Chapter 3-Keynesian Model 1.pdf

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Chapter 3

The Keynesian Model I

“Fascism… is the form that our capitalist society will acquire unless we are successful in bringing about Keynesian reforms or a socialist economy… the economic law of capitalism will take us down the same road that Germany followed so recently”

Lawrence Klein

In 1936, John M. Keynes wrote his main book *The General Theory of Employment, Interest and Money*. This book revolutionized economics especially macroeconomic theory and policy. Keynes was very aware of the revolutionary character of his new theories. In a letter to George Bernard Shaw on January 1, 1935, he said “I believe myself to be writing a book on economic theory which will largely revolutionize… not I suppose, at once, but in the course of the next ten years… the way the world thinks about economic problems”.

The Consumption Function

Keynes assumed that households in the economy determine the amount of how much to consume by taking income as the determinant of their consumption. In addition, he advanced what he called a ‘fundamental psychological law’ that consumers increase their consumption by less than their increase in their incomes. These two assumptions translate into the Keynesian Consumption Function.

\[ C = C(Y) \]

where \( dC/dY > 0 \) and \( dC/dY < 1 \)

A simple linear consumption function can hence be written as

\[ C = \bar{C} + mpcY \]
Where \( mpc = \frac{dC}{dY} \) = marginal propensity to consume and \( \overline{C} \) = autonomous consumption.

**Equilibrium in the economy**

Keynes said that entrepreneurs will increase output only if the increase in output is profitable. The entrepreneurs expect a certain amount of proceeds from a given level of employment (or output) that will maximize their profits. Hence their ‘planned’ output must be validated by proceeds from the demand side of the economy. For entrepreneurs planned expansion of output must be equal to expected expansion of demand. This condition can be represented graphically in Expenditures-Output space as the 45 degrees line.

![Expenditures-Output Diagram](image)

where \( \forall Y \) along the 45-degree line, planned output = actual expenditures by economic agents. Assuming for now that the only expenditure in the economy is aggregate consumption, then if we superimpose Keynes’s consumption function on the graph then we have equilibrium at \( Y_E \) where

\[
\text{Planned expenditures} = C(Y) = \text{planned output}
\]
The equilibrium output has three properties:

1) At $Y_E$, entrepreneurs attempting to push output beyond $Y_E$ will face the fact that actual proceeds ($\Delta Y$) is smaller than expected proceeds ($\Delta Y$) and hence expansion is not profitable and will not be pursued by the entrepreneurs. The reason for this result is that ($mpc < 1$ or $dC/dY < 1$).

2) $Y_E$ is not necessarily $Y_f$. The equilibrium output in the economy is not equal to full employment output necessarily. The equality between planned output & consumption can happen below $Y_f$.

3) $Y_E$ is stable & there is no automatic adjustment mechanism by which $Y_E \rightarrow Y_f$. We have seen from (1) that $Y$ cannot go beyond $Y_E$. Now, if $Y < Y_E$ then there are profit opportunities for entrepreneurs where the proceeds from $\Delta Y > 0$ exceed the expected proceeds and hence profits would increase if $y$ is increased $\Rightarrow$ entrepreneurs $\rightarrow \Delta Y > 0$ until $Y = Y_E$. Now if $Y_f > Y_E$ then according (1), the private ownership economy cannot push $Y \rightarrow Y_f$. 
Investment and Full Employment

In a closed capitalist economy with no government, the other component of aggregated demand is investment or the purchase of capital goods. Hence, in the closed capitalist economy, investment is the part of aggregate demand that will could potentially fill the gap between \( Y_f \) and \( Y_E \). For Keynes, investment, as we will see later, has a complex set of determinants. Given a rate of investment demand \( I \), there is no guarantee that investment is enough to fill this gap. The equilibrium condition becomes

\[
\text{Planned Expenditures} = C + I = \bar{C} + mpcY + \bar{I}
\]

Graphically, planned expenditures now intersect the 45 degree line giving an equilibrium output \( Y'_{E} \).

Again, most of the times the equilibrium output is less than full employment output unless investment demand happens to fill in the output gap between \( Y'_{E} \) and \( Y_f \). For any level of output beyond \( Y_E \), the output gap has a corresponding expenditures gap

\[
\text{Expenditures Gap} = \Delta Y - mpc\Delta Y
\]

Since as output increases, consumption increases but by a lesser amount as we established earlier, then at any level of output beyond \( Y_E \), investment must fill this expenditures gap.
Now, to achieve full employment, then investment must be equal to
\[ I = (1 - mpc)(Y_f - Y_E) \]

since the output gap is \( \Delta Y = Y_f - Y_E \).

Now since I is autonomous, there is no mechanism in the economy that will insure that investment demand is equal to \( (1 - mpc)(Y_f - Y_E) \). In the Keynesian model, the normal state of affairs in the capitalist economy is then a state of underemployment equilibrium.

**Solved Problem 3.1.** Suppose that \( C = 100 + 0.8Y \)

a) Derive \( Y_E \).

