Objectives:

- To understand the factors which determine the level of output in the short-run.

- To learn how, in the short run, the level of interest rates [*r*] both influences, and is influenced by, the level of real GDP [*Y*].

I. The Economy in the Short-run: An Introduction to Economic Fluctuations

1. Short-run versus long-run macroeconomic behaviour

Many key macroeconomic variables (e.g real GDP, unemployment) behave differently in the short run (e.g. from year to year) than in the long run (e.g. over a decade) or very long run (e.g. over many decades).

- in the (very) long run output and employment trend upwards (***economic growth***)
- in the short run output and employment fluctuate around trend in a pattern which is recurrent but neither regular nor predictable (the ***business cycle***).

- in the **long run** output is determined by the available supplies of the factors of production and the technology of production;
- in the **short run** output responds to variations in aggregate demand for goods and services.

2. Price flexibility and inflexibility

Most macroeconomists believe that observed differences in macroeconomic behaviour between the short run and the long run result from differences in the behaviour **prices.**

- In the long run, prices (of both final products and factors of production) are **flexible** and respond to variations in demand and supply;
- in the short run many prices are **"sticky"** at predetermined levels.

  While some prices (e.g. retail gasoline) can change daily, most prices are changed relatively infrequently.

  The causes of short-run price stickiness vary and include:
  - costs of price adjustment (called "menu costs");
  - contracts (both explicit and implicit)
  - reluctance to be the first, among competitors, to change price (called "coordination failure").

3. A short-run aggregate demand and supply model

In chapters 10 and 11, we utilize a (Keynesian) model of short run output determination based on two key assumptions about aggregate supply:

- **all** prices are **stuck** at predetermined levels in the short run and, hence, there is **a given, predetermined value of the aggregate price level**, denoted as $\overline{P}$;
- firms are willing to produce and sell **as much output** as buyers are willing to buy at given prices.

II. <u>The Keynesian-Cross Model of Output Determination</u>.

- the simplest interpretation of Keynes's theory of short-run output determination;
- ignores the impact of interest rates and monetary policy;
- is a building block for the more complex and realistic IS-LM model.

1. The determinants of planned expenditure *[PE*] in the Keynesian-Cross model.

Assume a closed economy: NX=0 and so:

$$PE = C + I + G$$

Consumption [C] is an increasing function of aggregate disposable income [Y-T]:

$$C = C(Y - T)$$

$$0 < \text{MPC} < 1, \quad \text{MPC}=\Delta C/\Delta(Y-T)$$

Planned investment spending is assumed to be an *exogenous* variable whose value is determined outside the model:

$$I = \bar{I}$$

Both govt. spending on output and taxes are assumed to be *exogenous*, determined outside the model by fiscal policy:

$$G = \overline{G}$$
$$T = \overline{T}$$

2. The planned expenditure function.

$$PE = \quad C \quad + \quad I \; + \; G$$

$$PE = C(Y - \bar{T}) + \bar{I} + \bar{G}$$

Planned aggregate expenditure is a function of:

- real GDP [Y];
- exogenous level of planned investment spending [$\bar{I}$]; and
- exogenous fiscal policy variables [$\bar{G}$ and $\bar{T}$].

3. The planned expenditure curve.

It shows how PE varies with Y when $\bar{I}$, $\bar{G}$, and $\bar{T}$ are **held constant.**

- PE increases with Y *because C increases with Y*:

$$Y\uparrow \rightarrow (Y - \bar{T})\uparrow \rightarrow C\uparrow \rightarrow PE\uparrow$$

The **slope** of the PE curve equals the **MPC:**

$$Slope = \frac{\Delta E}{\Delta(Y - \bar{T})} = \frac{\Delta E}{\Delta(Y - \bar{T})} = MPC$$

4. The equilibrium of the economy.

Definition: ***The level of Y such that Y = PE is called the <u>equilibrium</u> level of output, Y_e***

The process of adjustment to equilibrium.

Suppose, initially, $Y = Y_1 > Y_e$

When $Y = Y_1$, $PE = PE_1 < Y_1$. Firms are selling less than they are producing. Unsold output results in ***unplanned inventory accumulation.***

Adjustment mechanism: unplanned inventory increase → firms reduce production → Y falls
unplanned inventory decreas → firms increase production → $Y\uparrow$

So: firms react to this unplanned inventory build-up by ***reducing*** production levels to match demand:

Y falls **until** ***Y = PE.***
Output falls until actual expenditure = planned expenditure

Why is *Y* equal to actual expenditure? Because actual expenditure includes both planned and unplanned changes in inventories. In a closed economy, whatever is produced can be:

- Bought by consumers
- Bought by government
- Bought for investment purposes (this is planned investment)
- and whatever is left over ends up in inventory

Note: as *Y* falls, *PE* falls as well. But *Y* falls faster: *PE* falls by the decrease in *Y* times the marginal propensity to consume:

$$\Delta PE = MPC \cdot \Delta(Y - \overline{T})$$

At home: analyse what happens when $Y = Y_1 < Y_e$

6. Analysis of various changes.

We will always start initially in equilibrium at point A where:

$$Y = Y_e = PE$$

A) An increase in $\overline{G}$.

