The ASAD Model - Part 1

EC 313, Macroeconomics

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Book Chapter 7

Review

Review

Wage-Setting Relation:

- Workers (Labor Supply) ask wage based on $W = P^e F(u, z)$
- We assumed $P^e = P$. This simplifies the WS equations to $W = PF(u, z)$ and **it is this assumption that allows us to solve for u_n.**
- Under this assumption, the equilibrium unemployment rate is called **the natural rate of unemployment**.
- This assumption allows us to get the **real wage** asked by workers $\frac{W}{P} = F(u, z)$

Review

Price-Setting Relation:

- We assume that Y = AN, **where A is technology, and N is the number of workers**.
- For **one extra unit of product**, firms need to hire **1/A** more units of labor.
- Therefore, the marginal cost of production is **W/A**.
- Firms hold monopoly power: **P = (1 + m) W/A**, where **m is the mark-up.**
- We can write the **real wage** offered by firms is **W/P = (1 + m)/A**

Labor Market Equilibrium

Set the real wage asked workers equal to offered by firms:

$$F(u, z) = \frac{A}{1 + m}$$

Review

Labor Market Equilibrium

Set the real wage asked workers equal to offered by firms:

$$F(u_n, z) = \frac{A}{1+m}$$

u_n is the natural rate of unemployment

According to the equilibrium equation, we can study how u_n responds to changes in z, A, m

- z increases u_n increases
- A increases u_n decreases
- m increases u_n increases

Overview

Overview

Medium Run

- Now we want to study the behavior of the economy in the **medium run**.
- A hallmark of the medium run is that **prices change**!
- We need to have a model to incorporate **price** as a variable of interest.
- The other variable of interest is **output** (GDP).
- We need to build a model for **Aggregate Supply** that models the behaviors of **price and output**.

Short Run v.s Medium Run

Short-run story For aggregate supply:

- **Demand goes up**
- **Firms produce more to meet the demand**...
- **...without changing**
  - i) the number of people they hire
  - ii) prices of their products
  - iii) wages they offer to their employees.

Short Run v.s Medium Run

Medium run story For aggregate supply:

- **Demand goes up**
- **Firms produce more to meet the demand by hiring more workers**.
- **Conseuqences**:
  - i) Nominal wage goes up
  - ii) More costly to produce, so the price goes up.
  - iii) Higher price makes workers ask for a higher nominal wage.
  - **goes back to i) ...**

Overview

What's Next

We have now covered two cases:

- (Short-run) IS-LM equilibrium (Ch. 5) - Goods Market and Money Market
- (Medium run) Labor Market Equilibrium (Ch. 6)

Overview

What's Next

(Short-run) IS-LM equilibrium (Ch. 5) - Goods Market and Money Market

- Gives us **Aggregate Demand Relation**: captures **the effect of price level on output**.
- Note that IS-LM captures **consumer behaviors**, that's why it's called **AD** (aggregate demand) relation.

Overview

What's Next

(Medium run) Labor Market Equilibrium (Ch. 6)

- Gives us **Aggregate Supply Relation**: captures **the effect of output level on price**.
- Note that Labor Market captures **firms behaviors**, that's why it's called **AS** (aggregate supply) relation.

Aggregate Supply Relation

Aggregate Supply Relation

Labor Market Equilibrium Revisited

The AS Relation represents (medium run) equilibrium in the Labor Market.

Recall labor supply (WS) and labor demand (PS):

$$\begin{aligned} \text{WS} &: W = P^e F(u, z) \\ \text{PS} &: P = (1+m)W/A \end{aligned}$$

Before we assumed $P = P^e$ to solve for a specific equilibrium, u_n. **We now drop this assumption!**

Why?

Aggregate Supply Relation

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Before we assumed $P = P^e$ to solve for a specific equilibrium, u_n. **We now drop this assumption!**

Why?

Because we want to **model the behavior of price** P, which is one of the variables of interest in the AS-AD model.

Aggregate Supply Relation

Labor Market Equilibrium Revisited

The AS Relation represents (medium run) equilibrium in the Labor Market.

From now on, let's make a simplifying assumption: **technology A = 1**. This assumption is good for **the medium run**.

