Objectives:

- To apply IS-LM analysis to understand the causes of short-run fluctuations in real GDP and the short-run impact of monetary and fiscal policies on the economy.
- To use the IS-LM model to analyse and compare the short-run and long-run effects of demand shocks and monetary and fiscal policies on the economy.
- To use the IS-LM model to study the Great Recession

I. Explaining Short-run Fluctuations with the IS-LM Model.

1. Changes in fiscal policy.

(a) The short-run effects of an increase in govt. spending ($\Delta \overline{G}$)

Assume economy initially in equilibrium at point A, where $Y = Y_1$ and $r = r_1$.

Then $\overline{G}$ increases (with no change in any other exogenous variable).

IS shifts right by a horizontal distance equal to $\dfrac{1}{(1 - MPC)} \Delta \overline{G}$

New short-run equilibrium is at point B where $Y = Y_2 > Y_1$ and $r = r_2 > r_1$.

Explanation:

Goods market:

Here – recall the Keynesian cross:

When $\overline{G}$ increases, planned expenditure rises
So inventories fall
So firms increase production
So Y increases

Money market:

Here – recall the liquidity preference
As Y increases demand for money rises
Since supply of money is constant, equilibrium interest rate rises

Crowding out.

We say government spending crowds out private spending if an increase in $\overline{G}$ leads to a decrease in some part of private expenditure.

In the IS-LM model an increase in $\overline{G}$ increases income which causes an increase in interest rates which, in turn, lowers investment spending.

Hence, an increase in *G* reduces (or "crowds out") some amount of *I*.

The crowding-out effect will be **larger** the more interest rates rise as *Y* increases (i.e the **steeper the LM** curve) and the more investment spending falls as *r* increases (i.e. the **flatter the IS** curve).

Note the "vanishing" government purchases multiplier. IS shifts right by $\Delta \overline{G}$ /(1-MPC) but the equilibrium level of income increases by less than this:

- much less - if IS is **flat** or LM is **steep**
- not much less - if IS is **steep** or LM is **flat**

(b)   The short-run effects of a decrease in taxes ($\Delta \overline{T}$)

Assume economy initially in equilibrium at point A, where $Y = Y_1$ and $r = r_1$.

Then $\overline{T}$ decreases (with no change in any other exogenous variable).

IS shifts right by a horizontal distance equal to $-\dfrac{MPC}{(1-MPC)}\Delta \overline{T}$

- why the minus? Because a **decrease** in taxes shifts IS **right**
- why the *MPC* in the numerator? Because a reduction in taxes increases consumption by *MPC* times the reduction in taxes

New equilibrium is at point B where $Y = Y_2 > Y_1$ and $r = r_2 > r_1$.

Explanation:

Goods market:

Here – recall the Keynesian cross:

> When $\bar{T}$ increases, disposable income rises and consumption increases. So planned expenditure increases
> So inventories fall
> So firms increase production
> So Y increases

Money market:

Here – recall the liquidity preference
> As Y increases demand for money rises
> Since supply of money is constant, equilibrium interest rate rises

As for increase in government spending, the impact on equilibrium Y of a cut in taxes is reduced by the crowding-out effect; the tax multiplier is lower in the IS-LM model than in the Keynesian-cross model.

Conclusion: **expansionary fiscal policy raises output and interest rates**.

2. Changes in Monetary Policy: short-run effects of an increase in money supply ($\Delta \bar{M}$)

Assume economy initially in equilibrium at point A, where $Y = Y_1$ and $r = r_1$.

Then $\bar{M}$ increases (with no change in any other exogenous variable).

> ($\bar{M}/\bar{P}$) increases (since the price level is fixed) and LM shifts down or to the right.

> New equilibrium is at point B where $Y = Y_2 > Y_1$ and $r = r_2 < r_1$.

Explanation:

Now- start with the **money market**

As $\bar{M}$ increases, $\bar{M}/\bar{P}$ increases
> So supply for money exceeds demand for money
> So the interest rate falls

Goods market

As the interest rate falls, investment increases
So planned expenditure rises
So inventories fall
So firms increase production
So Y increases

Conclusion: **expansionary monetary policy lowers interest rates and increases income.**

3. **Monetary and Fiscal Policy Interactions.**

The effects of expansionary fiscal policy (higher $\overline{G}$ or lower $\overline{T}$) on Y, r depends on what Bank of Canada does:

(a) If it does nothing Y increases, r increases
(b) It may keep r constant by increasing the money supply
(c) It may keep Y constant by reducing the money supply

