

Session 9: Aggregate Demand - Supply

Professor: Alessandro Dario Lavia

`alessandro.lavia@unito.it`

ESCP - Macroeconomics EF01

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Course Outline

1. Quick Review:
 - 1.1 Introduction to the IS Curve
2. The MP Curve
 - 2.1 Monetary Policy
3. Aggregate Demand
4. Aggregate Supply
 - 4.1 The Inflation Spiral
 - 4.2 The Labor Market
 - 4.3 LRAS

Useful information:

- Assessment: MCQ and PS.
- Online Exercise Session: TBA.
- OH: after class and via email (Zoom or in person).

Quick Review

Aggregate Consumption

- To know the behaviour of aggregate consumption, in particular the aggregate marginal propensity to consume, we must know the proportion of ricardian and keynesian households.
- This not so trivial question has motivated the development of a specialized strand of research on New Keynesian Heterogenous Agents (HANK) models.
- Our analysis of consumer and firm behavior justifies writing the linear functions:

$$C(Y, r) = C_0 + C_Y Y + C_r r \quad (1)$$

- where C_0 is a constant level of consumption (survival level), C_Y corresponds to the proportion of Keynesian households and C_r corresponds to the proportion of Ricardian households.

IS Curve: Deriving Aggregate Demand

- Our analysis of consumer and firm behavior justifies writing the linear functions:

$$C(Y, r) = C_0 + C_Y Y + C_r r \quad (2)$$

$$I(r) = I_0 + I_r(r) \quad (3)$$

- Where $I_r(r) < 0$ as we increase r , and the values $C_Y > 0$ as we increase the income Y and $C_r < 0$ as we increase r .
- If we take government spending (G) and net exports (NX) as exogenous, total spending is:

$$C(Y, r) + I(r) + G + NX \quad (4)$$

IS Curve: Goods Market Equilibrium

- In macroeconomics, aggregate demand is given by:

$$Y = C(Y, r) + I(r) + G + NX \quad (5)$$

- This equation defines the **IS curve**, which links output Y to the real interest rate r .
- The IS curve represents equilibrium in the goods and services market:
 - Output adjusts to match aggregate demand.
 - Consumption and investment depend on the interest rate.
 - A higher r reduces demand (especially investment), lowering Y .
- Key assumption: firms can meet demand in the short run $\implies$ output is demand-driven.
- Therefore, monetary and fiscal policy affect output by shifting aggregate demand.

Why Is It Called the IS Curve?

- IS stands for **I**nvestment = **S**avings.
- Start from the national income identity:

$$Y = C(Y, r) + I(r) + G + NX \quad (6)$$

- Rearranging, we obtain:

$$\underbrace{(Y - T - C(Y, r))}_{\text{private savings}} + \underbrace{(T - G)}_{\text{government savings}} + \underbrace{NX}_{\text{foreign savings}} = I(r) \quad (7)$$

- Interpretation:
 - Total savings in the economy must equal investment.
 - The interest rate r adjusts to ensure this equilibrium.
- This equilibrium relationship defines the IS curve.

The IS Curve

- The IS curve can be expressed in terms of deviations from long-run output:

$$\tilde{Y} = -\sigma(r - r^*) \quad (8)$$

- $\tilde{Y}_t = \frac{Y_t - Y^*}{Y^*}$ is the output gap.
 - r^* is the long-run (natural) real interest rate.
 - $\sigma > 0$ measures how sensitive demand is to interest rates.
- Interpretation:
 - Higher real interest rates reduce aggregate demand.
 - Output falls below potential.
 - Lower real interest rates stimulate demand and increase output.
- Therefore, the IS curve is **downward sloping** in (Y, r) space.

Plotting the IS Curve

- The IS curve shows the negative relationship between short-run output $\tilde{Y}$ and the real interest rate r .
- Rearrange equation (8) to isolate r (actual interest rate):

$$r = r^* - \frac{\tilde{Y}}{\sigma} \quad (9)$$

- This equation represents a downward-sloping line:
 - The intercept is r^* , the real interest rate when output is at potential.
 - The slope is $-\frac{1}{\sigma}$, meaning an increase in output lowers the real interest rate.