Recall labor supply (WS) and labor demand (PS):

$$\text{WS}: W = P^e F(u, z)$$
$$\text{PS}: P = (1 + m)W$$

Combining the above two equations, we get the **labor market equilibrium equation**:

$$P = (1 + m)P^e F(u, z)$$

Aggregate Supply Relation

Labor Market Equilibrium Revisited

We get the **labor market equilibrium equation**:

$$P = (1 + m)P^e F(u, z)$$

Q: We want an equation for **P** and **Y** . How do we get there?

A: Note **u** is related to **Y**. Sub in for u!

- By definition $u = \frac{L-N}{L} = 1 - \frac{N}{L}$.
- Also $Y = N$
- Hence $u = 1 - \frac{Y}{L}$

Aggregate Supply Relation

AS Relation

We get the **labor market equilibrium equation** in terms of **P** and **Y**. This is the AS Relation:

$$P = (1+m)P^e F(1 - \frac{Y}{L}, z)$$

$$\text{AS Relation: } \underbrace{P}_{PriceLevel} = \underbrace{P^e}_{ExpectedPrices} \underbrace{(1+m)}_{constant} F(1 - \underbrace{\frac{Y}{L}}_{Output}, \underbrace{z}_{Constant})$$

Aggregate Supply Relation

AS Relation

$$P = (1 + m)P^e F(1 - \frac{Y}{L}, z)$$

Q: If Y increases, what happens to P?

A: P increases.

Aggregate Supply Relation

AS Relation

$$P = (1+m)P^e F(1 - \frac{Y}{L}, z)$$

Q: If Y increases, what happens to P?

A: P increases.

Mathematically

- **Y increases**
- $1 - \frac{Y}{L}$ goes down
- $F(1 - \frac{Y}{L}, z)$ goes up
- **P goes up**

Aggregate Supply Relation

AS Relation

$$P = (1 + m)P^e F(1 - \frac{Y}{L}, z)$$

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Aggregate Supply Relation

AS Relation

$$P = (1 + m)P^e F(1 - \frac{Y}{L}, z)$$

Q: If Y increases, what happens to P?

A: P increases.

Intuitively

- **Y increases**
- Unemployment rate decreases
- Workers ask for a higher wage
- More expensive for firms to produce goods

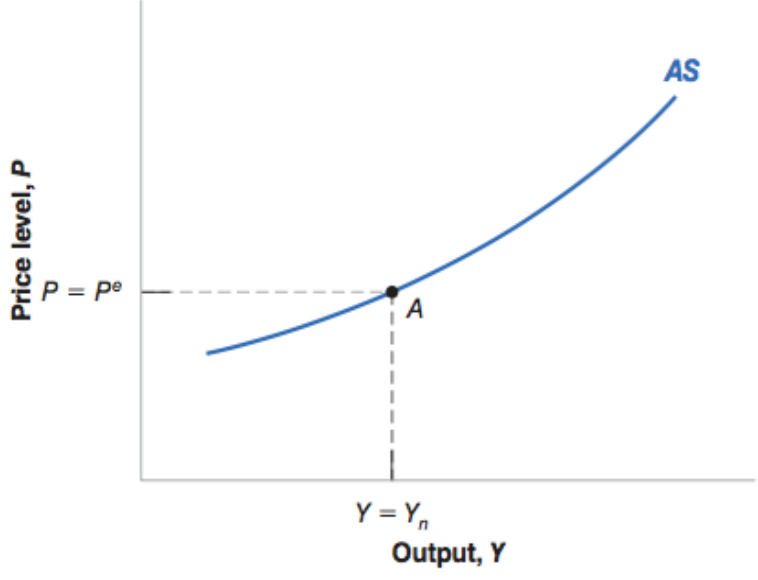
Aggregate Supply Relation

AS Relation - Moving Along

$$P = (1 + m)P^e F(1 - \frac{Y}{L}, z)$$

Q: If Y increases, what happens to P?