$\overline{G} \uparrow \Rightarrow$ PE $\uparrow \Rightarrow PE > Y_1$
$\Rightarrow$ unplanned inventory drop
$\Rightarrow$ firms react by producing more
$\Rightarrow Y\uparrow$
$\Rightarrow C\uparrow$ $[\Delta C = MPC \cdot \Delta(Y - \overline{T})]$
$\Rightarrow PE\uparrow$ $[\Delta E = \Delta C + I + G]$
$\Rightarrow$ both $Y\uparrow$ and $E\uparrow$ but *Y* rises faster
until $Y = Y_2 = PE_2$

The government purchases multiplier:

- Initial increase in $\overline{G}$ raises output by the same amount;
- as $Y\uparrow$consumption rises as well, increasing Y further;
- So: final increase in Y exceeds the initial increase in $\overline{G}$.

Def: ***The govt. purchases multiplier is the amount by which equilibrium Y changes, following a one-unit increase in*** $\overline{G}$ ***:***

Govt. purchases multiplier $= \dfrac{\Delta Y}{\Delta \overline{G}}$

Deriving the multiplier.

$$Y_e = C(Y_e - \overline{T}) + \bar{I} + \overline{G}$$

After an increase in $\overline{G}$:

$$\Delta Y_e = MPC\ \Delta Y_e + \Delta \overline{G}$$

$$\Delta Y_e (1\text{-}MPC) = \Delta \overline{G}$$

$$\Delta Y_e = \frac{\Delta \overline{G}}{(1 - MPC)}$$

$$\frac{\Delta Y_e}{\Delta \overline{G}} = \frac{1}{(1 - MPC)}$$

The larger [smaller] is the MPC the larger [smaller] is the multiplier of equilibrium income with respect to a change in govt. spending.

B) A decrease in taxes.

A drop in taxes raises consumption at each level of Y by - MPC·$\Delta \overline{T}$

A tax cut of \$1.00 has the same effect on Y_e as an increase in $\overline{G}$ equal to MPC·\$1

The tax multiplier formula:

We have: $Y_e = C(Y_e - \overline{T}) + \overline{I} + \overline{G}$

After an increase in $\overline{T}$:

$$\Delta Y_e = MPC\,\Delta Y_e - MPC\,\Delta \overline{T}$$

$$\Delta Y_e (1\text{-}MPC) = - MPC\,\Delta \overline{T}$$

$$\Delta Y_e = \frac{-\,MPC\,\Delta \overline{T}}{(1\text{-MPC})}$$

$$\frac{\Delta Y_e}{\Delta \overline{T}} = \frac{-\,MPC}{(1 - MPC)}$$

The multiplier in practice.

- MPC for Canada = 0.75. So, by our simple formula: 1/(1-MPC)=4.

But in fact the multiplier is considerably lower than that due to two factors which are ignored by our simple formula:

(a) As income increases, disposable income increases less because income taxes increase and subsidies fall

$Y \uparrow$ by \$1 $\rightarrow$ $T \uparrow$ by \$0.4 (taxes increase by \$0.25, subsidies fall by \$0.15)

We can write it as: $T=T_0+0.4Y$. So:

$$PE = C[Y - (T_o + 0.4Y)] + \overline{I} + \overline{G}$$

So: if $Y\uparrow$by \$1 $\rightarrow$ disposable income (Y-T) $\uparrow$ by 60 cents only

(b) Part of the extra spending is on **imports**:

75 cents of each \$1↑ in disposable income is spent, but only 75% of that increased spending is on Canadian-produced output, with 25% on imports.

We can write it as:

$$NX = EX - IM_0 - 0.25[Y - (T_0 + 0.4Y)]$$

Inserting into the equation for *PE:*

$$PE = C[Y - (T_o + 0.4Y)] + \bar{I} + \bar{G} + NX$$

$$PE = C[Y - (T_o + 0.4Y)] + \bar{I} + \bar{G} + EX - IM_0 - 0.25\left[Y - (T_0 + 0.4Y)\right]$$

$$PE = 0.75C[Y - (T_o + 0.4Y)] + \bar{I} + \bar{G} + EX - IM_0$$

So the effect of an increase in Y by \$1 on aggregate expenditure is, since the *MPC* is 0.75:

$$0.75 \text{ x } \quad 0.6 \text{ x } 0.75 = 0.34$$

Imposing in equilibrium PE= Y_e. So if $\bar{G}$ changes:

$$\Delta Y_e = \quad 0.75MPC\ \Delta Y_e(1\text{-}0.4) \ + \Delta \bar{G} = 0.34\Delta Y_e + \Delta \bar{G}$$

So the multiplier is 1/(1-0.34) = 1.5

Below we will abstract from the effect of income on taxes and on imports.

III. <u>The IS Curve.</u>

We will now develop the **IS-LM model**.

The Keynesian- cross is the basis for IS curve which shows the equilibrium in the goods market.

To obtain - replace the assumption of exogenous investment with the investment function.