The equilibrium condition is
\[ Y = C \]
\[ Y = 100 + 0.8Y \]
\[ \Rightarrow (1 - 0.8)Y = 100 \]
\[ \Rightarrow Y_E = 500 \]

b) If \( Y_f = 700 \) & \( I = 20 \). Is I enough to fill the gap needed for \( Y_E = 700 \)?

There are two ways to solve this problem. First, by calculating the expenditures gap which is:
\[ \text{Gap} = (1 - mpc)(Y_f - Y_E) = (1 - 0.8)(700 - 500) = (0.2)(200) = 40. \]

Since \( I = 20 < 40 \Rightarrow \) answer is No.

Or, calculating the equilibrium output with \( I = 20 \) we get,
\[ Y'_E = (1 - mpc)(\bar{C} + I) = (1 - 0.8)(100 + 20) = 5(120) = 600 \]

where \( Y'_E < Y_f \Rightarrow \) answer is no.
c) By how much should investment increase to generate full employment? 
Answer: \( \Delta I = 20 \)

**Effects of the marginal propensity to consume on output & fluctuations**

As we have seen in solved problem 3.1, the Keynesian equilibrium can be written as the familiar multiplier model

\[
Y_E = \frac{1}{(1 - mpc)}(\bar{C} + I)
\]

since the equilibrium condition

\[
Y = C + I
\]

\[
Y = \bar{C} + mpcY + I
\]

\[=> (1 - mpc) Y = \bar{C} + I \]

\[=> Y_E = (\bar{C} + I)/1 - mpc \]

where \(1/(1 - mpc) = \text{multiplier} \)

1) If mpc is \(\approx 1\), then small \(\Delta I \rightarrow \text{large } \Delta Y\) since \(\Delta Y = (1 / 1 - mpc)\). At the same time, the \(I\) needed to fill the gap is small.
2) If $mpc = \epsilon$ (small) then small $\Delta I \rightarrow$ small $\Delta Y$, but $I$ needed to fill the gap is very large. In actual economies, $mpc$ is somewhere in between where fluctuations in output are considerable & $I$ needed to fill the gap is large.

**Solved Problem 3.2** Suppose we have an economy with two possible marginal propensities to consume.

$C_A = 100 + 0.9Y$

$C_B = 100 + 0.8Y$

$Y_f = 2000 = full \ employment \ output$

a. Derive the gap in both cases

b. If investment was originally 10% of output, show the effect on output of a 10% drop in investment in both cases.

a) The equilibrium output in case A is

$C_A = Y$

$100 + 0.9Y = Y$

$\Rightarrow Y_E = 1000$

$\Rightarrow$ Output gap $= Y_f - Y_E = 2000 - 1000 = 1000$

& Investment gap $= 0.1(1000) = 100$

The equilibrium output in case B

$C_B = 100 + 0.8Y = Y$

$\Rightarrow Y_E = 500$

Output gap $= 1500$ & Investment gap $= (1 - 0.8)(1500) = (0.2)(1500) = 300$

b) If $= 0.1 Y_E$, then $I_E = (0.1)(1000) = 100$

For $I_A = 100, Y_E = 2000$. Hence $\Delta I_A = -10$
& \Delta Y = (1/1 - mpc)(\Delta I) = (10)(-10) = -100

and \Delta Y/Y = -100/2000 = -5%.

If I = 0.1Y_E, then I_B = (0.1)(500) = 50 & Y_E = (1/1 - mpc)(100 + 50) = 5(150) = 750. Hence \Delta I_B = -5 and \Delta Y = (1 - mpc)\Delta I = 5(-5) = -25 => \Delta Y/Y = -25/750 = -3.33%.

The Saving-Investment in the Keynesian Model

The Savings function in the Keynesian model can be derived as follows

\[ S = Y - C \]
\[ = Y - \bar{C} - mpcY \]
\[ = -C + (1 - mpc)Y \]

or

\[ S = -\bar{C} + mpsY \]

where \( mps = 1 - mpc \) = marginal propensity to save. Now the equilibrium condition in the economy can be written:

\[ S(Y) = I \]

Hence, in the Keynesian model, the variable that equilibrates, investment & savings is not the interest rate (r) but output (Y).
The Paradox of Thrift

The Classical economists have repeatedly stressed the importance of thrift in the economy. It is argued that when individuals save, the foregone future consumption is translated automatically into investment and the accumulation of capital would increase productivity in the long-run and improve the standards of living as measured by per capita GDP. What would be the effects of an increased savings in the Keynesian model?

In the Keynesian model, suppose that consumers decide to save more (say by reducing $C$) then the new savings function is

\[ S' = -C' + mpsY \]

The new equilibrium is

\[ S' = I - C' + mpsY = I \]

\[ Y'_{E} = (1/mps)(C' + I) \]

Since $C' < \bar{C}$ then $Y'_{E} < Y_{E}$

Hence, when households decide to save more, output goes down. How about saving?