A: P increases. (Moving Along the AS Curve)



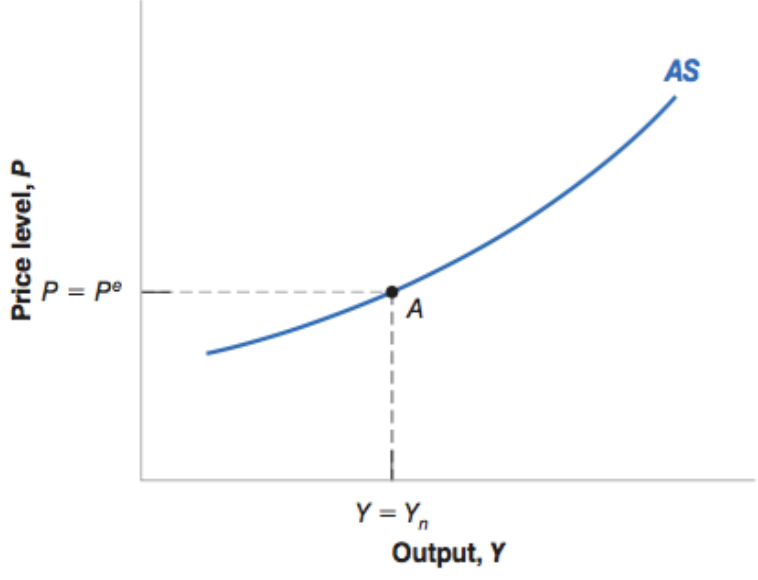
Aggregate Supply Relation

AS Relation - Shifting

$$P = (1 + m)P^e F(1 - \frac{Y}{L}, z)$$

Q: If monopoly power m increases, what happens to P?

A: P increases. Shifting Up



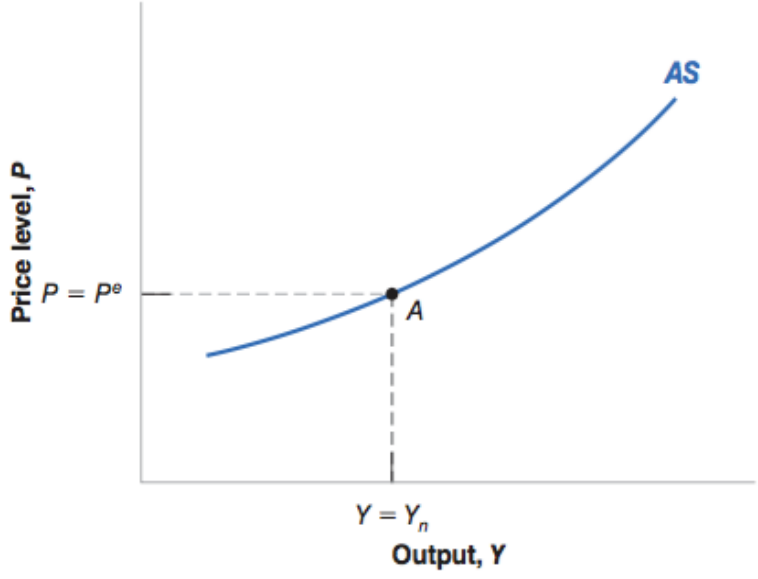
Aggregate Supply Relation

AS Relation - Shifting

$$P = (1+m)P^e F(1 - \frac{Y}{L}, z)$$

Q: If expected price P^e increases, what happens to P?

A: P increases. Shifting Up



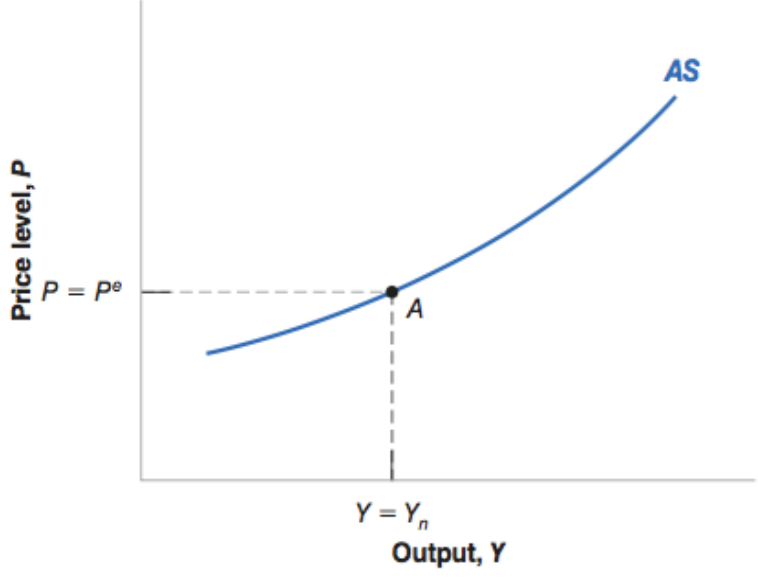
Aggregate Supply Relation

AS Relation - Shifting

$$P = (1 + m)P^e F(1 - \frac{Y}{L}, z)$$

Q: If Labor Force increases, what happens to P?