4. **Shocks in the IS-LM Model.**

Shocks to the IS curve - exogenous shocks to demand for goods and services
- wave of pessimism - I falls as business confidence falls- IS shifts left
- stock market crash – C falls as consumer wealth and confidence falls - IS shifts left (down)

Shocks to the LM curve - exogenous changes in the demand for money
- worries about security of holding wealth in less liquid forms leads to exogenous increase in money demand – LM shifts up (left)

Monetary and fiscal policies can be used to offset the impact of demand shocks:

- 1987 stock market crash - reduced consumer spending
  the US Federal Reserve Board adopted expansionary monetary policy:
  leftward shift of IS curve offset by rightward shift of LM curve.

- In 2001 - a sharp decline in investment demand (as the "irrational exuberance" and overoptimism of the late 1990s gave way to realism) sent the US economy into recession. In response, the Federal Reserve expanded the money supply and aggressively lowered interest rates. In addition, President Bush, who took office in early 2001, cut taxes and increased spending (particularly after 9/11). The US govt. budget went from surplus in

2000 to deficit in 2001 and 2002. The result was that the initial leftward shift of the IS curve (fall in investment) was offset by a rightward shift of the LM curve (increase in the money supply) and rightward shift of the IS curve (lower taxes and higher government spending)

5. Limits to macroeconomic policy

Delay in recognizing recession.

- Macroeconomic data are available with a delay (around 2 months)
- Do not want to react to every drop in output
- Operational definition: recession means at least two quarters of falling output

Example: NBER business cycle dating (http://www.nber.org/cycles.html)

- The June 2009 trough was announced September 20, 2010.
- The December 2007 peak was announced December 1, 2008.
- The November 2001 trough was announced July 17, 2003.
- The March 2001 peak was announced November 26, 2001.

Average delay – over a year

Both monetary and fiscal policy work with lags.

Inside lag: the lag between a shock and policy response
Outside lag: time between implementing policy and effect on the economy
These lags are long and variable; we will talk about them in more detail later.

Tax cuts and the life-cycle – permanent income considerations.

Permanent tax cuts – expensive – lead to large deterioration of government fiscal situation.
Example: reduction of GST; Bush tax cuts
Temporary tax cuts – little effect on wealth (or a transitory increase in disposable income) so most is saved, consumption increases little.

Sum up:

- Because of lags, fiscal and monetary policies are implemented long after a recession starts.

II. The aggregate demand (AD) – aggregate supply (AS) model (this is based on chapter 9)

This is a simple model which shows the relationship between the short and the long run.

Prices:

- In the short-run **prices are sticky. We assume an extreme case: prices are constant. The price level is stuck** at some pre-determined level [$\overline{P}$].
  Note: we will make an exception for a shock to firm costs. If costs increase or decrease, firms will adjust prices accordingly.
- In the long run prices are flexible.

Output:

- In the short run **firms adjust output to match demand** at constant prices.
- In the long run **output is equal to its natural level**; with full employment of labour and capital.

Equilibrium:

- Requires aggregate demand in the economy equals aggregate supply.

1. The aggregate demand curve.

Definition: the aggregate demand (AD) curve shows the relationship between total demand and the price level.

For now we will derive it from the Quantity Theory equation:

$$MV = PY$$

With *M* and *V* constant, we get:

$$Y = \frac{1}{P} MV$$

Why is *Y* decreasing in *P*?

With given *MV* the value of transactions is constant. So if each transaction requires more dollars(higher *P*) then the number of transactions has to decrease.

As the graph of the AD curve has *Y* on the horizontal axis, we will write the AD curve as:

$$P = \frac{1}{Y} MV$$

2. Shifts in the AD curve

- AD shifts to the right if *MV* increases

3. Aggregate supply in the short run: the SRAS curve.

Short-run Aggregate Supply curve (SRAS): relationship between price level and output in the short run.

We assume that in the short run prices are constant and firms adjust output to meet demand – no capacity constraints.

- So: SRAS is horizontal: firms supply any amount at the constant price level.

4. Equilibrium in the short run

- It is at the intersection of SRAS and AD.

5. Changes in the short-run equilibrium

- **Demand shocks:** Higher *M* or *V* shift the AD to the right;
  Y increases, the price level does not change.

- **Supply shocks:** A supply shock (higher price of oil, an increase in wages due to strikes)
  requires firms to change prices.
  SRAS shifts up
  P increases; *Y* falls

6. The economy in the long run.

We concentrate on the short – run behaviour in the course; now we briefly summarize the behaviour of economy in the long run.

