Chapter 10: Aggregate Demand I

Context

- Chapter 9 introduced the model of aggregate demand and aggregate supply.
- Long run
  - prices flexible
  - output determined by factors of production & technology
  - unemployment equals its natural rate
- Short run
  - prices fixed
  - output determined by aggregate demand
  - unemployment negatively related to output

This chapter develops the IS-LM model, the basis of the aggregate demand curve.

We focus on the short run and assume the price level is fixed (so, SRAS curve is horizontal).

This chapter (and chapter 11) focus on the closed-economy case. Chapter 12 presents the open-economy case.

The Keynesian Cross

- A simple closed economy model in which income is determined by expenditure. (due to J.M. Keynes)

Notation:
- I = planned investment
- PE = C + I + G = planned expenditure
- Y = real GDP = actual expenditure

Difference between actual & planned expenditure = unplanned inventory investment

Elements of the Keynesian Cross

- consumption function: \( C = C(Y - T) \)
- govt policy variables: \( G = \bar{G}, \ T = \bar{T} \)
- for now, planned investment is exogenous: \( I = \bar{I} \)
- planned expenditure: \( PE = C(Y - \bar{T}) + \bar{I} + \bar{G} \)
- equilibrium condition:
  - actual expenditure = planned expenditure
  - \( Y = PE \)

Graphing planned expenditure

\[ PE = C + I + G \]
Graphing the equilibrium condition

The equilibrium value of income

An increase in government purchases

Solving for $\Delta Y$

\begin{align*}
Y &= C + I + G \\
\Delta Y &= \Delta C + \Delta I + \Delta G \\
&= \Delta C + \Delta G \\
&= \text{MPC} \times \Delta Y + \Delta G
\end{align*}

Collect terms with $\Delta Y$ on the left side of the equals sign:

Solve for $\Delta Y$:

$$\Delta Y = \left(1 - \text{MPC}\right) \times \Delta G$$

The government purchases multiplier

Definition: the increase in income resulting from a $1$ increase in $G$.

In this model, the govt purchases multiplier equals

$$\frac{\Delta Y}{\Delta G} = \frac{1}{1 - \text{MPC}}$$

Example: If $\text{MPC} = 0.8$, then

$$\frac{\Delta Y}{\Delta G} = \frac{1}{1 - 0.8} = 5$$

Why the multiplier is greater than 1

- Initially, the increase in $G$ causes an equal increase in $Y$: $\Delta Y = \Delta G$.
- But $\Delta Y \Rightarrow \Delta C$:
  - further $\Delta Y$
  - further $\Delta C$
  - further $\Delta Y$

An increase in $G$ causes income to increase $5$ times as much!
The tax multiplier

def: the change in income resulting from a $1 increase in $T$

\[
\frac{\Delta Y}{\Delta T} = -\text{MPC} \quad \frac{1}{1 - \text{MPC}}
\]

If $\text{MPC} = 0.8$, then the tax multiplier equals

\[
\frac{\Delta Y}{\Delta T} = -\frac{0.8}{1 - 0.8} = -4
\]

The IS curve

def: a graph of all combinations of $r$ and $Y$ that result in goods market equilibrium

\[Y = C(Y - \bar{T}) + I(r) + G\]

Solving for $\Delta Y$

\[
\Delta Y = \Delta C + \Delta I + \Delta G
\]

eq'm condition in changes

\[\Delta C = \text{MPC} \times \Delta Y \]

\[\Delta I \quad \Delta G \text{ exogenous}\]

Solving for $\Delta Y$:

\[\Delta Y = (1 - \text{MPC}) \times \Delta Y = -\text{MPC} \times \Delta T\]

Final result:

\[\Delta Y = \left(-\frac{\text{MPC}}{1 - \text{MPC}}\right) \times \Delta T\]

The tax multiplier

...is negative:
A tax increase reduces $C$, which reduces income.

...is greater than one (in absolute value):
A change in taxes has a multiplier effect on income.

...is smaller than the govt spending multiplier:
Consumers save the fraction $(1 - \text{MPC})$ of a tax cut, so the initial boost in spending from a tax cut is smaller than from an equal increase in $G$.

NOW YOU TRY:
Practice with the Keynesian Cross

- Use a graph of the Keynesian cross to show the effects of an increase in planned investment on the equilibrium level of income/output.
### Deriving the IS curve

\[ \downarrow r \Rightarrow \uparrow I \]

\[ \Rightarrow \uparrow PE \]

\[ \Rightarrow \uparrow Y \]

\[ PE = C + I(r_1) + G \]

\[ PE = C + I(r_2) + G \]

**Why the IS curve is negatively sloped**

- A fall in the interest rate motivates firms to increase investment spending, which drives up total planned spending (PE).
- To restore equilibrium in the goods market, output (aka actual expenditure, Y) must increase.