A: P decreases Shifting Down



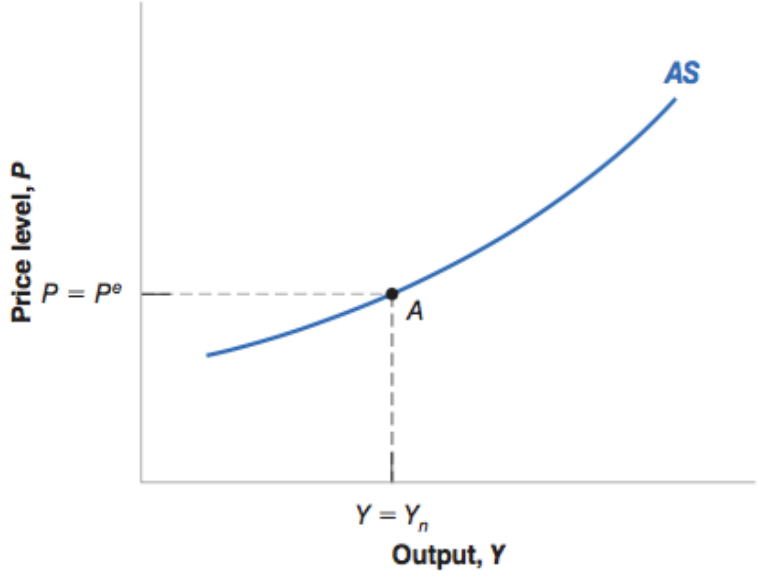
Aggregate Supply Relation

AS Relation - Shifting

$$P = (1+m)P^e F(1 - \frac{Y}{L}, z)$$

Q: If reservation wage, z, increases, what happens to P?

A: P increases Shifting Up



Aggregate Demand Relation

Aggregate Demand Relation

IS-LM Equilibrium Revisited

The IS-LM model captures the (short-run) equilibrium in the Goods and Money Market.

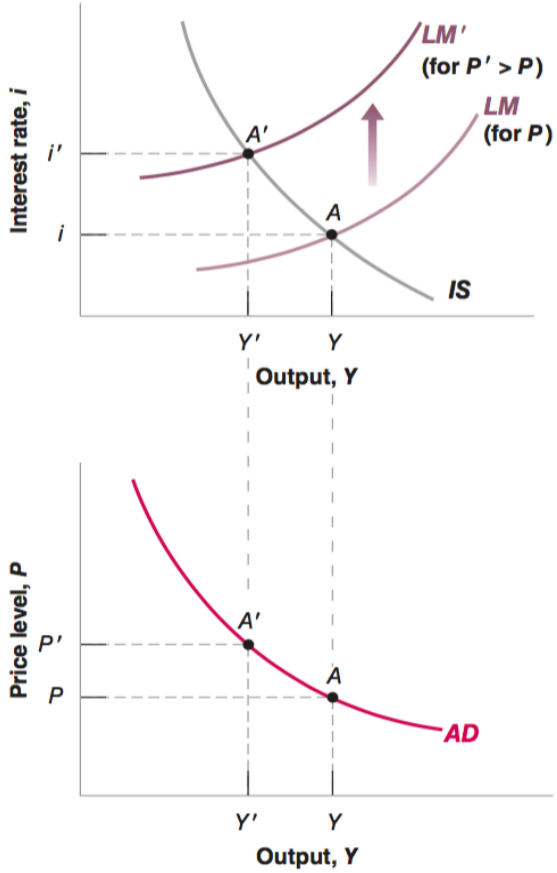
Recall IS-LM:

$$\text{Goods Market IS}: Y = f^C(Y - T, i) + f^I(Y, i) + G$$
$$\text{Money Market LM}: \frac{M}{P} = YL(i)$$