(a)   Growth.

In the long run output grows for two reasons:

- Technological progress: with the same amount of inputs more output is produced
- More inputs: the amount of labour and capital (including human capital) increases

Below we will abstract from economic growth. You can think of the discussion below as

referring to deviations from the growth path.

(b)   Utilization of factors of production.

In the long run, factors of production are fully utilized: there is full employment, and capital is fully utilized.

But that does not mean there is no unemployment and every machine is used all the time. In practice, this means about 6% unemployment (the natural unemployment rate in Canada) and about 12% spare capacity.

Why:

- unemployment: people move between jobs, enter the labour market, some firms go bankrupt. Finding a new job takes time.

- Spare capacity: machines break, demand varies. Firms keep spare capacity to replace broken machines or to be able to meet demand.

So, in the long run, output depends on the availability of factors of production:

$$Y=F(K, L)$$

We will assume growth away. So technology does not change, the amount of capital and labour is constant and so output is constant.

$$\bar{Y} = F(\bar{K}, \bar{L})$$

where $\bar{K}$ and $\bar{L}$ are the (constant) amounts of capital and labour and $\bar{Y}$ is the full employment level of output.

(c)   Prices

- In the long – run prices are flexible.

7. Long-run aggregate supply curve (LRAS)

Definition: LRAS shows the relationship between output and the price level in the long run.

- In the long run, output is independent of the price level. So: LRAS is vertical.

8. Equilibrium in the long-run

- It is at the intersection of the LRAS and AD

9. From short run to long run

We use a simple rule:

In the long-run, **prices are flexible** and rise or fall depending on whether actual output (Y) exceeds, or is less than, full-employment, or natural, output, ($\bar{Y}$):

- $Y > \bar{Y}$: when output is **above** its natural level prices **rise**
- $Y < \bar{Y}$: when output is **below** its natural level prices **fall**
- $Y = \bar{Y}$: when output **equals** its natural level prices are **stable**

Intuition:

- if output is above full employment level, unemployment and spare production capacity are low. So workers get high wage increases, and there are sometimes shortages of supply. Both lead to firms increasing prices.
- If output is below full employment level, unemployment and spare capacity are high. So firms give workers small wage increases, and try to utilize capacity by reducing prices.

10. Short and long run effects of exogenous changes

Increase in the money supply (or velocity): AD shifts right
- SR: output increases above full employment level $\bar{Y}$. Equilibrium at the intersection of SRAS and AD
- Over time: as long as $Y > \bar{Y}$, prices increase and SRAS shifts up. Equilibrium moves along AD up and to the left
- LR: output declines back to full employment level, prices are higher.

This stresses the simple rule: an increase in the money supply does not affect output in the long run. It only affects prices.

A supply shock that increases the price level. SRAS shifts up

- SR: output falls below full employment level $\overline{Y}$. Equilibrium at the intersection of the **new** SRAS and AD
- Over time: as long as $Y < \overline{Y}$, prices fall and SRAS shifts down.
  Equilibrium moves along AD down and to the right
- LR: back to the original equilibrium.
  So what changes? Relative prices.
  Assume the supply shock was an increase in the price of oil. Over time all prices fall. This means:
  - Price of oil increases, but less than it originally went up
  - All other prices, on the average, fall
  So – the relative price of oil has increased.

11.   Changes in *M* have only temporary effects.

An increase in the money supply (or in velocity) increases output in the short run, and prices in the long run.

III.   The IS-LM Model in the Short Run and in the Long Run.

1. Deriving aggregate demand curve from the IS-LM model.

- **AD shows the set of** equilibrium **points in the IS-LM as the price level varies.**

For a given price level:
- The intersection of the IS and LM shows a point on the AD curve (the level of demand corresponding to that price level)
- As the price level changes, LM shifts and the intersection of IS and LM is at a different level of AD

Slope of the AD.

If prices increase, supply of real money balances (*M/P*) falls. LM shifts left (up) and the new LM curve intersects the IS curve at a lower level of output.

- So: AD is negatively sloped.

2.   The adjustment from a short-run IS-LM equilibrium to a long-run IS-LM equilibrium.

- Assume that the economy is initially in a short-run equilibrium at point A, where the IS and LM curves intersect to the **right** of the vertical line representing the natural level of

output, $(\overline{Y})$, which we will call "***the full-employment line***." The short-run equilibrium values of output, interest rate, and price level are $Y_1 > \overline{Y}$, r_1, and P_1.