Given $S = -\bar{C} + mpsY$
\( \Delta S = - \Delta \bar{C} + mps \Delta Y \)

but from the multiplier

\[ \Delta Y = \left(\frac{1}{mps}\right) \Delta \bar{C} \]

\[ \Rightarrow \Delta S = -\Delta \bar{C} + \left(\frac{1}{mps}\right) \Delta \bar{C} (mps) \]

\[ \Rightarrow \Delta S = 0. \] Hence, the equilibrium savings did not change. As households tried to increase their savings, this led to a reduction in output such that \( \Delta S = 0 \). Graphically, this can be seen as

Solved problem 3.3 Suppose there is an economy with \( mpc = 0.75, \bar{C} = 100 \); \( I = 200 \).

a) Derive the savings function.

\[ S = Y - C = Y - \bar{C} - mpcY \]
\[ S = Y - 100 - 0.75Y \]

\[ \Rightarrow S = -100 + 0.25Y \]

b) Calculate equilibrium output & savings.

\[ S = I - 100 + 0.25Y \]

\[ = 200 \Rightarrow 0.25Y = 300 \]
\[ Y = \left( \frac{1}{0.25} \right)(300) = 1200 \]

& \[ S = -100 + 0.25(1200) = 200 \]

c) Calculate new savings & equilibrium output if households attempt to save more by reducing \( \bar{C} \) to 50.

\[ S' = -50 + 0.25Y \]

\[ S' = I - 50 + 0.25Y = 200 \]

\[ \Rightarrow Y = \frac{250}{0.25} \]

\[ \Rightarrow Y_E = 1000 \]

\[ S' = -50 + 0.25(1000) \]

\[ \Rightarrow S' = 200 \]
Fiscal policy in the Keynesian Model

We have seen that in the normal state of affairs, the capitalist economy will generate a state of underemployment equilibrium ($Y_E < Y_f$). This is resultant from the insufficiency of investment demand needed to generate full employment. Moreover, there is no automatic adjustment mechanism that would push the economy from $Y_E$ to $Y_f$. Keynes said that government through expenditures $G$ is the only centralized economic agent that can bring the economy out of its underemployment equilibrium. So far our model has no government; hence the multiplier model has to be rewritten to include government expenditures. In the savings-investment equilibrium and assuming that $T = 0$ then

$$S_{total} = -\bar{C} + mpsY + (0 - G) = I$$

$$=> mpsY = \bar{C} + G + I$$

$$=> Y_E = \left(\frac{1}{1 - mpc}\right)(\bar{C} + G + I)$$

Hence, an increase in $G$ will cause equilibrium output to increase. If initially, $Y_E$ is such that $Y_E < Y_f$ which means that investment demand ($I$) is not enough to fill the gap then $G$ can fill this gap. Graphically, this can be represented as:
Given $C + I => Y_E < Y_f$

Given $C + I + G => Y_E = Y_f$

**Solved problem 3.4** Suppose economy in problem 4.3. In addition the government spends $50.

a) Calculate new output from the multiplier model.

$$Y_E = \left( \frac{1}{1 - mpc} \right) ( \bar{C} + I + G )$$

$$= \frac{1}{0.25} (100 + 200 + 50)$$

$$= (4)(350) = 1400$$

b) If $\Delta G = 25$, calculate new equilibrium output.

$$\Delta \frac{\Delta Y}{\Delta G} = \left( \frac{1}{1 - mpc} \right) \Delta G$$

$$= (4)(25)$$

$$=> \Delta Y = 100$$
Problems

1. In the multiplier model developed in the chapter, we have assumed a closed economy. In an open economy with exports and imports, the multiplier is smaller than in a closed economy. Show that assuming that exports $X$ are autonomous and imports $M$ are given by

$$M = \bar{M} + mY$$

Where $\bar{M}$ = autonomous imports and $m$ = marginal propensity to import.

2. In the multiplier model in the chapter with government, we have assumed that there are no taxes. Derive the equilibrium output (the multiplier) in the case where taxes are given by

$$T = \bar{T} + tY$$

Where $\bar{T}$ = lump-sum taxes and $t$ = tax rate and $0 \leq t \leq 1$.

3. Show the paradox of thrift when investment is not autonomous but given by

$$I = \bar{I} + \alpha Y.$$  

Comment.

4. Suppose there is an economy with $mpc = 0.8$, $C = 100$; $I = 100$.

a. Write down the savings function.

b. What is equilibrium output?

c. If individuals wanted to save more by reducing $mpc$ to 0.75, what happens to output and savings? Comment.
5. In a New York Times article, Paul Krugman introduced a Keynesian model to explain why a coordinated European fiscal stimulus will have a larger impact on GDP than individual European countries acting alone. He assumed the following:

i. for every Euro spent by consumers or government, \( m \) goes to imports (not part of GDP—leakage)

ii. \( t = \) share of GDP that goes to government in taxes (hence total tax \( T = ty \))

iii. \textit{Marginal propensity to consume} = 0.5 on average for each European country and for Euro zone as a whole.

iv. \( m = 0.4 \) for average European country, \( t = 0.4 \).

v. For Eurozone \( m = 0.13 \) (since 2/3 of all imports are from other European countries), \( t = 0.4 \).

Prove Krugman’s hypothesis that each extra euro spent by government in a coordinated way at the European level has a higher impact on GDP than disconcerted individual country efforts.