1. The investment function.

$$\boldsymbol{I = I(r),} \quad \text{where: } r\uparrow \rightarrow I\downarrow$$

2. Planned expenditure and the interest rate.

The **NEW** planned expenditure function is:

$$PE = C(Y - \overline{T}) + \boldsymbol{I(r)} + \overline{G}$$

With Y, $\overline{T}$, and $\overline{G}$ held constant:

If r increases, I falls and PE falls

3. DEF: ***The IS curve shows combinations of r and Y for which there is equilibrium in the output market of the economy in the sense that output [Y] equals planned expenditure [E] (for given values of the fiscal variables G and T).***

WARNING

In what follows we will **NOT** be talking about the equilibrium level of income. We will be talking about the level of income needed for **equilibrium in the goods market only.**

Equilibrium level of income will involve:
- equilibrium in the goods market
- equilibrium in the money market.

So - the discussion now is half of the story only.

4. Graphical derivation of the IS curve.

5. Slope of the IS curve.

IS - **negatively (downward) sloped**

IS will be **flatter** the **more responsive is *I* to a change in *r***:

If investment is very responsive to changes in r then when r decreases a large change in Y will be required to restore $Y = PE$; so IS will be **flat.**

6. Fiscal policy and shifts in IS.

A drop in $\overline{T}$ or an increase in $\overline{G}$ **shifts IS to the right**; rise in $\overline{T}$ or a decrease in $\overline{G}$ **shifts IS to the left.**

Horizontal size of the shift = the initial change in G or in T times the appropriate (Keynesian-cross) multiplier.

When $\overline{G}$ increases the IS curve shifts right by a distance: $\Delta Y = \dfrac{\Delta \overline{G}}{(1 - MPC)}$

When $\overline{T}$ decreases the IS curve shifts right by a distance: $\Delta Y = \dfrac{-MPC\Delta \overline{T}}{(1 - MPC)}$

Note: the minus means that a decrease in taxes shifts IS right

IV. The LM Curve.

1. The supply of money.

Def*: **Supply of money = the amount of money in circulation***.

Nominal money supply (M^s) = actual supply;

Real money supply $(M/P)^s$ = nominal money supply divided by the price level.

M^s is an **exogenous** variable - determined by the Bank of Canada:

$$M^s = \overline{M}$$

In the IS-LM model the price level is also an exogenous variable:

$$P = \overline{P}$$

Hence, the real money supply is an exogenous variable:

$$(M/P)^s = \overline{M} / \overline{P}$$

2. The demand for money.

Def: ***Demand for money = the amount of money Canadians <u>wish</u> to hold*.**

- **Nominal** money demand (M^d) = actual dollar demand;
- **Real** money demand $(M/P)^d$ = nominal money demand divided by the price level.

The real demand for money depends on the nominal interest rate and the level of income.

(a) **Higher nominal interest rate** →higher (opportunity) cost of holding money →lower money demand (note: money pays no interest):

$$i \text{ increases } \rightarrow (M/P)^d \text{ falls}$$

Since the price level is fixed, the rate of inflation is zero and so **the nominal and real interest rates are equal.**

We will use below r to denote the interest rate, to make it comparable to investment

(b) **Higher income** → more transactions → higher money demand:

$$Y \text{ increases } \rightarrow (M/P)^d \text{ increases}$$

The dependence of $(M/P)^d$ on Y and r is summarized by the ***money demand function L( )***:

$$\boldsymbol{(M/P)^d = L(r,Y)}$$

3. The (Keynesian) liquidity preference theory of interest rates.

The interest rate [r] is determined at the level which *equilibrates the money market* by equating the [aggregate] **demand for money** to the [aggregate] **supply of money**.

- A fall in the money supply reduces supply. The money supply curve shifts left. The interest rate increases to equate demand to supply.
- An increase in Y raises the money demand. The money demand curve shifts right. The interest rate increases to equate demand to supply.
- An increase in r means movement along the given demand for money curve (since r is on the vertical axis). There is no shift in the graph.

4. The LM curve

Def: ***LM curve shows combinations of r and Y such that there is equilibrium in the money market (demand for money = supply of money) for a given supply of money.***

5. Deriving the LM Curve.

LM is upward sloped because, at higher income, a higher interest rate is **<u>needed for the money market equilibrium</u>**

6. Shifts of LM.

If real **money supply** $\overline{M} / \overline{P}$ **falls**, **→LM shifts UP;**

if real **money supply rises**, **LM shifts DOWN.**
If Y or r change – movement along a given LM curve, since Y is on the horizontal axis and r is on the vertical axis

V. The Full IS-LM Model.

Def.: ***The IS-LM model is a short-run model of income and interest rate determination with prices fixed.***

Consists of two equations in two unknowns or endogenous variables:

IS: $Y = C(Y - \overline{T}) + I(r) + \overline{G}$

LM: $\overline{M} / \overline{P} = L(r, Y)$

Endogenous variables: $r,\ Y$.

Exogenous variables: $\overline{G}, \overline{T}, \overline{M} / \overline{P}$

The IS-LM Diagram: At the intersection of the two curves both markets are in equilibrium and we get equilibrium values of Y and r.