### The IS curve and the loanable funds model

(a) The L.F. model

(b) The IS curve

**Fiscal Policy and the IS curve**

- We can use the IS-LM model to see how fiscal policy (G and T) affects aggregate demand and output.
- Let’s start by using the Keynesian cross to see how fiscal policy shifts the IS curve…

### Shifting the IS curve: \( \Delta G \)

At any value of \( r \),

\[ \uparrow G \Rightarrow \uparrow PE \Rightarrow \uparrow Y \]

...so the IS curve shifts to the right.

The horizontal distance of the IS shift equals

\[ \Delta Y = \frac{1}{1 - MPC} \Delta G \]

**NOW YOU TRY:**

**Shifting the IS curve: \( \Delta T \)**

- Use the diagram of the Keynesian cross or loanable funds model to show how an increase in taxes shifts the IS curve.
The Theory of Liquidity Preference

- Due to John Maynard Keynes.
- A simple theory in which the interest rate is determined by money supply and money demand.

Money supply

The supply of real money balances is fixed:

\[ (M/P)^* = \bar{M}/\bar{P} \]

Money demand

Demand for real money balances:

\[ (M/P)^d = L(r) \]

Equilibrium

The interest rate adjusts to equate the supply and demand for money:

\[ M/P = L(r) \]

How the Fed raises the interest rate

To increase \( r \), Fed reduces \( M \)

CASE STUDY: Monetary Tightening & Interest Rates

- Late 1970s: \( \pi > 10\% \)
- Oct 1979: Fed Chairman Paul Volcker announces that monetary policy would aim to reduce inflation
- Aug 1979-April 1980: Fed reduces \( MP \) 8.0%
- Jan 1983: \( \pi = 3.7\% \)

How do you think this policy change would affect nominal interest rates?
Monetary Tightening & Interest Rates, cont.

<table>
<thead>
<tr>
<th>The effects of a monetary tightening on nominal interest rates</th>
</tr>
</thead>
<tbody>
<tr>
<td>short run</td>
</tr>
<tr>
<td>model</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>prices</td>
</tr>
<tr>
<td>prediction</td>
</tr>
<tr>
<td>actual outcome</td>
</tr>
<tr>
<td></td>
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</tbody>
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The $LM$ curve

Now let's put $Y$ back into the money demand function:

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

The $LM$ curve is a graph of all combinations of $r$ and $Y$ that equate the supply and demand for real money balances. The equation for the $LM$ curve is:

$$\frac{\bar{M}}{\bar{P}} = L(r, Y)$$

Why the $LM$ curve is upward sloping

- An increase in income raises money demand.
- Since the supply of real balances is fixed, there is now excess demand in the money market at the initial interest rate.
- The interest rate must rise to restore equilibrium in the money market.

NOW YOU TRY:
Shifting the $LM$ curve

- Suppose a wave of credit card fraud causes consumers to use cash more frequently in transactions.
- Use the liquidity preference model to show how these events shift the $LM$ curve.
The short-run equilibrium

The short-run equilibrium is the combination of \( r \) and \( Y \) that simultaneously satisfies the equilibrium conditions in the goods & money markets:

\[
Y = C(Y - \bar{T}) + I(\bar{r}) + \bar{G} \\
\bar{M}/\bar{P} = L(r, Y)
\]

Equilibrium interest rate

Equilibrium level of income


Preview of Chapter 11

In Chapter 11, we will

- use the IS-LM model to analyze the impact of policies and shocks.
- learn how the aggregate demand curve comes from IS-LM.
- use the IS-LM and AD-AS models together to analyze the short-run and long-run effects of shocks.
- use our models to learn about the Great Depression.

Chapter Summary

1. Keynesian cross
   - basic model of income determination
   - takes fiscal policy & investment as exogenous
   - fiscal policy has a multiplier effect on income

2. IS curve
   - comes from Keynesian cross when planned investment depends negatively on interest rate
   - shows all combinations of \( r \) and \( Y \) that equate planned expenditure with actual expenditure on goods & services

3. Theory of Liquidity Preference
   - basic model of interest rate determination
   - takes money supply & price level as exogenous
   - an increase in the money supply lowers the interest rate

4. LM curve
   - comes from liquidity preference theory when money demand depends positively on income
   - shows all combinations of \( r \) and \( Y \) that equate demand for real money balances with supply

5. IS-LM model
   - Intersection of IS and LM curves shows the unique point \((Y, r)\) that satisfies equilibrium in both the goods and money markets.