- Because $Y_1 > \overline{Y}$, in the **long-run** when prices are flexible, P will rise, reducing the real supply of money ($\overline{M} / P$ falls) and causing the **LM curve to shift left**.

- As the price level increases, the SRAS curve shifts up. The equilibrium is at the intersection of the new SRAS and AD
  This continues as long as $Y_1 > \overline{Y}$: P increases, SRAS shifts up, LM shifts left and equilibrium moves along the AD curve left and up

- The **long-run IS-LM equilibrium** occurs at point B where IS-LM intersect on the vertical full-employment line, where: $Y = Y_2 = \overline{Y}$; $r = r_2 > r_1$; and $P = P_2 > P_1$. The final position of the SRAS curve is through point B.

3. **The short-run and long-run effects of fiscal policy in the IS-LM model.**

- Assume economy initially in long-run IS-LM equilibrium at point A where $Y_1 = \overline{Y}$, $r = r_1$ and $P = P_1$.

Then $\overline{G}$ increases (with no change in any other exogenous variable).

- IS shifts right and a new **short-run** equilibrium is reached at point B where $Y = Y_2 > \overline{Y}$, $r = r_2 > r_1$, and $P = P_1$.

- In the **long-run**, prices rise reducing the real money supply and shifting the LM curve to the left.

- The new long-run equilibrium is at point C where $Y = Y_1 = \overline{Y}$, $r = r_3 > r_2 > r_1$, and $P = P_2 > P_1$.

Conclusion: While expansionary fiscal policy raises the equilibrium level of output in the **short run,** in the **long run it has no permanent impact on output** but results only in an increase in interest rates and prices.

In the long-run the crowding-out effect of expansionary fiscal policy completely offsets the direct expansionary impact of the increase in G or cut in T.

4. **The short-run and long-run effects of monetary policy in the IS-LM model.**

- Assume economy initially in long-run IS-LM equilibrium at point A, where $Y_1 = \overline{Y}$, $r = r_1$,

and $P = P_1$.

Then $\overline{M}$ increases (with no change in any other exogenous variable).

- LM shifts right and a new **short-run** equilibrium is reached at point B where $Y = Y_2 > \overline{Y}$ $r = r_2 < r_1$, and $P = P_1$.

- In the **long-run**, prices rise reducing the real money supply and shifting the LM curve back to the left.

- The new long-run equilibrium is at point A where $Y = Y_1 = \overline{Y}$, $r = r_1$, and $P = P_2 > P_1$.

Conclusion: While expansionary monetary policy raises the equilibrium level of output in the short run, in the long run it has no permanent impact on output but results only in an increase in the price level proportionate to the increase in money supply.

The IS-LM model can be used to confirm the truth of the (classical) proposition that in the long-run money is **neutral** and changes in the money supply have **no impact on real variables**, such as output and the (real) interest rate.

IV. **Differences Between the Keynesian and Classical Models: An IS-LM Interpretation**

- Begin with the two equations of the IS-LM model:

$$Y = C(T - \overline{T}) + I(r) + \overline{G} \tag{1}$$
$$\overline{M}/P = L(r, Y) \tag{2}$$

- To complete the model we need a **third** equation.

1. **Keynesians** believe the price level is stuck. So they add:

$$P = \overline{P} \tag{3a}$$

- If $\overline{P}$ is above its long-run equilibrium value (i.e. when $P = \overline{P}$, $Y < \overline{Y}$) then output is too low and unemployment is too high and a stimulative policy is needed (increase $\overline{G}$, lower $\overline{T}$ or higher $\overline{M}$).

2. **Classical** economists believe that prices are flexible. So they add this third equation:

$$Y = \overline{Y} \tag{3b}$$

- If output is below $\overline{Y}$, prices will fall and the economy will (quickly) adjust to full employment.

3.   Reconciliation.

- In the short-run prices are sticky – the world looks Keynesian.

- In the long-run prices are flexible - the world looks classical.

IV. The Great Depression

We now will discuss the reasons for the Great Depression in the US (in Canada – it was caused by the decline of the US economy)

1. The spending hypothesis

Initial cause – contractionary shift of the IS curve.

Why?