Aggregate Demand Relation

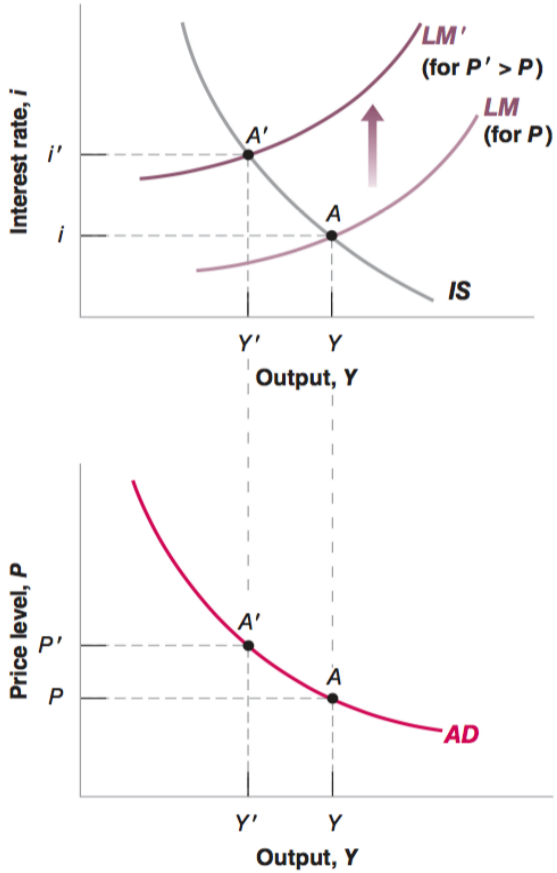
$$\text{Goods Market IS} : Y = f^C(Y - T, i) + f^I(Y, i) + G$$

$$\text{Money Market LM} : \frac{M}{P} = YL(i)$$



Aggregate Demand Relation

Every point on the AD Curve represents a potential SR Equilibrium in the IS-LM model!



Aggregate Demand Relation

AD Relation

Q: If P increases, what happens to Y

A: Y decreases

Aggregate Demand Relation

AD Relation

Q: If P increases, what happens to Y

A: Y decreases

- **P increases**
- Nominal GDP increases
- Money Demand increases
- More people sell bonds, bonds price goes down, the interest rate goes up
- Consumption and Investment goes down
- Output **Y goes down**