Plotting the IS Curve

FIGURE 11.2

The IS Curve

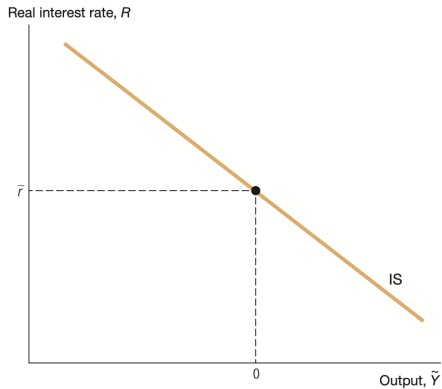


Figure 1: IS Curve

Interest Rate Sensitivity and the IS Curve

- The slope of the IS curve depends on how sensitive output is to interest rate changes, captured by σ .
- From the IS equation:

$$r = r^* - \frac{\tilde{Y}}{\sigma} \quad (10)$$

- If σ is large, the IS curve is flatter:
 - Output responds strongly to changes in the real interest rate.
- If σ is small, the IS curve is steeper:
 - Output responds weakly to changes in the real interest rate.
- Therefore, σ determines how powerful interest rate changes are in affecting aggregate demand.

Interest Rate Sensitivity and the IS Curve

FIGURE 11.3

An Increase in the Real Interest Rate to R'

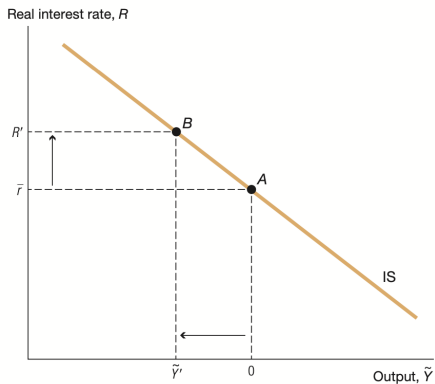


Figure 2: Interest Rate Sensitivity and the IS Curve

A Modified IS Curve with Demand Shocks

- The IS curve can be extended to include exogenous demand shocks:

$$\tilde{Y}_t = -\sigma(r_t - r^*) + \theta_t \quad (11)$$

- θ_t captures factors that shift aggregate demand independently of the interest rate.
- Interpretation:
 - $\theta_t > 0 \implies$ higher demand $\implies$ output increases at any given r .
 - $\theta_t < 0 \implies$ lower demand $\implies$ output decreases.
- Therefore, θ_t shifts the IS curve:
 - Positive shock $\implies$ IS shifts to the right.
 - Negative shock $\implies$ IS shifts to the left.

Demand Shocks and Shifts in the IS Curve

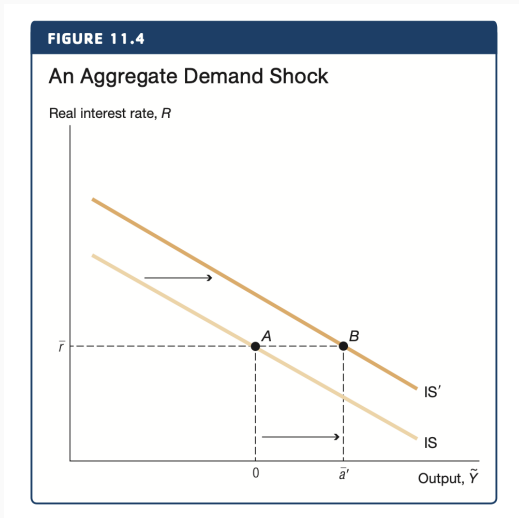


Figure 3: Demand Shocks and Shifts in the IS Curve

Examples of Demand Shocks (θ_t)

- Demand shocks reflect changes in spending not driven by r .
- Examples include:
 - **Consumer expectations:** optimism or pessimism about future.
 - **Fiscal policy:** changes in government spending or taxation.
 - **Net exports:** shifts in foreign demand or exchange rates.
 - **Financial conditions:** changes in wealth, asset prices, or uncertainty.
 - **Credit conditions:** easier or tighter access to borrowing.
 - **Policy shocks:** unexpected stimulus measures or reforms.
- All these factors shift aggregate demand $\implies$ shift the IS curve.

