.

Why should actual expenditure equal planned expendi-
ture in equilibrium? This is what the KEYNESIAN CROSS explains. (Figure 10-4).

Let $E$ denote planned expenditure. Suppose $Y > E$. That is, suppose firms are producing more than the private sector and the government plan to purchase. Firms are forced to accumulate inventories. When this happens, firms will reduce production and that reduces $Y$.

Suppose $Y < E$. That is, suppose firms are producing less than the private sector and the government want to purchase. Firms will run down their inventories. When this happens, firms will increase production and that increases $Y$.

The Keynesian cross shows how $Y$ determined for fixed $I$, $G$ and $T$. Suppose any of these variables change, $Y$ will change.

**Example 1**

Suppose $G = 10$, $T = 10$. $C(Y - T) = 20 + 0.5(Y - T)$, $I(r) = 30 - 50r$ and $r = 0.1$. Compute the equilibrium $Y$.

Substitute $G = 10$, $T = 10$. $C(Y - T) = 20 + 0.5(Y - T)$, $I(r) = 30 - 50r$, $r = 0.1$ into the equilibrium condi-
tion to obtain

\[ Y = 20 + 0.5(Y - 10) + 30 - 50 \times 0.1 + 10 \]

so

\[ 0.5Y = 20 - 5 + 30 - 5 + 10 = 50 \]

and \( Y^* = 100 \).
Consider now the following more general case. Suppose $C(Y - T) = M(Y - T)$, where $M$ is the constant $MPC$. $0 < M < 1$. Suppose the investment function $I(r)$ and $G$ and $T$ are left unspecified.

Substitute the above information into the equilibrium condition $Y = C(Y - T) + I(r) + G$ to obtain

$$Y = M(Y - T) + I(r) + G$$

which implies

$$Y = MY - MT + I(r) + G$$

or

$$(1 - M)Y = -MT + I(r) + G$$

or

$$Y^* = \frac{-MT + I(r) + G}{1 - M}$$

The above equation makes the following predictions:

1. An increase in $G$ implies an increase in $Y^*$.
2. An increase in $T$ implies a decrease in $Y^*$.
3. An increase in $r$ implies a decrease in $Y^*$.

What happens if the government reduces $G$?

What happens if the government reduces $T$?

What happens if the Fed reduces $r$?
Example 2 Suppose $G = 10$, $T = 10$. $C(Y - T) = 20 + 0.5(Y - T)$, $I(r) = 30 - 50r$ and $r = 0.1$.

(1) Suppose now the Fed decides to cut interest rate by one percent. Will GDP increase or decrease? By how many percentage points? (hints) With $r = 0.1$, $Y^* = 100$. With $r = 0.09$, $Y^* = 101$. So GDP goes up by one percent.

(2) Suppose the Fed wants to pursue an interest rate policy that implements the following (full-employment) policy objective: $Y^* = \bar{Y}$ and $\bar{Y} = 102$. How should the Fed set its interest rate target.
We now know that an increase in government purchases ($G$) can cause the equilibrium $Y^*$ to increase. We now ask a more specific question. Suppose we increase $G$ by one unit. $Y^*$ will increase by how many units?

To prepare for the analysis. Suppose variable $y$ depends on variable $x$ in the following way: $y = 2 + 3x$. Now here if we increase $x$ by 1 unit, then $y$ will increase by 3 units.

Suppose instead $y = 2 + Mx$ where $M$ is some unknown constant. Then an increase in $x$ by 1 unit will cause $y$ to increase by $M$ units. More generally, an increase in $x$ by $\Delta x$ units will increase $y$ by $M \times \Delta x$ units.

We now go back to our model. Suppose the consumption function is $C(Y - T) = 25 + M(Y - T)$, where again $M$ is the constant $MPC$. $0 < M < 1$. Suppose the investment function $I(r)$ and $G$ and $T$ are left unspecified.

Substitute the above information into the equilibrium condition

$$Y = C(Y - T) + I(r) + G$$
to obtain
\[ Y = 25 + M(Y - T) + I(r) + G \]
which implies
\[ Y = 25 + MY - MT + I(r) + G \]
or
\[ (1 - M)Y = 25 - MT + I(r) + G \]
or
\[ Y^* = \frac{25 - MT + I(r) + G}{1 - M} \]
or
\[ Y^* = \frac{25 - MT + I(r)}{1 - M} + \frac{G}{1 - M} \]

The above equation shows that an increase in \( G \) by one unit will cause \( Y^* \) to increase by \( \frac{1}{1-M} \) units. We call \( \frac{1}{1-M} \) the government-purchases multiplier.

Note that since \( M < 1 \), the government-purchases multiplier is greater than one. For example, suppose \( M = 0.8 \), then the government-purchases multiplier is equal to 5. Thus for example if the government increases its \( G \) by 10 billion, then GDP will increase by \( 5 \times 10 \) billion.

implies an increase in \( Y^* \).

(2) An increase in \( T \) implies a decrease in \( Y^* \).
(3) An increase in $r$ implies a decrease in $Y^*$. 

What happens if the government reduces $G$? 
What happens if the government reduces $T$? 
What happens if the Fed reduces $r$?

**Example 2** Suppose $G = 10$, $T = 10$. $C(Y - T) = 20 + 0.5(Y - T)$, $I(r) = 30 - 50r$ and $r = 0.1$. Suppose now the Fed decides to cut interest rate by one percent. Will GDP increase or decrease? By how many percentage points?

(hints) With $r = 0.1$, $Y^* = 100$. With $r = 0.09$, $Y^* = 101$. So GDP goes up by one percent.
4 Case Study: Cutting Taxes to Stimulate the Economy

In 1961, John F. Kennedy became president of the United States. FKK brought to Washington a group of bright young economists to work on his Council of Economic Advisers. These economists were educated in the school of Keynesian economics.

One of .... (see Mankiw page 266 (a very nice page))

5 The IS curve

If both $r$ and $Y$ are treated as variables, not constants. Then $Y = C(Y - T) + I(r) + G$ describes a relationship between $r$ and $Y$. This relationship is called the IS curve. There $I$ means investment $S$ means saving.

6 A Loanable-Funds Interpretation of the IS equation

The equilibrium condition $Y = C(Y - T) + I(r) + G$ can be rewritten as

$$Y - C(Y - T) - G = I(r)$$