Aggregate Demand Relation

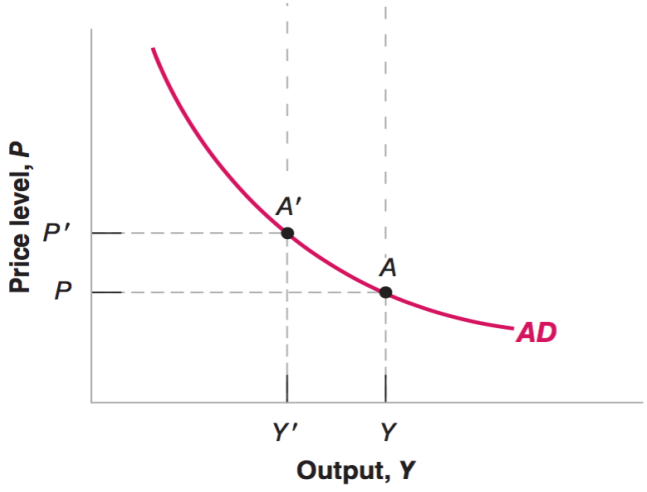
AD Relation - Moving Along

$$\text{Goods Market IS} : Y = f^C(Y - T, i) + f^I(Y, i) + G$$

$$\text{Money Market LM} : \frac{M}{P} = YL(i)$$

Q: If P increases, what happens to Y

A: Y decreases



Aggregate Demand Relation

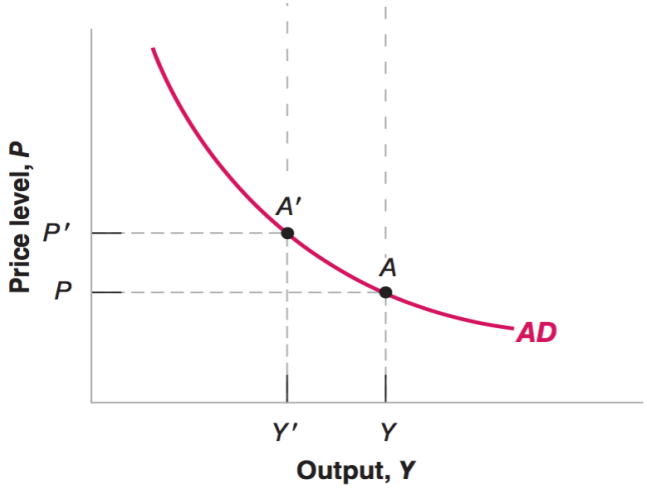
AD Relation - Shifting

$$\text{Goods Market IS} : Y = f^C(Y - T, i) + f^I(Y, i) + G$$

$$\text{Money Market LM} : \frac{M}{P} = YL(i)$$

Q: If T increases, what happens to Y

A: Y decreases, Shift Left



Aggregate Demand Relation

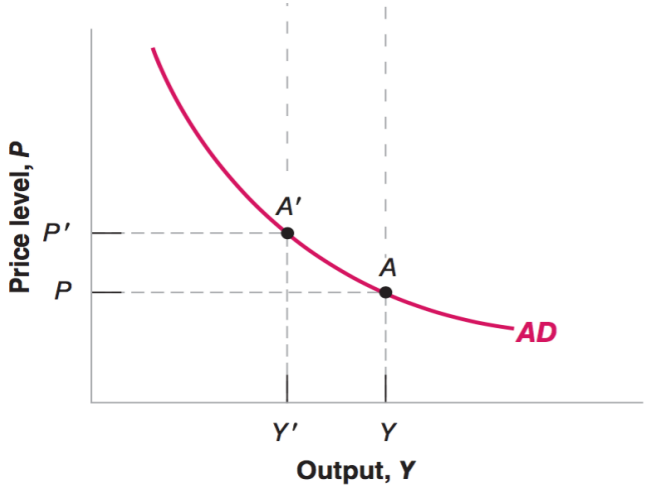
AD Relation - Shifting

$$\text{Goods Market IS} : Y = f^C(Y - T, i) + f^I(Y, i) + G$$

$$\text{Money Market LM} : \frac{M}{P} = YL(i)$$

Q: If G increases, what happens to Y

A: Y increases, Shift Right



Aggregate Demand Relation

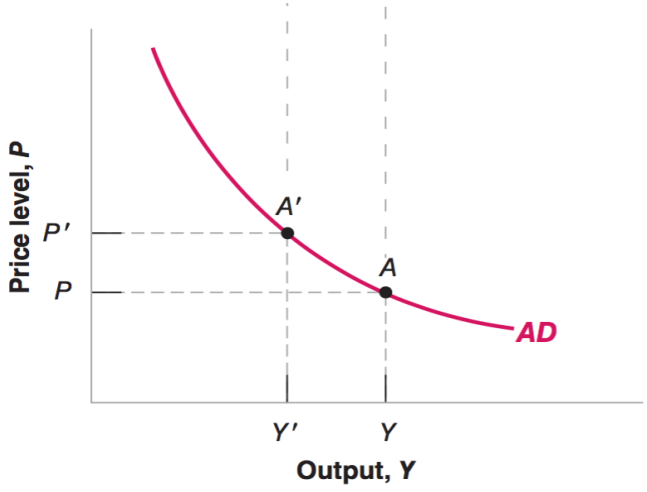
AD Relation - Shifting

$$\text{Goods Market IS} : Y = f^C(Y - T, i) + f^I(Y, i) + G$$

$$\text{Money Market LM} : \frac{M}{P} = YL(i)$$

Q: If M increases, what happens to Y

A: Y increases, Shift Right



Aggregate Demand Relation

The Aggregate Demand Relation is the underlying negative relation between output and the price level implied by our AD curve:

$$\text{AD Relation: } Y = Y \quad \begin{matrix} (\frac{M}{P}, G, T) \\ (+, +, -) \end{matrix}$$

- Equilibrium conditions from the goods and financial markets allow us to derive the *aggregate demand relation*.
- This relation implies that output is a decreasing function of the price level.
- Changes in Monetary or Fiscal Policy (M, G, and T) that **shift** the IS or LM curve will **shift** the aggregate demand curve.

Aggregate Demand Relation

The AS Curve:

- Derived using the *AS Relation* implied by equilibrium in the Labor Market.
- *The AS Curve* is found by choosing different levels of output and finding the corresponding price level implied by WS=PS.
- *The AS Curve* slopes upward and is **shifted** by changes in the expected price level, P^e.

The AD Curve:

- Derived by examining Short Run equilibrium in the IS-LM graph.
- *The AD Curve* is found by choosing different values of the price level and finding the corresponding equilibrium output implied by IS=LM.
- *The AD Curve* slopes downward and is **shifted** by changes in Monetary (M) or Fiscal (G and T) Policy.