Analysis of Business Cycles I: The Demand Side of the Economy

Bilgin Bari
God put macroeconomists on earth not to propose and test elegant theories but to solve practical problems. The problems He gave us, moreover, were not modest in dimension.

Gregory Mankiw
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   - Building the IS-LM Model
   - The Goods Market and the IS Model
   - The Money Market and the LM Curve
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Great Depression

- Classical theory was incapable of explaining the Great Depression.
- According to Classical theory, national income depends on factor supplies (capital and labor) and available technology.
- They didn’t change substantially from 1929 to 1933.
- So many economists believed that a new model was needed.
Aggregate Demand II

Keynes (1936), The General Theory of Employment, Interest, and Money
Aggregate Demand III

Aggregate Demand: The total amount of output demanded in the economy.

- Keynes proposed that low aggregate demand is responsible for low income and high employment.
- He criticized classical theory which assumes aggregate supply alone determines national income.
Using Models I

Keynesian Cross → IS Curve → IS–LM Model → Aggregate Demand Curve → Model of Aggregate Supply and Aggregate Demand → Explanation of Short-Run Economic Fluctuations

Theory of Liquidity Preference → LM Curve
In the long-run, prices are flexible, and aggregate supply determines income.

In the short-run, prices are sticky, and aggregate demand influence income.

We focus on aggregate demand to study economic fluctuations.

The model of aggregate demand: IS-LM model.
The goal of the model:
- to show what determines national income for a given price level (sticky prices).
- to show what causes the aggregate demand curve to shift.

IS (Investment-Saving): markets for goods and services
LM (Liquidity-Money): markets for money

The key determinant is the interest rate, because it influences both investment and money demand.
Importance of Expenditures

Keynes proposes that

- In the short-run, economy’s total income was determined largely by the spending of plans of households, firms, and the government.
- The problem during recessions was inadequate spending.
Planned Expenditure

- Actual expenditure (AE): the amount households, firms and the government spend on goods and services (GDP)
- Planned expenditure (PE): the amount households, firms and the government would like to spend on goods and services.
- Planned Expenditure = Aggregate Demand
- $Y_{pe} = C + I + G + NX$
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Building the IS-LM Model

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Keynesian Multiplier

\[ Y = C + I + G + NX \]
\[ Y = \bar{C} + (mpc \times Y_D) + \bar{I} + \bar{G} + \bar{NX} \]
\[ Y = \bar{C} + \bar{I} + \bar{G} + \bar{NX} + (mpc \times Y) - (mpc \times \bar{T}) \]

subtracting \( mpc \times Y \) from both sides of equation

\[ Y - (mpc \times Y) = Y(1 - mpc) = \bar{C} + \bar{I} + \bar{G} + \bar{NX} - (mpc \times \bar{T}) \]

dividing both sides of equation \((1 - mpc)\)

\[ Y = \frac{1}{1-mpc} \times [\bar{C} + \bar{I} + \bar{G} + \bar{NX} - (mpc \times \bar{T})] \]
Keynesian Cross II

Keynesian cross gives that the relation between expenditure and income (production).

\[ Y = \frac{1}{1 - mp^c} \times [\bar{C} + \bar{I} + \bar{G} + \bar{NX} - (mp^c \times \bar{T})] \]

For example

- When there is a change in one of the autonomous components (e.g. government expenditures: \( \Delta G \)), the change in production (or income will be):

\[ \frac{\Delta Y}{\Delta G} = \frac{1}{1 - mp^c} \]
Keynesian Cross III

1. An increase in government purchases shifts planned expenditure upward, ...

2. ...which increases equilibrium income.
When there is a change in one of the autonomous components (e.g. government expenditures: $\Delta G$), the change in production (or income will be):

$$\frac{\Delta Y}{\Delta T} = \frac{-mpc}{1 - mpc}$$
Keynesian Cross V

1. A tax cut shifts planned expenditure upward, ...

2. ...which increases equilibrium income.

$PE_1 = Y_1$

$PE_2 = Y_2$

$\Delta Y$

$\Delta Y$

Income, output, $Y$

Expenditure

$PE_2 = Y_2$

$PE_1 = Y_1$

Actual expenditure

Planned expenditure

$\text{MPC} \times \Delta T$
Derivation of IS Curve

IS curve describes the relationship between interest rate and aggregate output when goods market is in equilibrium for a given price level.
Shifts in IS Curve

1. An increase in government purchases shifts planned expenditure upward by \( \Delta G \),...

2. ...which raises income by \( \frac{\Delta G}{1 - MPC} \),...