Monetary Policy: Movement vs. Shock

- The IS relation is:

$$\tilde{Y}_t = -\sigma(r_t - r^*) + \theta_t \quad (12)$$

- **Systematic monetary policy (movement along IS):**
 - The central bank adjusts the real interest rate r_t in a predictable way.
 - Lower r_t stimulates consumption and investment.
 - Output increases **along the IS curve**.
- **Monetary policy shock (shift of IS):**
 - An unexpected FOMC action (e.g. surprise rate).
 - Affects demand beyond the usual interest rate channel (expectations, credit conditions).
 - Captured by $\theta_t \implies$ **IS curve shifts**.
- **Key idea:**
 - Predictable changes in $r_t \implies$ movement along IS,
 - Unexpected monetary shocks $\implies$ shift in IS.

Movements Along vs. Shifts of the IS Curve

- The IS relation is:

$$\tilde{Y} = -\sigma(r - r^*) + \theta \quad (13)$$

- **Movement along the IS curve:**

- Caused by changes in the real interest rate r .
- Output adjusts along a given IS curve.

- **Shift of the IS curve:**

- Caused by changes in θ (demand factors independent of r).
- Output changes at any given interest rate.

- **Direction of shifts:**

- $\theta > 0 \implies$ IS shifts right (higher demand, higher output).
- $\theta < 0 \implies$ IS shifts left (lower demand, lower output).

The MP Curve

- The main objective of the central bank consists in stabilizing inflation π around its target π^* .
 - It achieves this objective by influencing demand in response to business cycles fluctuations.
 - Demand is affected by real interest rate r , more precisely ricardian households and firms react to r .

$$Y = C(Y, r) + I(r) + G + NX \quad (14)$$

Monetary Policy

- In practice, the central bank sets the nominal interest rate i and because inflation does not follow interest rate 1 to 1, the central bank is able to influence r .

$$r \approx i - \pi \quad (15)$$

- To simplify, we assume the CB indirectly chooses the real interest rate to whichever level it wants.
- We can describe the response function of the central bank as:

$$r_t = r^* + \gamma(\pi_t - \pi^*) \quad (16)$$

- Typically CBs raise interest rate to reduce inflation, so $\gamma > 0$.

Aggregate Demand

Aggregate Demand

- Now that we are equipped with the IS curve:

$$\tilde{Y}_t = -\gamma(r_t - r^*) + \theta \quad (17)$$

- And the central bank's policy response (MP):

$$r_t = r^* + \gamma(\pi_t - \pi^*) \quad (18)$$

- We can substitute out real interest rate to get an aggregate demand (AD) equation:

$$\tilde{Y}_t = -\sigma\gamma(\pi_t - \pi^*) + \theta_t \quad (19)$$

- This curve represents the equilibrium on the goods and services markets, taking into account the central bank's decision rule.

Aggregate Demand Curve

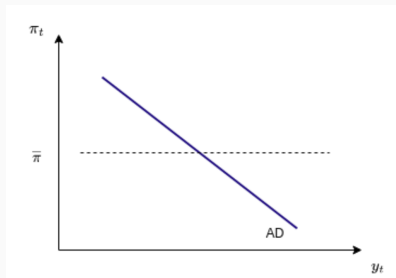


Figure 4: Aggregate Demand Curve

$$\tilde{Y}_t = -\sigma\gamma(\pi_t - \pi^*) + \theta_t \quad (20)$$

“When inflation is higher, the central bank response raises real interest rates, which induces consumers and investors to postpone their expenditures, lowering hence aggregate demand in equilibrium.”

Aggregate Supply

Firms Behavior

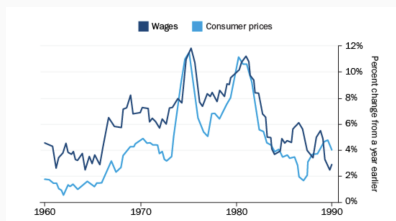


Figure 5: Wage and Price, U.S.

We want to understand the behavior of firms in a macroeconomic environment:

- Firms change prices on the goods markets.
- Firms hire workers on the labor market.

Both are interdependent:

- Workers with higher wages increase demand for consumption goods.
- Higher prices make workers ask for salary rises.