- Stock market crash 1929 – lower wealth – lower consumption
- Drop of investment in housing: reaction to overbuilding in 1920s

Subsequently

- Bank failures
- Contractionary fiscal policy – politicians were concerned about the deficit

2. The money hypothesis

Cause – Decline in the money supply. It fell by 25% from 1929-1933. So - leftward shift in the LM curve:

Two problems:
- What matters is not nominal money supply, but real balances. Prices fell in the Great Depression so much that 1929-1931 real balances rose slightly – so cannot blame them for initial drop
  Real money balances fell in 1931-33 – so may be responsible for continuation of the Great Depression

- Interest rates fell continuously from 1929-1933

3. The effect of falling prices

Def: changes have a **stabilizing** effect if, when output is falling, they tend to increase it
                                                     rising   reduce it
Def: changes have a **destabilizing** effect if, when output is falling, they tend to reduce it further
                                                     rising   increase

Stabilizing effect:

- If the price level falls then, with constant money supply, real balances increase and LM shifts right

- Pigou effect: money is part of household assets. If the price level falls, purchasing power of money increases, raising wealth and leading consumers to spend more.

Destabilizing effect:
Unanticipated deflation - the debt –deflation theory
   (a)   Loan has to paid with money that now have greater purchasing power. Borrowers lose, lenders gain.

If lenders have a lower propensity to consume than borrowers, they increase spending by less than borrowers reduce spending so IS shifts left

   (b)   Anticipated inflation.

IS depends on the real interest rate, LM on the nominal interest rate. So draw IS-LM with nominal rate on the vertical axis.

Rewrite the equations:

IS: $Y=C(Y-T)+I(i-\pi^e) +G$
LM: $M/P=L(i, Y)$

π^e – expected inflation rate

If prices are expected to be stable then $E\pi=0$ and the two equations are as before.

Assume now $\pi^e >0$ unexpectedly. Then
         -   Real interest rate $i- \pi^e$ increases
         -   At any given **nominal** interest rate the IS curve shifts down by the amount of deflation $(-\pi^e)$

New equilibrium: the intersection of the new IS with the old LM gives output and the new

nominal interest rate; the new real interest rate is at the intersection of the vertical line above the level of output with the old IS.

Overall, as the nominal interest rate falls by less than expected inflation, the real interest rate rises, reducing planned investment

The effect of falling prices supports the money hypothesis and puts the blame on the FED: when it reduced the money supply it led to deflation which led to a leftward shift in the IS

<u>**IV. IS-LM model and the Great Recession**</u>

The crisis – fits the IS-LM

> **1.   Decline in spending**

- Drop in house prices – lower wealth – lower consumption
- Defaults – bank losses – reduced availability of credit – lower investment and purchases of consumer durables (cars, furniture, appliances etc.)
- Decline in consumer confidence – lower consumption

So: a large shift left of the IS

> 2.   **Policy response**
>
>   followed the IS-LM conclusions:

- Increase the money supply – lower interest rates

    FED reduced interest rates from 5.25% in Sep 2007 to almost zero in Dec 2008 – large rightward shift of the LM curve

    In Canada – the bank rate fell from $4.5% in Dec 2007 to 0.25% in April 2009

So: LM shifts left

> **Liquidity trap.**
>
> If the nominal interest rate falls to almost zero, it cannot fall further. Putting more money into the economy (increasing liquidity) by the central bank will have no effect.
>
> **Solutions to liquidity trap:**
>
> (a) Higher average inflation rate

- The higher is the average inflation rate, the higher is the nominal interest rate, and the more it can be reduced:

Examples 1.
  r=3%, π=0 then i = 3%.
  the nominal interest rate can be reduced by 3%,
  the real interest rate can be reduced to zero

Example 2.
  r=3%, π=3% then i = 6%
  the nominal interest rate can be reduced by 6%,
  the real interest rate can be reduced to -3%

So in example 2 there is greater scope for monetary policy.

(b) Increase inflation expectations
  If the nominal interest rate is near zero, and there are expectations of inflation then the ex ante real interest rate is negative

(c) Quantitative easing

  Central Bank buys wider range of assets: mortgages, corporate bonds, long-term government bonds

  Problems with solutions to liquidity trap

  (a) Central banks spent a lot of time and energy building reputation for maintaining low inflation rate. This reputation will be lost
  (b) As for (a)
  (c) May raise inflation since the purchases increase the money supply

  In the US – bank recapitalization: US Treasury put money in the banks in exchange for temporary part-ownership.

  In Canada – no need for that – banks had no significant problems

- Expansionary fiscal policy

In both countries – significant increase in spending and deficits – rightward shift of the IS curve