3. ...and shifts the IS curve to the right by \( \frac{\Delta G}{1 - MPC} \),...
The Theory of Liquidity Preference I

- The theory is the building block for the LM curve.
- The theory assumes that there is a fixed supply of real money balances:
  \[
  (\frac{M}{P})^s = \bar{M} / \bar{P}
  \]
- The theory posits that interest rate is one determinant of money demand. It is the opportunity cost of holding money.
- Economy’s level of income (Y) also effect the demand of money.
- The demand for real money balances:
  \[
  (\frac{M}{P})^d = L(r, Y)
  \]
The Theory of Liquidity Preference II
Derivation of LM Curve

(a) The Market for Real Money Balances

1. An increase in income raises money demand, ...

2. Increasing the interest rate.

(b) The LM Curve

3. The LM curve summarizes these changes in the money market equilibrium.
Shifts in LM Curve

(a) The Market for Real Money Balances

Interest rate, $r$

$\frac{M_2}{P}$ → $\frac{M_1}{P}$ Real money balances, $\frac{M}{P}$

1. The Fed reduces the money supply, ...

2. ... raising the interest rate ...

(b) The LM Curve

Interest rate, $r$

$\frac{M_2}{P}$ → $\frac{M_1}{P}$

$\bar{Y}$ Income, output, $Y$

3. ... and shifting the LM curve upward.
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Building the IS-LM Model
The Goods Market and the IS Model
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The Short-Run Equilibrium in the IS-LM Model

![IS-LM Diagram](image)

- **IS** curve:
  - Income, output, \( Y \)
  - Equilibrium level of income

- **LM** curve:
  - Interest rate, \( r \)
  - Equilibrium interest rate

Equilibrium point where IS and LM curves intersect.
We can use the IS-LM model to explain national income in the short-run when the price level is fixed.

We now examine what happens in the IS-LM model if the prices allowed the change.

By examining the effects of changing the price level, we have a theory to explain the position and slope of the aggregate demand curve.
IS-LM as a Theory of Aggregate Demand II

(a) The IS–LM Model

1. A higher price level $P$ shifts the LM curve upward, ...

2. ... lowering income $Y$.

(b) The Aggregate Demand Curve

3. The AD curve summarizes the relationship between $P$ and $Y$. 

Interest rate, $r$

Price level, $P$

IS

LM($P_1$)

LM($P_2$)

$P_2$

$P_1$

$Y_2$ $ightarrow$ $Y_1$

$Y_2$ $ightarrow$ $Y_1$

Income, output, $Y$

Income, output, $Y$
Shifts in AD Curve I

Expansionary Monetary Policy:

\[ M^s \uparrow \Rightarrow r \downarrow \Rightarrow \bar{I} \downarrow \Rightarrow Y_{pe} \uparrow \Rightarrow Y \uparrow \]
Shifts in AD Curve II

Expansionary Fiscal Policy:

\[ G \uparrow \Rightarrow Y_{pe} \uparrow \Rightarrow Y \uparrow \Rightarrow M^d \uparrow \Rightarrow r \uparrow \]
Planned Expenditure

- Planned Expenditure: The total amount of spending on domestically produced goods and services.
- Planned Expenditure = Aggregate Demand
- $Y_{pe} = C + I + G + NX$
Consumption Expenditure (C)

\[ C = \bar{C} + (mpc \times Y_D) - cr \]

\( \bar{C} \): autonomous consumption expenditure

\( mpc \): marginal propensity to consume

\( Y_D \): disposable income (Y-T)

\( c \): a parameter reflects how consumption respond changes in the real interest rate

\( r \): real interest rate

⇒ Real interest rate affects on savings decisions.
Planned Investment Spending (I)

\[ I = \bar{I} - dr \]

\( \bar{I} \): Fixed Investment
\( d \): a parameter reflects how investment respond to changes in the real interest rate.

\( \Rightarrow \) Real interest rate affects on investment decisions through cost of finance.