The Inflation Spiral

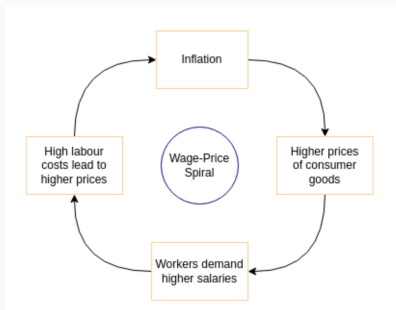


Figure 6: Wage Price Spiral

Comovement of inflation and wages led economists to believe there was a wage-price inflation spiral:

1. Prices increase.
2. Workers demand higher wages.
3. Production costs increase.
4. Prices increase.

The Inflation Spiral and Policy Measures

- Governments and policymakers have attempted to control inflation using various strategies.
- In 1970, President Nixon implemented a price freeze on wages and prices.
 - This policy aimed to curb inflation.
 - However, it ultimately failed to achieve long-term stability.
- The inflation spiral was finally halted with the Volcker Plan:
 - The Federal Reserve, under Chairman Paul Volcker, aggressively raised interest rates.
 - Interest rates increased from 3% to 20%, a drastic measure to control inflation.
 - Inflation was successfully curbed, but this led to a severe recession in 1982-1983.

Goods Market and Price Setting

- Firms produce using labor as the only input:

$$Y = L \tag{21}$$

- Producing one unit of output requires one worker:
 - $\Rightarrow$ Marginal cost = wage W

- **Monopolistic competition:**

- Firms have some market power and set prices.
- Prices include a markup over costs:

$$P^* = (1 + \mu)W \tag{22}$$

- High markup $\mu \Rightarrow$ less competition, higher prices
- Low markup $\mu \Rightarrow$ more competition

Labor Market: Intuition

Wages depend on two key factors:

1. **Prices (P):**

- Higher prices $\Rightarrow$ workers need higher wages
- To maintain purchasing power

2. **Labor demand (L):**

- More work required $\Rightarrow$ higher wages
 - Firms must incentivize workers.
-
- Wages increase with prices and employment

Labor Supply: Basic Idea

- Workers choose between:
 - Consumption (C)
 - Leisure ($U = 1 - L$)
- They work more when the **real wage** is higher:

$$L_S = \left(\frac{W}{P} \right)^\xi \quad (23)$$

$$W^R = \frac{W}{P} \quad (24)$$

- **Key intuition:**
 - Higher real wages $\Rightarrow$ more labor supply

Labor Cost for Firms

- We can invert labor supply to get wages:

$$W(L) = PL^{\frac{1}{\xi}} \quad (25)$$

- Wages increase with:
 - Prices (P)
 - Employment (L)
- **Implication:**
 - Producing more increases costs

The Wage-Price Nexus

- Recall our assumption of $Y = L$

- **Goods market:**

$$P^* = (1 + \mu)W(Y) \quad (26)$$

- **Labor market:**

$$W(Y) = PY^{\frac{1}{\epsilon}} \quad (27)$$

- **Key idea:**

- Prices depend on wages.
 - Wages depend on prices and output.
-
- Strong interaction between goods and labor markets.

Natural Equilibrium

- In the long run, prices are flexible:

$$P = P^* \tag{28}$$

- Using both equations:

$$1 = (1 + \mu)Y^{\frac{1}{\xi}} \tag{29}$$

- This determines equilibrium output.

Natural Output (LRAS)

$$Y^* = \left(\frac{1}{1 + \mu} \right)^{\frac{1}{\xi}} \quad (30)$$

- Output depends on:
 - Markup μ
 - Labor supply elasticity ξ
- **Key implication:**
 - Higher markup $\Rightarrow$ lower output
- Price level disappears $\Rightarrow$ classical result.
- This is a simplified framework, in reality natural output depends on:
 - Technology and productivity
 - Capital accumulation
 - Labor market institutions and frictions

Long Run Aggregate Supply

- In the long run:
 - Output = natural level Y^*
 - Independent of prices
- LRAS is:
 - Vertical in (Y, π) space
- **Implication:**
 - Demand policies affect inflation
 - Not output in the long run