Goverment Purchases and Taxes

Goverment Purchases: \( G = \bar{G} \)
Taxes \( T = \bar{T} \rightarrow \) disposable income: \( Y - T \)
Net Exports (NX)

\[ NX = \bar{NX} - x_r \]

\( \bar{NX} \): autonomous net export
\( x \): a parameter reflects how net export respond to changes in the real interest rate

⇒ real interest rate affect net export through the exchange rate:

changes in real interest rate → changes in return → capital flow → changes in export and import prices → changes in net export
Goods Market Equilibrium

\[ Y = Y_{pe} \]

\[ Y = C + I + G + NX \]
\[ Y = \bar{C} + (mpc \times Y_D) - cr + \bar{I} - dr + \bar{G} + \bar{NX} - xr \]
\[ Y = \bar{C} + \bar{I} + \bar{G} + \bar{NX} + (mpc \times Y) - (mpc \times \bar{T}) - (c + d + x)r \]

subtracting \( mpc \times Y \) from both dies of equation

\[ Y - (mpc \times Y) = Y(1 - mpc) = \]
\[ \bar{C} + \bar{I} + \bar{G} + \bar{NX} - (mpc \times \bar{T}) - (c + d + x)r \]

dividing both sides of equation \((1 - mpc)\)

\[ Y = [\bar{C} + \bar{I} + \bar{G} + \bar{NX} - (mpc \times \bar{T})] \times \frac{1}{1 - mpc} - \frac{c + d + x}{1 - mpc} r \]
IS Curve

\[ Y = [\bar{C} + \bar{I} + \bar{G} + NX - (mpc \times \bar{T})] \times \frac{1}{1 - mpc} \quad \frac{c + d + x}{1 - mpc} r \]

- The equation shows how to determine aggregate output when goods market is in equilibrium.
- It shows the relationship between aggregate output and the real interest rate when the goods market is in equilibrium.
- First component of the equation explains shifts in IS curve (given interest rate)
- Second component of the equation explains movements on IS curve (changes in real interest rate)
 Monetary Policy

- Central Banks use a very short-term interest rate as their primary policy tool.
- The interest rate is overnight interest rate at which banks lend to each other.
- We need real interest rate: \( r = i - \pi^e \)
  - changes in nominal interest rate \( \rightarrow \) changes in real interest rate (only if actual and expected inflation remain unchanged in the short-run)
  - We know prices are sticky in the short-run.
- Central bank can determine the real interest rate in the short-run.
  not long run, because prices are flexible in the long-run.
- In the long-run, real interest rate is determined by the interaction of saving and investment.
MP Curve I

- MP curve indicates the relationship between the real interest rate which central bank sets and the inflation rate.

\[ r = \bar{r} + \lambda \pi \]

- MP has an upward slope:
  - Policy makers follow Taylor principle to stabilise inflation.
  - Interest rate is raised more than any rise in expected inflation.
  - Real interest rate rise if there is a rise in inflation.
MP Curve II

- The graph shows the relationship between real interest rate (r) and inflation rate (π).
- Points A, B, and C are marked on the graph, indicating different combinations of real interest rate and inflation rate.
- The line MP represents the Monetary Policy Curve, showing how changes in monetary policy affect the real interest rate for a given inflation rate.
MP Curve III

Shifts in MP curve shows changes in stance of monetary policy:
- tightening of monetary policy: MP ↑
- easing of monetary policy: MP ↓
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Monetary Policy
AD Curve

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## AD Curve

### MP curve

shows how central bank respond to changes in inflation with setting interest rate

### IS curve

shows how changes in interest rate affects equilibrium output.

### AD curve

shows the relationship between the quantity of aggregate output and inflation rate (given inflation expectations and stance of monetary policy)
Derivation of AD Curve

**Step 1.** The MP curve links the inflation rate to the real interest rate level set by the central bank.

**Step 2.** The IS curve links the real interest rate level from the MP curve to equilibrium output.

**Step 3.** The AD curve links the inflation rate from the MP curve to equilibrium output.
Shifts in AD Curve

(a) MP Curve

Step 1. The MP curve links the inflation rate to the real interest rate level set by the central bank.

(b) IS Curve

Step 2. A rise in government purchases increases equilibrium output, shifting the IS curve rightward...

(c) Aggregate Demand Curve

Step 3. and shifting the AD curve rightward.
Effects of Monetary Policy on Aggregate Demand

Step 1. Autonomous monetary policy tightening increases the real interest rate...

Step 2. Causing movement along the IS curve, decreasing equilibrium output...

Step 3. And shifting the AD curve leftward.
References

- Mankiw, Macroeconomics: Chapter 10 and 11
- Mishkin, Macroeconomics: Chapter 9
Recommendations